

C O N T E N T S

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P R E F A C E

This study has been undertaken by the Tasman Institute on behalf of the New Zealand Business Roundtable (NZBR). We were asked by the NZBR to provide our “best professional advice” on appropriate conservation strategies for New Zealand. The NZBR left the scope and content of the report up to the Tasman Institute. We are extremely grateful for their support and confidence.

The basic questions the report addresses are:

- What is New Zealand trying to achieve with its conservation policies?
- How consistent are those objectives with other goals of policy and how should conflicts between goals best be reconciled or resolved?
- How can the objectives of conservation policy in New Zealand best be achieved?
- How do current policies and practices compare with the ideal approach?
- In the light of these considerations, what policy changes or reforms does the Tasman Institute recommend?

Staff from the Tasman Institute have had extensive consultations with many interested parties in New Zealand. The report reflects the information and opinions obtained during these conversations. The editor of the volume, Peter Hartley, takes full responsibility, however, for the accuracy of the report and the opinions expressed herein. In particular, while the contributors to the report have made every attempt to be as objective and unbiased as possible, our approach to the issues inevitably reflects our training as economists.

A number of individuals contributed to the report. Peter Hartley is responsible for the overall structure and content. He also is the author of chapters 1-4 and chapter 10. Chapter 5 was written by Peter Hartley with assistance from Matthew Waite. Andrew Chisholm and Peter Hartley wrote chapter 6, again with assistance from Matthew Waite. Chapter 7 was written by Andrew Morris and Peter Hartley. Michael Warby commented extensively on all chapters and is primarily responsible for chapters 8 and 9 (although Peter Hartley also edited them). Jan Woods provided valuable research support and assisted with editing. These individuals, and others at Tasman, also suggested changes to chapters throughout the report.

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remain anonymous for refereeing a draft of the book. We have not necessarily incorporated all of their suggestions, however, and they cannot be held responsible for any of the errors or interpretations that remain.

This report was largely written while Peter Hartley was on leave at the Tasman Institute. He is also a Professor of Economics in the James A. Baker III Institute for Public Policy at Rice University in Houston, Texas. He thanks Rice University for granting him leave to work on this and other publications at the Tasman Institute over 1996–1997.

S U M M A R Y

Environmental amenity contributes significantly to the standard of living of the people of New Zealand. It is therefore in the interest of New Zealanders that resources that can provide conservation services be used to their best effect.

Conservation is one of a range of competing uses for land and other resources. The Department of Conservation (DOC) controls about 30% of the land area of New Zealand, while agricultural activities take up another 50%. Forestry, mining, tourism, manufacturing, housing and other infrastructure also use land and other natural resources. For New Zealand to gain the most out of its resources, effective mechanisms for balancing these sometimes competing, sometimes complementary, uses have to be found.

Market exchanges generally allow more efficient use of resources – that is, more benefit from use of a given level of resources – than do other forms of exchange. Markets encourage people to reveal information about preferences, to respond to consumer demand and to ensure that any use of resources delivers benefits at least as great as the market value of alternative uses that have been thereby precluded.

It is sometimes argued that environmental problems arise because markets fail and that greater market activity *necessarily* comes at the expense of environmental amenity. Most of the conservation and environmental costs of commercial activities arise, however, from the *absence* of suitable markets (in clean air and water, in endangered species, in valued habitats and so on). The most effective way to ensure that increased market activity does not come at the expense of environmental amenity is to *extend* the domain of markets so that market prices reflect the benefits of environmental amenities to consumers, and the costs of using resources include the costs of eliminating valued environmental goods and services.

Tradeable permits in sulphur dioxide emissions in the United States and fishing quotas in New Zealand provide examples of innovative allocations of property rights helping to reduce environmental and conservation problems. In both cases, an even greater reliance on markets and strengthening of the allocated property rights would increase the social benefits from the property rights regimes.

In some cases, it is not feasible or cost effective to define enforceable property rights to valued resources. The result will be “externalities” – unpriced effects of activities on third parties. Economies can also be characterised by demands for what have been termed “public goods” –

goods or services that can be, indeed must be, consumed jointly and simultaneously by many people. It is often argued that externalities or a demand for public goods *require* government action to ensure the *best possible* use of resources.

It is undeniable that externalities or a positive demand for public goods can make it extremely difficult, if not impossible, for markets to attain the *maximum conceivable* benefit from the available resources. However, political and central planning approaches to resource allocation have their own limitations and failures.

In particular, political resource allocation mechanisms result in poor incentives for revealing and responding to information on costs and benefits. Wherever resources are managed on behalf of others, questions of management incentives and mechanisms of accountability arise. This is even more the case with management of public assets, and regulation for public policy purposes, than it is with private companies. Voters or taxpayers, as the nominal “owners” of public sector enterprises, cannot divest themselves of their “ownership shares”. Nor is there a contestable market for management control (except at the remote and all-encompassing level of Parliamentary control). Politicians have an interest in monitoring and controlling employees in public institutions, but are usually interested in objectives other than minimising production costs. Furthermore, in contrast to shareholders in a private corporation, the personal wealth of politicians does not depend on their oversight of enterprises nominally under their control.

Political resource allocation mechanisms also encourage people to transfer the costs of meeting their desires onto others. In particular, voters have strong incentives to exaggerate the demand for, and the benefits of, politically-provided goods and services. For example, there is a clear incentive to claim that the environment is “sacred” or otherwise incommensurate with commercial services in order to pre-empt alternative resource uses. It is obviously a major rhetorical advantage to contrast environmental “altruism” with commercial “profit-seeking selfishness”. Actually, both environmental and commercially-produced goods and services ultimately are valued by society only because people value them.

Even when government action can be beneficial, policy has to be carefully structured in order to capture those potential gains. In particular, the significant efficiency costs of taxation – through the lost value of displaced economic activity as well as administrative and compliance costs – mean that government spending will result in a net loss of social value unless

considerably more than \$1 of social benefit is gained from the use of each \$1 of tax revenue.¹

In short, it is one thing to claim that political processes have the *potential* to improve social outcomes. It is quite another to ensure that they actually do so.

The high costs of monitoring and controlling employees in public institutions subject to review only by political decision-making processes make it essential that the institutions have clear objectives, and mechanisms of accountability. Benchmarking of activity is one method of clarifying objectives and measuring performance in achieving those objectives. It allows the efficiency of operations to be gauged both against comparable organisations elsewhere and over time. The text presents a range of benchmarking indicators that might be suitable for DOC. A regular benchmarking program within DOC would improve accountability and the capacity of management to make rational allocative decisions. An avenue for promoting benchmarking within DOC would be for the Department to become much more involved in the Benchmarking and Best Practice Program of ANZECC.

A remarkable aspect of the *Conservation Act* is that it charges DOC with preserving the “intrinsic value” of conservation assets, a concept that the Act leaves undefined. We suggest that the concept borders on being meaningless. Nor are there proxy goals available that could give “intrinsic value” useful content. In particular, “preserving native biodiversity” cannot function as an appropriate proxy measure. Preserving intrinsic value therefore fails comprehensively as a clear objective able to guide appropriate resource use.

An undefined, perhaps meaningless, objective represents an insuperable barrier to accountability. It effectively allows DOC to choose its own purposes within the general ambit of “conservation”. Current statements by DOC of its purposes and activities:

- do not provide clear information allowing an accurate assessment of its effectiveness;
- do not show an appropriate focus on the full costs and benefits obtained from the use of resources placed in the Department’s care;
- show a distinct tendency to see visitors to conservation areas as threats rather than opportunities to provide valued services to customers; and

¹ Research by Tasman Institute suggests that, in New Zealand, the last \$1 of taxes costs about \$1.28 to raise when the losses in economic activity caused by the taxes are measured along with the administrative and compliance costs.

- more generally, reveal the pervasive problems and failures generated by the inappropriate policy goal of attempting to preserve “intrinsic value”.

The extent of the resources that have been placed under DOC management means the fundamental defect of the legislation governing DOC is a very serious matter.

Lack of proper accountability, coupled with high costs of monitoring and controlling employees in public institutions, also produces a fertile breeding ground for arbitrary exercise of official authority. This could do much to explain the less than ideal interaction between DOC and many other users of resources – including iwi, commercial operators such as farmers, miners and tourism firms and voluntary groups such as private conservation bodies.

Another remarkable aspect of the legislative framework governing DOC is that section 4 of the *Resource Management Act* (RMA) excludes from the purview of the RMA any activities of DOC that the Minister of Conservation certifies as “necessary for, or incidental to, maintaining the intrinsic values of that area of land”. Conservation is only one among many uses of resources. “Sustainable development”, the basis of the RMA, requires resources to be used to provide the greatest benefit to the people of New Zealand subject to the constraints that “health and safety”, the “life-supporting capacity” of the resources and the “reasonably foreseeable needs of future generations” are all protected. Sustainable development cannot be achieved unless conservation operates under the same set of general rules that govern other resource users. In particular, just as the RMA contains provisions to ensure that other resource users take account of the potential conservation benefits they could instead produce, so also DOC needs to be forced to take account of the non-conservation benefits lost as a result of its activities.

Conservation is a far from costless activity. Effective use of resources for conservation purposes requires a lot more than “locking areas away”. Active management is needed to eradicate ferals, control weeds and fires, mitigate the environmental impacts of tourism, study the biological and physical resources needed to ensure the survival of endangered species and so on. Maximising conservation value as part of maximising overall social value requires institutional structures that:

- avoid the often unnecessary cost of single purpose use of resources;
- take advantage, where practicable, of the superior efficiency, due to superior incentive structures, of private sector management; and
- register the real costs and benefits of resource use decisions.

More use should be made of private management of conservation resources, including by private clubs and other voluntary organisations. Voluntary activity is the major alternative to markets and governments as a source of social benefits. Indeed, what people do for family and close friends may well provide more well-being than either market activity or government spending. Customs, manners and conventions are also major regulators of social behaviour. New Zealand has enjoyed considerable conservation benefits arising from voluntary activity. Granting voluntary groups title to areas of public land that they have restored would encourage substantial voluntary labour and could, in some cases, produce superior social outcomes to either public or private commercial ownership.

With greater private involvement in delivering conservation services, government could focus more effectively on its regulatory and oversight roles. This would eliminate the confusions of purpose, and conflicts of interest, that plague the simultaneous pursuit of service delivery and service regulation. The greater legal liability of private organisations would also do much to foster more appropriate levels of due care in the provision of services to tourists and other users of conservation areas.

Users of conservation assets should be required to pay the full cost of their claims on valuable resources, including their contingent claim on costly search and rescue services. The current subsidies provided by New Zealand taxpayers to users of conservation assets, and customers of concessions in conservation areas, are inefficient and inequitable.

Given the extra costs of taxation, taxes should be treated as a scarce resource and not used to finance activities that could reasonably be financed by user charges. An offsetting benefit of access charges for users is that a reduced call on public funds would reduce political opposition to the use of resources for conservation purposes.

Access charges also would lead to a genuine market in conservation services that would encourage more private provision. By providing free access to conservation areas, the government greatly reduces the market price of eco-tourism and other private conservation activity, thereby discouraging private entities from using resources for conservation purposes. If DOC were a commercial organisation, its current pricing policies would be illegal as a form of predatory pricing used to inhibit competition in the market place.

Methods other than prices – such as queues, waiting lists, complicated application processes, or unnecessary physical exertion or investment of time – are currently used to ration demand. These methods are ineffective, if

not counter-productive, ways of redistributing income and lead to inefficient resource use.

A range of pricing mechanisms could be used to charge for access and other use. Experimentation would allow more effective determination of forms and patterns of demand for conservation services, particularly if other customer information is collected at the time fees are paid.

Intelligent and creative use of property rights has great potential to aid the conservation of habitats and species and encourage sustainable resource use. For example, species with enforceable property rights, such as farm animals, are far less endangered than species that no one owns and so no one has an incentive to preserve. If such unowned species have a black market value, poaching of the unowned resource can become a serious problem – as is the case with the declining elephant populations of Kenya and Tanzania. By contrast, the owned elephant populations of Zimbabwe, Botswana, Namibia and South Africa are increasing in number. The contrast of the spread in the nineteenth century of (owned) cattle and the near disappearance of (unowned) bison in North America provides a particularly powerful example of the effects of property rights – and their absence. In the case of endangered species, as in other cases, “common” ownership turns out to be no ownership at all. The disappearance of the moa in New Zealand provides another example of the disastrous effects of lack of private ownership of valued resources.

Even under the current poor incentive structures, successful private conservation operations exist. These operate as for-profit operations, as trusts or as by-products of other business activities. Sentiment that, for example “penguins are not for profit”, represents not only a confusion about ends and means but also a sacrifice of conservation possibilities to narrow ideology. It is also hard to see why conservation operations that are funded by consensual transfers through markets are in any way morally inferior to those funded by coercive transfers through the tax system.

A great virtue of market-based structures is that they create incentives to participate, to experiment, to invest and more generally to use resources in ways that provide greater benefits to others. By contrast, central planning and political mechanisms tend to discourage such activity. For example, imposing heritage orders on private owners, restricting use of their property without compensation, creates an incentive to hide, or even destroy, features with potential heritage value. Imposing heritage orders without adequate compensation is another example of political mechanisms transferring costs to others. Regulatory mechanisms can therefore also provide poor

accountability – as unfunded and unmeasured costs and benefits are difficult to assess by electoral processes.

Similarly, central planning and political mechanisms tend to be much poorer than markets at permitting multiple or sequential uses of resources. They instead tend to encourage non-negotiable “all or nothing” choices. Achieving optimum value from the available resources requires institutional structures that permit and encourage “net conservation value trades” – where lower value conservation assets are traded for assets with higher actual or potential conservation value.

The values of alternative resource uses that could be facilitated by DOC are not currently permitted to contribute in full measure to increased conservation outputs. Managers of conservation areas therefore have little incentive to consider alternative uses of resources, even where the result could be a substantial gain in total community benefit or even in net conservation output. Similarly, since DOC does not have to compensate owners for opportunities forgone, it has little incentive to consider non-conservation uses of resources when arguing against resource consents for private activities. Nor does it have incentives to weigh the value of conservation areas or activities against each other, or to produce a given level of conservation services at least social cost. Considerable improvements in the use of resources, including in total conservation output, could be achieved by an institutional structure that encouraged a search for net conservation value trades and multiple use of resources.

DOC has been largely immune from the reforms that have swept through the New Zealand public sector in the last decade. Its performance does not suggest that this immunity has been beneficial to the public interest. To reduce conflicts of role, and increase clarity of purpose (and thus accountability), the advocacy, policy and operational functions of DOC should be placed in separate organisations.

The new policy development body should:

- be independent of all existing government bodies;
- ensure that conservation policy is consistent with the sustainable development objectives of the RMA;
- consider reclassifying land according to IUCN categories (so as to provide a more effective and useful taxonomy of conservation areas); and
- consider extending DOC’s capital charge to include the market value of the areas it manages.

Reclassification of land managed by DOC raises the issue of Treaty of Waitangi claims. Given the exclusion of private and state enterprise land from Treaty of Waitangi claims, public land managed by DOC is an obvious source of land for Treaty settlements. Provided appropriate property rights and regulatory regimes are in place, transfer of DOC land to Maori ownership could provide a means of final settlement of Waitangi claims while protecting, even fostering, the production of valued conservation outputs. Ownership of natural resources suitable for eco-tourism and other resource-using commercial ventures could assist the further adaptation of Maori to commercial society. Such adaptation is necessary if Maori are to achieve social outcomes comparable to the rest of New Zealand society.

In the case of historical heritage, a regulatory and institutional approach to maximise the value that New Zealand gains from its heritage assets would incorporate:

- separation of policy and regulatory responsibility from asset management;
- separation of policy and regulatory responsibility for conservation of cultural heritage from other objectives;
- removal of disincentive to preserve heritage assets, while ensuring equity and discipline in heritage assessments, by compensation for loss of value from heritage orders, listings and other restrictions on property usage specific to, or with disproportionate effects on, heritage assets; and
- permitting appropriate adaptations and multiple use of heritage assets.

1. INTRODUCTION

The NZBR expressed an interest in sponsoring this study for a number of reasons:

- access to environmental amenities is a significant, and growing, component in the standard of living of New Zealand residents;
- environmental resources are a major foundation for a very important part of the New Zealand economy – tourism – that is likely to grow in significance; and
- there are important interactions between the environment and other industries – agriculture, forestry, manufacturing and mining.

Environmental amenity and living standards

Contrary to much ill-informed criticism, economists do not argue that only goods or services that are bought and sold on organised markets have value. Values derive from individual preferences. Many individuals obtain substantial value from “non-market” activities, or uses of resources (such as recreational and sporting activities, voluntary activity, household activities, engagement with friends and neighbours and so on). The real “economic value” of a particular use of a resource is the value that individuals place on that use.

Market goods and services have to compete with non-market activities to satisfy individual desires. An individual’s time, energy and other resources can be sold to be used by others with marketed output being consumed in exchange. Alternatively, the same resources often can be used for non-market activities that can provide greater satisfaction than whatever marketed output could have been obtained instead. Under those circumstances, using the resources for non-market activity would result in a lower total output and consumption of marketed goods and services, but individuals would nevertheless be better off.¹ Measures of the overall level of market activity, such as the Gross National Product (GNP), are *not* measures of welfare.

¹ Strictly speaking, this statement ignores the distorting effects of welfare payments (that provide access to market goods and services without having to participate in the market economy) and taxes on labour income. Both of these interventions artificially encourage individuals toward undertaking non-market activities at the expense of market activities. Some switching by individuals from non-market toward market activities could then result in a net increase in total social value.

Economists ultimately are interested in individual welfare, and market activity is a means to that end and not an end in itself.

In particular, it may well be sensible to use land and other natural resources for non-market purposes rather than using them to supply marketed goods and services. Environmental amenities contribute to individual living standards just as marketed goods and services do. In New Zealand, environmental amenities and recreational opportunities contribute substantially to the overall standard of living. The community therefore has a strong interest in ensuring that such resources are used wisely to yield the greatest benefits. It is in this spirit that the NZBR sees conservation as an important "economic activity" and just as legitimately the subject of scrutiny as other economic activities in New Zealand.

Tourism and the environment

While environmental amenities have direct benefit for New Zealand residents, environmental amenities are also an important resource for the market economy. Tourism is a major industry in New Zealand. The New Zealand Tourism Board (NZTB, 1996) notes that international visitor arrivals in the year to March 1996 were 1.4 million, an increase of 7% over the previous year, while an OECD report released in March 1997 (*The Australian*, 12 March, 1997) stated that visitor arrivals to New Zealand increased by 9% in calendar 1996 compared with 1995. The NZTB also reported that international visitor arrivals to New Zealand grew at an average rate of 9% in the three years to March 1996. The NZTB claimed that international visitors to New Zealand "currently support 100,000 full-time job equivalents and this is predicted to rise to 180,000 by the year 2000".

The recently released volume on the state of New Zealand's environment (Ministry for the Environment, 1997b) reports estimates that international tourists "pumped almost \$5 billion into the New Zealand economy in 1995 as against total export income of almost \$21 billion". The NZTB also reported that international tourism is now the single biggest earner of foreign exchange amongst New Zealand industries. In the year to March 1996, export earnings from international tourism exceeded export earnings from meat and animal products by 64%, dairy products by 43%, wool by 343%, fruit and vegetables by 298%, fish and seafood products by 314%, forest products by 87% and machinery and metal manufactures by 95%.

More significantly, from 1994 to 1996, export earnings from tourism increased about 40%, while the largest increase for the remaining sectors was in machinery and metal manufactures, where the increase was 17%. This

trend is likely to accelerate as a result of increasing living standards in South-East, East and North Asia and falling costs of air travel in both dollar terms and travel time. For example, the World Tourism Organisation² reported that world tourist arrivals increased by over 3.8%, and international tourism receipts (excluding international transport) increased by 7.2%, from 1994 to 1995. However, the East Asia and Pacific region experienced an 8.6% growth in arrivals and a nearly 12% increase in tourism receipts over the same year.

While international tourists come to New Zealand for more than its wonderful scenery and other natural amenities, environmental resources are nevertheless a significant attraction. A 1993 joint publication (NZTB and the Department of Conservation (DOC), July 1993) reports that between 50% and 75% of foreign tourists (depending on country of origin) are interested at least in half- to one-hour nature walks, and from 5% to 30% are interested in half- to one-day walks. The same publication estimates (Table 3B) that about 2.5% of foreign visitors tramp the four major tracks (Abel Tasman, Routeburn, Milford and Kepler), although the percentage of trampers reaches 14% for tourists from Germany.

Domestic tourists also derive considerable value from New Zealand's natural amenities. For example, the joint NZTB and DOC publication referenced above reports that the six major natural attractions in New Zealand³ experienced between 90,000 and 371,000 visits in 1990-91. The Ministry for the Environment (1997b, p 9.39) reports that, "In all, about 2 million people are recorded at Department of Conservation visitor centres each year".

Perkins *et al.* (1993, p 180) note that in the early 1990s domestic tourism represented over 70% of person nights, although it is probably more difficult to separate tourist and business use of motel accommodation for domestic travellers. An offsetting factor for increased domestic tourism was also noted by Perkins *et al.* They observed that the same growth in international air travel that has brought increasing numbers of foreign tourists to New Zealand has facilitated more New Zealand residents taking recreation trips abroad.

Apart from nature walks, sight-seeing and tramping, many other tourism and recreation industries of considerable market value significantly depend

² They have an internet site at <http://www.world-tourism.org/>.

³ These are Whakarewarewa (371,000 visits), Waitomo Caves (250,000 visits), Milford Sound (243,000 visits), Mt. Cook Village (200,000), Franz Josef Glacier (100,000 visits) and Fox Glacier (90,000 visits).

on retaining access to environmental amenities or conservation areas. These include skiing, hunting, fishing, river rafting, snorkelling, sailing, horse trekking, bike riding and bungy jumping. Many of these industries also support a substantial number of firms and employees in sectors as diverse as transport, accommodation, retailing and restaurants.

Early government involvement in tourism included the establishment of resorts, which were sometimes associated with the Railways Department. The Department of Tourist and Health Resorts was established in 1901 and took control of government-owned facilities at Rotorua, Hanmer Springs and the Hermitage at Mount Cook. By 1926, the Department owned and managed additional resorts at Te Aroha, Waitomo Caves, Waikaremoana, Queenstown, Te Anau and Milford Sound. Perkins *et al.* (1993, p 176) note that:

A strong relationship existed between tourism and management of the natural environment. From the early days of European settlement, the tourism potential of New Zealand scenery, especially thermal areas such as Rotorua, and the Southern Alps, had been recognised. It remains an important reminder of these times that the administration of the *Scenery Preservation Act 1903* was placed initially in the hands of the fledgling Tourist Department. Subsequently, a variety of mechanisms were established to facilitate communication between conservation, recreation and tourism interests in the use of public lands. These included the appointment of tourism specialists on national parks and reserve authorities and parks boards. The *National Parks Act 1952* was important in this regard, because, for the first time, the dual purposes of preservation and public recreational use of national parks were formally recognised.

While environmental amenities are important for the tourism industry, that industry also has significant impacts on the environment. As the Ministry for the Environment (1997b, p 9.39) notes:

More visitors means more roadworks, more tracks and track maintenance, and more and bigger camp sites, accommodation and service facilities. It also means more crowding, trampling, sewage and waste, and weed invasions, particularly in small reserves, near roads and along the most popular walking tracks ... When an area becomes degraded, visitors tend to seek more pristine areas, thus widening the impact zone. Visitor impacts also occur at marine reserves ...

In a box on page 9.38 of the same volume, the Ministry reports:

In 1995, the New Zealand Conservation Authority asked its regional boards to identify sites where visitor activities were thought to be having a detrimental effect. The resulting list of 60 sites is not necessarily representative, or even accurate, being based on perceptions ... but it identifies overcrowding as a recurrent seasonal problem ... Overcrowding lowers the quality of visitors'

experiences and intensifies pressure on facilities such as parking, space in huts, and toilets. Fouling of ground and streams, including water supplies, by human waste was seen as a nationwide problem at huts, bivouacs, camping areas, reserves and (especially) roadside areas. Other visitor effects can include: habitat destruction and wildlife disturbance ...; increased risk of fires and new weed introductions; vandalism ...; vegetation clearance...; track deterioration; noise and visual pollution.

Other industries and the environment

Most other areas of economic activity in New Zealand also have significant effects on environmental amenities. Agricultural industries (grazing and horticulture) utilise at least 50% of the land area of New Zealand and thus represent the greatest competitor for conservation as a use of land resources. The Ministry for the Environment (1997b, p 9.34) reports that in New Zealand the:

area of domesticated land now stand[s] at 63% and the percentage of significantly disturbed habitat is estimated at 73%. Habitat loss in New Zealand has occurred at three levels:

- wholesale removal of ecosystems for conversion to farmland, exotic forests and settlements;
- partial removal or fragmentation of ecosystems into 'islands' surrounded by farmland;
- degradation of ecosystems through loss of species and disruptions of ecological processes ...

Lowland forests, wetlands, dunelands and tussock grasslands have been largely converted to farmland.

In the previous chapter on "The State of Our Land" the Ministry observed:

In modern agriculture, biodiversity is deliberately reduced, and forest regeneration is suppressed, so that energy and nutrient flows can be channelled into a narrow range of plant and animal products.

The impact on soils has been mixed. In many areas, soils have been improved ... However, in some areas, soil quality has come under a variety of pressures ...

Farming in New Zealand spans a continuum from "extensive" through to "intensive" production systems ... The two types of farming have significant but different impacts on the land. Intensive farming produces more biomass per hectare, higher concentrations of animal waste, fertilisers and pesticides, and makes more use of irrigation water ... In addition, high stock densities, or the frequent use of heavy machinery, increase the risk of soil compaction, while the removal of high volumes of plant and animal products increases the risk of carbon and nutrient loss.

Extensive pastoralism puts less concentrated pressure on soil and water but, because of the vast area involved, it has had a greater impact on natural ecosystems and biodiversity. Also, because this sort of farming is often located on hilly terrain where the soils are naturally more susceptible to erosion and nutrient depletion, it has caused accelerated erosion in many areas and sedimentation of streams and rivers.

Natural habitats also provide services that are used as production inputs by agricultural industries. Most of the agricultural industries depend on access to water supplies of reasonable quality. Birds and insects also have important influences on productivity in some agricultural industries (through becoming, or helping to control, pests, by pollinating flowers and so on), while trees and other plants assist in controlling erosion and maintaining soil quality.

Forestry competes directly with conservation for alternative uses of trees and land. It can also complement conservation by providing alternative habitats for native species, or alternative locations for human activities such as fishing, hunting or bike riding, and thus releasing areas with more native species for alternative, "less invasive", uses.

The Ministry for the Environment (1997b, p 8.37) observes:

Compared to pastoral farming, forestry is a minor land use, but it still covers a substantial area and has impacts on the environment, some positive and some potentially negative. Each year about 20,000 hectares of forested land are harvested and replanted, and about 70,000 hectares of new forest are planted over disused pasture or regenerating scrub. Only a few hundred hectares of indigenous forest are now logged and these are left to regenerate naturally.

The total area of standing forest potentially available for timber production exceeds 2 million hectares [about 7% of the land area of New Zealand]. About 1.6 million hectares of this is exotic forest, 600,000 hectares is privately owned indigenous forest, and some 150,000 hectares is Crown-owned forest which has been allocated to Timberlands West Coast Ltd for timber production ...

The environmental effects of production forestry vary with the type of forest, the terrain, and the preceding land use. The effects can often be positive ...

Despite these advantages, production forestry can also have negative effects on soils, water, biodiversity and scenery ...

Established forests, particularly after several planting and harvesting rotations, may cause changes in soil nutrients and acidity. Nutrient depletion, especially of nitrogen, is most likely in sandy soils. However, in more fertile soils, nutrients, particularly phosphorus, sometimes show an increase. Nutrient depletion associated with forestry is mainly caused by ... poor practices ... [that] are increasingly uncommon. In many instances, such as the exotic forests of the pumice-based central plateau, the organic matter has actually increased,

improving soil fertility. Soils have occasionally been found to become more acidic under pine forests, but ... the processes ... are similar to those which occur under indigenous forests ...

In most cases forestry pressures on water are probably offset by the benefits of flood and sediment reduction ...

Biodiversity concerns with exotic forestry have generally focused on the establishment phase of the plantation rather than the harvesting phase ... These days ... the majority of new plantings are on pasture land and are probably beneficial to indigenous biodiversity by relieving logging pressure on native forests and allowing indigenous habitats to regenerate on forest margins and beneath forest canopies ...

Under the indigenous forests provisions of the *Forests Act 1949* (which were introduced through the *Forests Amendment Act 1993*), most indigenous timber production must be subject to a sustainable management plan or permit ... Under the New Zealand Forest Accord 1992, the main forestry companies have agreed not to replace native forest, regenerating scrub or other significant natural habitats with exotic forests. The forestry industry also has safeguards for soil, water, scenery and native habitats in its Forestry Code of Practice.

Mining also competes with conservation (and other land use industries) – particularly when an open cut, or extensive surface processing facilities, are required. The Ministry for the Environment volume (1997b, p 8.40) notes that:

... modern mining creates considerable disturbance to soil and vegetation which can be very significant at the local level. At the national level, however, the affected area is very small, totalling about 25,000 hectares since European settlement, or less than 0.1 percent of the land surface. In addition, most modern mines are now subject to strict environmental standards which require waste water and sediment to be safely treated or stored and mined landscapes to be rehabilitated.

The total amount of sediment ever disturbed by mining in New Zealand is estimated to be ... about 15 percent of the natural erosion rate. These estimates cover all types of mining, as well as quarrying and sand and gravel extraction. They also include an allowance for off-site effects, such as access roads and processing plants.

Most of the land disturbance was caused by alluvial gold mining in Central Otago and the West Coast which began in the 1850s ... This represents 60 percent of the total area disturbed by mining and 70 percent of the total sediment disturbed by mining since European settlement ...

While these figures put the scale of mining impacts into national perspective, they do not change the fact that local impacts may be considerable ...

Mining in New Zealand requires permission from the local authorities which set the environmental standards that must be adhered to. Mining also requires

permission from the land owner. If a mining or exploration site, or access to it, happens to be on Conservation Department land, the Minister's permission is required. Although exact figures are not available, several hundred licences or permits for mining-related activities are currently in effect on conservation land. However ... the majority of permits and licences are for exploration and prospecting, rather than mining and, at any one time, only a relatively small proportion of licences and permits are actually being used.

A 1991 report to the Ministry of Commerce (ACIL Australia Pty Ltd, 1991) claims that "around 70% of the likely mineralisation of the country is contained in these lands [controlled by DOC]".⁴ This may be, in part, because minerals and land less suitable for agriculture, and thus more likely to retain native vegetation, are both more likely to be found in the more mountainous areas. However, other forces may have been at work. Some of the most likely mineral prospects in New Zealand at the time of the formation of DOC were on government-owned land (perhaps in part to facilitate mining). Even so, sub-surface resources were not considered in the reallocation of government-owned land at that time.

A related issue is that much of the land most suitable for hydroelectric development is also now controlled by DOC. Yet water resources also were not considered at the time government-owned land was being allocated to DOC, and the forestry and land corporations.

The Ministry for the Environment volume (1997b, p 9.40) also notes that hydroelectric development can have adverse environmental impacts:

The effects of hydro development range from flooding of land-based ecosystems to disturbing the flow of aquatic ecosystems ... Fish are also affected by the physical barrier which a dam presents to their movement

OTHER IMPORTANT ISSUES RELATING TO CONSERVATION IN NEW ZEALAND

A brief history of conservation in New Zealand

Setting aside land in National Parks and other conservation areas has a long history in New Zealand. As discussed below, Tongariro was the first National Park and was established in 1887. Egmont National Park, formed to "preserve the remaining buffer of forest on Mt. Taranaki" (Perkins *et al.*, 1993,

⁴ The New Zealand Minerals Industry Association recently made the stronger claim in comments on the Protected Areas Prohibition on Mining Bill that, if passed, the Bill would "sterilise 70% of the nation's known minerals as they occur beneath twelve DOC land categories to be locked up".

p 174), was established in 1900, while the basis of the Fiordland National Park was set aside in 1904. According to Perkins *et al.* (1993, p 175), the eventual formation of Arthur's Pass National Park in 1928 was based on the efforts of concerned individuals "and groups such as the Christchurch Beautifying Society". The *National Parks Act* 1952 culminated a series of other acquisitions that still form the core of conservation areas in New Zealand.

In the period 1950–1980, local authorities, such as the Auckland Regional Authority, took increased responsibility for management of many urban and regional reserve areas as recreation assets. Other special purpose authorities, such as those concerned with catchment protection, also set aside land for other purposes but nevertheless made it available for recreational use. Some schools even became important providers of outdoor recreational opportunities (Perkins *et al.*, 1993, p 179).

The gazettement of Mt. Aspiring National Park in 1964 marked the beginning of a period of slower national park acquisition by the Lands and Survey Department, although the Forest Service continued to reallocate lands for multiple purposes, including recreation. Perkins *et al.* (1993, p 179) note:

By the end of the 1970s 21 forest parks had been gazetted. By this stage New Zealand had 18.69 per cent of its land area under some form of protection. Recreation was permitted in most of these areas.

National park boards, which initially had significant executive powers, were placed under the control of the Lands and Survey Department. The *Reserves Act* 1977 classified many areas of public land as recreation reserves. The *Walkways Act* 1975 established long distance wilderness walkways over public and private lands as well as many shorter walks close to urban areas (Perkins *et al.*, 1993, p 179).

The 1980 *National Parks Act* reinforced the recreational role of national parks, while the recreational component of Forest Service activities continued to expand. Both the Department of Lands and Survey and the Forest Service introduced fees for use of some of their facilities in the 1980s.

In 1982, the government proposed to combine the Department of Lands and Survey and the Forest Service into a single department of lands and forests. According to Hendry (1994):

conservation groups opposed this, publicising their own strategy for environmental management in New Zealand. Their counter was based on splitting the concepts of the environment and conservation.

While in opposition, the Labour Party responded to growing community concern about environmental and conservation issues. It proposed a

“comprehensive environmental policy” for the 1984 election in which, according to Hendry (1994, p 16), it:

proposed it would establish a single Ministry for the Environment, based on a philosophy of “unity of control”, which would operate through two divisions: (i) Planning and (ii) Nature Conservation ...

Within weeks of Labour’s win, the new Minister for the Environment, C. R. Marshall, set in motion a process of discussion and consultation on how the new government’s environmental policy should be implemented. A group of officials was given the task of drawing up a range of options, which were released in a discussion paper for public submissions. Representatives from the community and interest groups were then invited to an “Environment Forum” to express their views further. Finally, a working party from the Forum drew up detailed recommendations for the Minister.

Meanwhile, the remainder of the government and the rest of the New Zealand economy began what has been called “the most radical economic reform program in the Western world in modern times” (James, 1996). Government departments and state owned enterprises were an important part of this restructuring process:

The *State-Owned Enterprises Act* 1986 provides for the conversion of state commercial entities into state-owned enterprises (SOEs) operating under the same conditions as private-sector enterprises, including raising capital on the open market. The *Commerce Act* 1986 establishes a uniform regulatory regime for the trading activities of the public and private sectors by making them both equally open to competition ... The new competitive regime for SOEs entailed separating their commercial from their non-commercial activities, with the latter being delivered by government departments or purchased directly from the SOEs. (James, 1996, p 11).

Hendry (1994, p 12) also remarks that:

Government ministries and departments were forced to reduce cost structures, improve cash flows and generally concentrate on the efficient management of the resources they possessed. All businesses and most government departments restructured their activities to be more competitive, while holding or reducing costs.

He goes on to argue that:

The [economic] reformers wanted unambiguous commercial goals for corporate land management agencies. This implied support for an unambiguous conservation role for another agency to manage protected areas.

This conclusion only follows, however, in so far as conservation is a “non-commercial” activity. While conservation often is non-commercial, one of the

issues we shall examine in this report is whether this *has* to be so. We fundamentally reject the notion that there needs to be a clear separation between “economic uses” of resources and “conservation”. All resource use is, or should be, undertaken to provide outputs that are valued by the community. The production of conservation outputs is another “economic use” of resources even if the value thereby produced is not reflected in market prices.

Hendry argues that the emphasis on the importance of “separation of functions” in the prevailing intellectual environment influenced thinking about conservation issues within the steering committee of the Environmental Forum and the subsequent working party that drew up the final recommendations for the Minister:

The steering committee managed to get the concept of separation of powers (the environment versus conservation) accepted as necessary for “effective implementation” of conservation and environmental management. The concept of “unity of control”, initially espoused by the Labour government, was forgotten.

Hendry (1994, section 2.2) argues that the “intent of the government” in forming DOC was that “the new department for conservation would serve government, reflecting its balanced decision-making processes”. To support his case that “the government clearly did not intend to form a department based purely on preservation values” and that “preservation ... was only part of its job”, Hendry quotes Woollaston (1986, p 30):

The government’s responsibility must remain to look at all such issues in the round, weighing not only ecological evidence, but also various social, economic and cultural factors that bear on the national interest ... An equally important purpose for a conservation agency is to manage resources so that they remain available for best use by a community on a long-term basis

Hendry adds:

It was not the intent of government to form a conservation department that would simply “lock up” Crown resources ... This initial balanced approach to conservation and resource use was altered following pressure from lobby groups ... The adoption of the conservation groups’ proposals was helped by the fact that they were in accord with the government’s philosophy to separate production functions from policy functions and were seen to be in line with the government’s economic reforms. Conservationists lobbying for the separation of the development and conservation functions of government departments found that their views on this point coincided with those of Treasury and the Minister of Finance.

The government announced in September 1985 an intention to form the proposed conservation department. The commercial functions of the Department of Lands and Survey and the Forest Service would be constituted as single-purpose commercial SOEs.

On 1 April 1987, Lands and Survey and the Forest Service were disestablished and separated into “commercial” and “non-commercial” sectors. The latter sectors were combined with the Historic Places Trust, the Wildlife Service, which was formerly part of the Department of Internal Affairs, the *Harbours Act* responsibilities of the Ministry of Transport and the marine reserve and mammal protection functions of the Ministry of Agriculture and Fisheries to form the Department of Conservation. Fish and game management was handed over to reformed Acclimatisation Societies, which were renamed Fish and Game Councils (Perkins *et al.*, 1993, p 180).

Hendry summarises what he sees as the victory of the conservation lobby in the formation of DOC:

Intense lobbying from environmental groups meant that the initial concept of separation of powers no longer applied. More fundamentally Woollaston’s vision of “not locking up” the estate was rendered meaningless. The resultant legislation establishing the Department of Conservation was loaded towards the preservation of the conservation values on the Department’s estate. The legislation that DOC operated under imposed a hierarchical framework that meant the Minister, even if he or she desired, could not evaluate the values attached to other possible uses of resources on the conservation estate on a consistent basis. In addition no mechanism was set in place that would allow economic activity to occur even if that development did not affect the conservation value of the resources.

In fact, at present almost any economic activity can *potentially* be pursued within a conservation area.⁵ Where Hendry’s claim has some force, however, is that there does not appear to be a formal mechanism whereby:

- conservation outputs from different areas, or different zones within a single conservation area, are valued on a consistent basis;

⁵ As we discuss further in chapter 6, attempts are being made to permanently exclude mining from some conservation areas, no matter how valuable the mining might be. The harvest of some wildlife and all marine mammals is already impossible. Logging of native trees is also impossible in practice – even if it could be shown that mature climax forests could not support some native biodiversity and judicious logging could assist the conservation of some native species benefited by ecosystem disturbance. As we also argue in chapter 6, the procedures for permitting the use of water resources in conservation areas for hydroelectricity generation also appear to be unsystematic.

- these valuations are made in a way that allows conservation outputs to be compared with the value of alternative outputs; and
- trade-offs between alternative uses are routinely made, including exchanges of land that could simultaneously increase both conservation and alternative outputs.

As we argue in more detail in chapter 6, such trade-offs require standardised processes and procedures and a broad consistent framework that gives clear messages to landholders, land users, potential investors and environmental interest groups. They probably also would require changes to the legislation under which the Department operates.

In 1990, a *Conservation Law Reform Act* was passed which, among other things, established the New Zealand Conservation Authority (NZCA) and Conservation Boards. According to a DOC Fact Sheet ('The New Zealand Conservation Authority', Department of Conservation, 1996a), the NZCA:

provides for interaction between the community and the Department of Conservation (DOC). The NZCA is an independent statutory body appointed by the Minister of Conservation to advise on the department's policy and activities at the national level. The NZCA is closely involved in conservation planning, policy and management advice and it represents the long-term public interest in conservation ... The NZCA focuses on policy and strategic direction, not on the day-to-day operational details of DOC's work. A major responsibility is overseeing Conservation Management Strategies (CMSs) for each region around the country – ten year plans for managing and protecting the natural and historic features and the wildlife of the region ... Other NZCA work can include:

- considering proposals for new national parks;
- investigating conservation issues of national importance, such as Maori customary use of native species;
- advising on DOC's national strategies for visitors to conservation lands, and on recreational use issues, such as mountain bikes;
- making recommendations on national priorities for control of possums, deer, rats, weeds and other pests;
- advising on projects with endangered species such as kiwis, bats, kokako; and
- advising the Minister on overall conservation policies and directions.

In other words, the NZCA performs many of the policy advising functions one would normally expect to find in a professional civil service. The NZCA has 12 members:

- 5 appointed after consultation with the Ministers of Maori Affairs, Tourism, and Local Government;

- 3 appointed on the recommendations of the Royal Society of New Zealand, Forest and Bird and Federated Mountain Clubs; and
- 4 appointed from public nominations.

Another Fact Sheet ('Conservation Boards', in Department of Conservation, 1996a) describes the role of the Conservation Boards in almost identical words to the role of the NZCA. However, the boards are regional and, according to the Fact Sheets, have a somewhat different list of "other work":

- developing or reviewing national park management plans;
- working with proposals for marine reserves;
- advising on concessions for activities on conservation lands;
- looking at the range of recreational opportunities in the region;
- recommending priorities for control programs for possums, deer, rats, weeds and other pests;
- advising on projects with endangered species such as kiwi, bats and kokako; and
- commenting on regional and district councils' planning processes.

Each conservation board can have up to 12 members who:

are appointed for the knowledge they have of nature conservation, natural earth and marine sciences, historic heritage, recreation, tourism, the local community and Maori perspectives. Before making appointments to the boards the minister consults with the NZCA. The Minister of Maori Affairs is consulted for any appointment representing tangata whenua interests.⁶

The NZCA and the Conservation Boards thus appear to be a formalised mechanism for independent bodies with a strong interest in a particular area of public policy to have a say in influencing the development of that policy. Hendry (1994, p 27) remarks:

There is significant opportunity for development on the DOC estate and DOC administered lands without reducing the net conservation value of those areas. In addition, the area of land involved in most potential developments is relatively small. Despite this, the economic interests of the nation in these potential developments are strikingly absent in the terms of reference for appointing members to the NZCA.

⁶ A Waikato tribal representative was recently appointed to the Waikato Conservation Board, while Ngai Tahu will nominate two representatives to South Island Conservation Boards and an additional member for the NZCA.

This again raises the issue of whether opportunities exist for sustainable resource use on lands administered by DOC and whether the NZCA and the conservation boards are adequately placed to evaluate such opportunities.

Current Government Management of Environmental Policy

Department of Conservation

The Department of Conservation is the central government agency responsible for the integrated management of conservation. Its mission is to conserve the natural and historic heritage of New Zealand. Strategic advice and policy analysis is provided by the Conservation Policy Division.

Ministry for the Environment

The role of the Ministry for the Environment is to provide policy advice to the Minister and the government that promotes sustainable management of the environment and to enable the implementation of sustainable management through the administration of environmental statutes, advocacy, education and advice. The Ministry was established by *The Environment Act 1986*.

New Zealand Conservation Authority

The New Zealand Conservation Authority (NZCA) provides for interaction between the community and the Department of Conservation (DOC). The NZCA is an independent statutory body appointed by the Minister of Conservation to advise on the department's policy and activities at the national level. The Authority consists of twelve members appointed from diverse backgrounds, chosen with regard to the interests of conservation, natural earth and marine sciences, and recreation.

Office of the New Zealand Parliamentary Commissioner for the Environment

The commissioner is an officer of Parliament who, with the objective of maintaining and improving the quality of the environment, reviews and provides advice on the system of agencies and processes established by the government to manage the allocation, use and protection of natural and physical resources. The Commissioner is independent of the executive arm of government and may only be removed or suspended from office by the Governor-General.

Conservation Boards

The seventeen Conservation Boards are independent statutory bodies appointed by the Minister of Conservation to advise on the Department's policy and activities at the regional level. They consist of up to twelve members appointed mostly from public nominations. The conservation boards are closely involved in conservation planning, policy and management advice. A major responsibility for each board is overseeing the Conservation Management Strategy (CMS) for their region.

Fish and Game Councils

There are twelve regional fish and game councils and a national New Zealand council. Members of the New Zealand council are appointed by the regional councils. The primary role of the councils is managing, maintaining and enhancing sports fish and game resources.

The accompanying box (p 15) lists the government organisations involved with conservation in New Zealand and summarises their functions.

The objectives and role of DOC

In another DOC Fact Sheet ('Legislation', in Department of Conservation, 1996a) the Department states that:

The Department of Conservation administers 23 Acts of Parliament and has functions under several others. *The department is not a free agent. It has only those functions explicitly stated in legislation.* [emphasis added]

It thus becomes very important that we understand what the Acts administered by DOC have to say about the functions of the Department.⁷ The most important of the relevant Acts is the *Conservation Act 1987*. It defines the functions of the Department of Conservation to be:

- (a) To manage for conservation purposes, all land, and all other natural and historic resources, for the time being held under this Act, and all other land and natural and historic resources whose owner agrees with the Minister that they should be managed by the Department.
- (b) To advocate the conservation of natural and historic resources generally.
- (c) To promote the benefits to present and future generations of –

⁷ According to the Fact Sheet, 'Legislation', the relevant Acts are, in alphabetical order, the *Canterbury Provincial Buildings Vesting Act 1928*, *Conservation Act 1987*, *Conservation Law Reform Act 1990*, *Foreshore and Sea-bed Endowment Revesting Act 1991*, *Harbour Boards Dry Land Endowment Revesting Act 1991*, *Historic Places Act 1993*, *Kapiti Island Public Reserve Act 1897*, *Lake Wanaka Preservation Act 1973*, *Marine Mammals Protection Act 1978*, *Marine Reserves Act 1971*, *Mount Egmont Vesting Act 1978*, *National Parks Act 1980*, *Native Plants Protection Act 1934*, *New Zealand Walkways Act 1990*, *Queen Elizabeth II National Trust Act 1977*, *Queenstown Reserves Vesting and Empowering Act 1971*, *Reserves Act 1977*, *Stewart Island Reserves Empowering Act 1976*, *Sugar Loaf Islands Marine Protected Area Act 1991*, *Trade in Endangered Species Act 1989*, *Waitangi Endowment Act 1932-33*, *Wild Animal Control Act 1977* and *Wildlife Act 1953*. In addition, DOC has powers or duties under the *Agricultural Pests Destruction Act 1967*, *Biosecurity Act 1993*, *Building Act 1991*, *Crown Minerals Act 1991*, *Employment Contracts Act 1991*, *Fisheries Act 1983*, *Fire Service Act 1979*, *Forest and Rural Fires Act 1977*, *Health and Safety in Employment Act 1992*, *Land Act 1948*, *Land Transfer Act 1952*, *Litter Act 1979*, *Manapouri-Te Anau Development Act 1963*, *Maori Land Amendment and Maori Land Claims Adjustment Act 1926*, *Maori Reserved Land Act 1955*, *Marine Farming Act 1971*, *Noxious Plants Act 1978*, *Official Information Act 1982*, *Privacy Act 1993*, *Public Finance Act 1989*, *Public Works Act 1981*, *Reserves and Other Lands Disposal Act 1956*, *Resource Management Act 1991* and the *State Sector Act 1988*.

- (i) The conservation of natural and historic resources generally and the natural and historic resources of New Zealand in particular;
- (ii) The conservation of natural and historic resources of New Zealand's sub-antarctic islands and, consistently with all relevant international agreements, of the Ross Dependency and Antarctica generally; and
- (iii) International cooperation on matters relating to conservation.
- (d) To prepare, provide, disseminate, promote, and publicise educational and promotional material relating to conservation.
- (e) To the extent that the use of any natural or historic resource for recreation or tourism is not inconsistent with its conservation, to foster the use of natural and historic resources for recreation, and to allow their use for tourism.
- (f) To advise the Minister on matters relating to any of those functions or to conservation generally.
- (g) Every other function conferred on it by any other enactment.

The Act also defines "conservation" to mean:

the preservation and protection of natural and historic resources for the purpose of maintaining their intrinsic values, providing for their appreciation and recreational enjoyment by the public, and safeguarding the options of future generations.

Similarly, it defines "preservation of a resource" to mean:

the maintenance, so far as is practicable, of its intrinsic values.

The concept of "intrinsic values" is, unfortunately, nowhere defined in the Act. The *Resource Management Act* (RMA) of 1991, however, defines "intrinsic values, in relation to ecosystems", to mean:

those aspects of ecosystems and their constituent parts which have value in their own right, including –

- (a) Their biological and genetic diversity; and
- (b) The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience.

The definition of "intrinsic value" is an important issue, since it is fundamental to determining the goals and the effectiveness of DOC. Unless we have a clear idea of the objectives of conservation policy, how can we decide whether those objectives are being achieved, or whether they could be achieved at lower cost?

Another reason for analysing the functions of DOC as specified in the *Conservation Act* is that, on the surface at least, they would appear to be in conflict with the principles enunciated in the RMA. While DOC applies for resource consents to place structures in conservation areas, undertake pest

eradication and so on, the *Conservation Act* and the RMA appear to conflict in the sense that DOC is not required to manage resources to promote “sustainable development”.

Section 5 of the RMA states that the purpose of the Act “is to promote the sustainable management of natural and physical resources”. The section then defines “sustainable management” as:

managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while –

(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

(b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and

(c) avoiding, remedying or mitigating any adverse effects of activities on the environment.

Indeed, the Minister for Conservation and the Minister for the Environment (who has primary responsibility for administering the RMA) appeared on opposite sides in a recent case before the Court of Appeal.⁸ At p 429 of the judgment, the Court records that the case argued by the party supported by the Minister for the Environment “is not to be lightly dismissed, although the weight of the Minister’s support is somewhat diminished by the fact that his colleague the Minister of Conservation (whose functions under the legislation relate to coastal matters) espouses the opposite view”.

The conclusion that the *Conservation Act* and the RMA are fundamentally in conflict may be confirmed by section 4 of the RMA. It notes, among other things, that the RMA does not apply to any work or activity of the Crown:

within the boundaries of any area of land held or managed under the *Conservation Act 1987* or any other Act specified in the First Schedule to that Act (other than land held for administrative purposes)

and which, among other things,

(i) the Minister of Conservation certifies is necessary for, or incidental to, maintaining the intrinsic values of that area of land; or

(ii) conforms to a management strategy or management plan established under the *Conservation Act 1987* or any other Act specified in the First Schedule to that Act.

⁸ *Auckland Regional Council v North Shore City Council* [1995] NZRMA 424.

Hendry (1994, pp 21–22) also concludes that DOC is managed in a way that is fundamentally in conflict with the sustainable use of resources:

While it was the intent of government that DOC's mandate should be to promote conservation, it was also intended that this advocacy should not be at the expense of balanced economic development. The new department focused on promoting conservation values and interpreted the legislation under its authority in a manner that promoted conservation at all costs.

The purpose of the RMA, as the Act itself states, is to promote the *sustainable use* of resources. While DOC applies for resource consents when, for example, it undertakes developmental activities in conservation areas, DOC is not required to implement sustainable resource use in the areas it manages since conservation activity is exempted from the purview of the RMA in section 4. This raises the question as to whether DOC alone among resource users *should* be exempted from the sustainable use goal of the RMA when managing land under its stewardship, and if so why? This will be another important issue we consider in the remainder of the report.

Resources under DOC control

We have noted that conservation is an important economic activity. Another reason for examining conservation in New Zealand is that substantial resources are devoted to it. Currently National Parks cover 2.9 million hectares, or almost 11% of New Zealand. An additional 1.8 million hectares, or almost 7% of New Zealand is allocated to Forest Parks. There are also 3,500 Reserves, which apparently take the area in New Zealand under DOC management to about 32% of the country ('The Department's Role in Resource Management', in Department of Conservation, 1996a). Another 61,760 hectares of private land have been placed under conservation covenants. Hendry (1994, p 39) claims that DOC is:

in charge of a huge area of land with insufficient resources to manage [it] in such a way as to protect [its] conservation values. Additionally, the costs associated with managing this land reduce DOC's ability to protect lands of "high conservation value".

The problems associated with continued land acquisition are compounded by the lack of mechanisms within the Department's structure to assess the trade-offs associated with acquiring more land. This process of unconsidered land acquisition is a contradiction to the principles of public sector philosophy that currently guide other government departments.

Boundaries for conservation areas reflect artificial lines imposed on the environment, dictated by what is available, and political compromise, not what will provide the most satisfactory ecological and economic outcomes.

Another DOC Fact Sheet ('DOC at a Glance', in Department of Conservation, 1996a) reported that the department is also responsible for over 500 actively managed historic places including 125 historic reserves. In the same document, it was also claimed that over 10,000 historic places are protected on conservation lands. 'Conservation Campgrounds and Visitor Structures' (in Department of Conservation, 1996a) states that DOC manages over 250 camp grounds, about 8,600 km of tracks, 1,200 km of roads, 960 huts, thousands of roadside, waterside and road-end facilities and about 15-20,000 other structures (board walks, boat ramps, jetties, bridges, retaining walls, safety fences, guard rails and viewing platforms) at about 4,500 sites.

DOC had an annual budget in 1996-97 of about \$160 million, of which about \$131 million came from the taxpayers. The department reported that conservation management consumed 52% of its budget, while 47% was spent on visitor services, public involvement and enjoyment. The department has over 1,400 permanent staff (full and part-time) and up to 450 temporary and seasonal staff.

Public perceptions of DOC

It is undeniable that there is widespread concern in New Zealand about the public image of DOC. Many of our informants in New Zealand expressed the opinion that DOC officers can be "arrogant" or "high-handed" in their dealings with others. We must say that, on the whole, our own dealings with DOC staff (particularly at the local level) have been quite congenial. We did, however, encounter considerable opposition to our study from the Head Office in Wellington. The Department was not very cooperative in providing information or facilitating contacts with key people. We found this attitude indicative of a less than full commitment to openness and public accountability concerning its management of very extensive public assets.

Hendry (1994, p 41) refers to a poll conducted by Heylen Research in October 1992:⁹

As could be expected, there was a wide range of opinion, but the general theme is that those groups which directly compete with DOC for use of the Crown's

⁹ A referee commented that "the Heylen [poll is] ... out of date" and "recent public opinion polls have shown the Department is second to the New Zealand Police in the public's confidence of government departments". Our interest in the quote from Hendry, however, is not what it might say about the overall satisfaction with DOC but rather with the correlation between dissatisfaction with DOC and the extent to which the party being polled competes directly with DOC for resource use. Unfortunately, our referee did not report what the new polls say about that issue.

resources have a poor relationship with the Department. The opinion of the pastoral lease holders exemplifies this. They feel DOC has a poor relationship with the rural community, the staff are too idealistic, there is a lack of communication and there are too many hidden agendas with the Department.

Hendry suggests that some of the hostility may stem from the fact that there is no appeal process against DOC decisions. He suggests that this compounds the problems associated with an asymmetry of influence between parties concerned with conservation versus parties with other resource use interests.

An issue we examine is whether rules for compensation of private parties when the market value of their resources is affected by DOC action might be a source for some of the hostility. Rules for compensation are in fact of much more importance than the effects they may have on the public reputation of DOC. They also can have very significant effects on the amount of conservation activity undertaken by the *private* sector.

Other evidence on the public attitudes to conservation in New Zealand, and the performance of DOC and other organisations, was provided in two recent surveys reported in Craig *et al.* (1995a). One sample, of 309 people from Auckland, included individuals from a number of different groups,¹⁰ but is unlikely to be representative of the country as a whole. This was followed by a nationwide random sample of face to face interviews with 2000 people undertaken by an independent national research company.

In the Auckland survey, respondents were asked to declare (on a scale of 0–10) the importance of an issue for them and the performance of “the major conservation groups” (Greenpeace, Royal Forest and Bird Protection Society and DOC) in managing that issue. The authors summarise the results as showing “significant performance gaps” for all policy issues examined. These issues, ranked by a decreasing gap between importance and performance, were:

- managing introduced species;
- influencing public opinion of conservation;
- providing value for taxpayer’s money;
- influencing media on conservation;
- quality and quantity of information on conservation;

¹⁰ The groups were undergraduate students in zoology, botany and commerce, two groups of high school students, a group of indigenous people, a conservation group, the staff of the Auckland office of DOC, and the office staff of a food factory.

- providing opportunities to see protected species in the wild;
- the influence of science on conservation; and
- opportunities for nature conservation.

In the national survey, respondents were asked for a level of agreement (on a 0–10 scale) with a number of statements on conservation policies. The responses (with their average scores of agreement in brackets):

again emphasised the desire for a greater emphasis on New Zealand information (7.9) ... a greater emphasis on ecosystems over species (7.8) ... greater opportunity for public involvement (7.6) ... and ... cost effective conservation (7.5). There was also substantial agreement (7.1) with the statement that “the management of conservation in New Zealand should be more accountable to the public for its decisions and actions”.

The authors conclude that the survey responses “suggest that the department [DOC] is not managed in a way that the public want”. They comment that a survey undertaken by DOC (Department of Conservation, 1992) “reaffirmed the findings of our own survey” in that:

people working most closely with the Department primarily see the Department of Conservation as being over-protective and not working well with others – it was not sufficiently consultative and was driven by the certainty that it was always right.

The collapse of the viewing platform at Cave Creek on 28 April 1995, which caused the death of 14 people, has not been good for DOC’s public image. In a book on the tragedy, and the subsequent inquiries into it, Hunt (1996) states that his book:

is about the failings of a poorly managed government department that broke the law; that acted recklessly; that was negligent beyond any reasonable standard that could excuse honest mistake or momentary lapse of care; that hijacked a public inquiry and put its own spin on the proceedings to shield its officers from criminal culpability.

As Hunt himself notes, and DOC has pointed out to us, these views are inconsistent with the findings of the official Commission of Inquiry and the State Services Commission Review of the tragedy. We did not undertake an independent review of the Cave Creek tragedy and are not in a position to judge whether Hunt or the official inquiries have the more accurate view. In particular, we do not express any opinion on what those events might or might not say about the management and performance of DOC.

It is not the main purpose of this study to evaluate the management and performance of DOC. Rather, our aim is to analyse the objectives of

conservation policy in New Zealand, the relationship between those objectives and other policies, and how the conservation objectives might best be achieved. Our review of the performance of DOC is focused on what we might learn about the best way to implement conservation policy in the future. We have no interest in assigning blame for past mistakes or shortcomings.

Biodiversity in New Zealand

The paper on public attitudes by Craig *et al.* (1995a) also claims that New Zealand has over 500 rare and endangered taxa, including “11% of the world’s rare birds”.¹¹ In another paper in the same volume by Craig and a different set of authors (Craig *et al.*, 1995b), it is claimed that in New Zealand “more than 75% of forests and more than 95% of wetlands have been lost or grossly modified”.

The recent Ministry for the Environment volume (1997b) quoted from above claims (p 9.48) that:

About 1,000 of our known indigenous taxa (800 species and 200 sub-species) are now considered threatened. These figures relate only to the “higher” organisms whose conservation status has been studied – plants, animals and fungi. Nearly 300 threatened plants and 500 animals have been listed by the Department of Conservation, while scientists at Landcare Research have compiled a list of more than 200 threatened fungi. Some endemic microorganisms (bacteria, protozoans and algae) may also be threatened, though research on these groups has tended to focus on their effects on health, soil and water rather than assessing their conservation status.

The Department of Conservation has ranked 403 plant and animal taxa as having conservation priority ... These include all of our endemic frogs and mammals, more than three quarters of our endemic birds, more than a third of our reptiles and freshwater fish, and most of our giant land snails and giant wetas. A further 389 threatened plants and animals are unranked. Most of these are species and subspecies whose rarity is known, but whose precise status is uncertain because of insufficient information. Two dozen ... have not been seen for several years and are possibly extinct (10 plants, 12 invertebrates, 1 bird, 1 bat). A further

¹¹ Brendan Moyle has disputed this claim in correspondence with us:

This is an old IUCN statistic from the 1970s. It ignores subsequent knowledge of the plight of many bird species endemic to the tropics. Tropical deforestation in the 1970s and 80s has lowered our ranking in these world wide comparisons. The statistic is also inflated by our practice of including subspecies as threatened species. We also have more generous criteria for counting a species as threatened compared to other countries. The rates of endemism are highest for our invertebrate and lower plant species. In fact for birds, our endemism rates are relatively low. New Zealand is known as a species-poor region also.

40 of the unranked taxa are ... plants and migratory birds which are threatened in New Zealand but have secure populations overseas. The Department also lists a further 19 taxa which have special importance to Maori culture and are rare or localised. These include half a dozen plant species introduced by early Maori settlers.

Craig *et al.* (1995b) note that “the natural environment in New Zealand has been colonised by the introduction of more than 30 species of birds and more than 30 species of mammals”. Simpson (1996) concurs, noting that people have introduced an extraordinarily large number of other types of animals and plants into New Zealand over a quite short period of time (relative to the speed of evolution and adaptation of most species). There are nearly as many introduced “naturalised”¹² flowering plants (1700) as the number of native flowering plants (1813). Similarly, the number of introduced naturalised freshwater fish and the number of introduced amphibians approximates the numbers of native species. The number of introduced naturalised conifers (30) substantially exceeds the number of native species (20). A substantial fraction of the earthworms (18%) and insects (10%) in New Zealand are also naturalised exotic species.

Many of the introduced species often lack predators and are better adapted than are New Zealand natives to surviving in the presence of the full complement of introduced species. As a result, the introduced species have a tendency to spread at the expense of the natives. The natives – particularly those originally restricted to habitats that are also suitable for other uses such as agriculture or forestry – often become isolated in fragmented tracts of substantially or predominantly native biota. Their chances of survival and continual adaptation are thereby greatly reduced.

A large fraction of the native species of many categories of plants and animals are endemic to New Zealand. Questions we need to address are why New Zealanders might wish to assist the survival of these native plants and animals and, if so, how this might best be accomplished in the context of the other goals and aspirations of the New Zealand community.

Treaty of Waitangi

The *Treaty of Waitangi* was signed in 1840 by representatives of Queen Victoria and Maori tribes. It established British governance of New Zealand, while also affirming the rights of the Maori to their lands, forests, wildlife

¹² We use this term to denote species that survive and reproduce on their own in the wild.

and fisheries. Both an English language and a Maori version of the Treaty were drafted, although the two versions differed in significant ways. Debate thus continues as to exactly what was agreed in the Treaty.

The Ministry for the Environment (1997b, p 2.14) notes that:

In the 150 years since the Treaty's signing, Maori communities have voiced many grievances over the Crown's failure to provide the protection promised in the Treaty. In some cases, the government was not only negligent, but actively complicit in forcing land sales, fraudulent sales, or outright confiscations.

The *Treaty of Waitangi Act* 1975 established a Waitangi Tribunal to examine Maori claims against the Crown, while the *Treaty of Waitangi Amendment Act* 1985 extended the authority of the Tribunal to look at claims dating back to 1840. The Ministry for the Environment (1997b, p 2.14) notes that, to the date of the report, "About 550 claims have been lodged and most of these are still pending. Natural resources are central to many of these claims".

In another paper in the same volume as Simpson's paper, Moller (1996) observes that:

The *Treaty of Waitangi* guaranteed wildlife management rights to Maori, but in reality these assurances have not been honoured. Many Maori land claims include areas with outstanding natural resources, and some of these are within the existing protected natural areas that are currently managed as part of the conservation estate. The *Conservation Act* (1987) and the *Resource Management Act* (1991) aim to give effect to the principles of the *Treaty of Waitangi*. Mounting frustration and conflict between Maori and conservation interests are evident ... Conservation, justice and race relations will be much the poorer in New Zealand if these conflicts are not resolved quickly.

Maori people have a long association with conservation in New Zealand. As reported in Perkins *et al.* (1993), the first national park in New Zealand, Tongariro National Park, "was gifted by Ngati Tuwharetoa in 1887, to protect and preserve the spiritual and cultural values of their ancestral mountains". Similarly, as part of the recent Ngai Tahu Treaty settlement:

freehold title to Greenstone, Routeburn and Elfin stations at Lake Wakatipu, will be transferred to Ngai Tahu. However, Ngai Tahu has agreed to gift mountain tops and lease other areas with high conservation value, totalling 35,000 hectares, back to the Crown in perpetuity at a peppercorn rental, to be managed by DOC for conservation. Title to the Crown Titi Islands will be returned to Ngai Tahu but the islands will be managed as if they were a nature reserve under the Reserves Act.¹³

¹³ This information was obtained from the DOC web site (<http://www.doc.govt.nz/>).

Through the thermal reserve at Whakarewarewa in Rotorua, Maori have also had a long association with basing tourism operations on natural attractions.

The issue of what should best be done with resources in New Zealand cannot be divorced from the issue of who shares in the benefits and to what degree. Different ownership, or management rights, over resources will influence the way resources are used in addition to the distribution of benefits.

OUR APPROACH TO THE TOPIC

On our trips to New Zealand, quite a few people expressed concern, almost indignation, that the NZBR had asked us to examine conservation. They questioned whether we were intending to “attack DOC” in order to pursue some other unspecified agenda. Many of these people also opposed the idea that economics had anything useful to say about conservation. We have a number of responses to these concerns:

- Our intention was to produce the best report on conservation strategies for New Zealand that we could, within the time and other resource constraints that we faced. The final report, of course, necessarily reflects our limitations and constraints but we have not deliberately biased our analysis or interpretations to suit some other hidden motive.
- Conservation constitutes a significant and valuable use of resources in New Zealand. Economics is the study of the allocation of resources to alternative purposes in order to achieve the maximum benefit for the community. Hence, we believe it is quite appropriate to examine conservation from an economic perspective.
- We also view this study as a contribution to the on-going dialogue between economists and ecologists on environmental issues. As specialists in narrow fields of study we all see issues from our own perspectives. Only by explaining our own perspective in terms that other specialists can understand can we hope to arrive at a more balanced understanding of the issues and develop management techniques and policies that are more effective in delivering benefits for the community.
- Since most conservation activity in New Zealand is currently undertaken by DOC, any examination of conservation strategies in New Zealand must involve some discussion of the goals, activities and management of DOC. Thus, while conservation as a resource use is our primary focus, we shall also have quite a bit to say about DOC.

- We also note that DOC is a public organisation, not a secret one. It relies upon the New Zealand taxpayers for financial resources to fund its activities. It also attempts to control the use of resources over a large part of the country. As an organisation, therefore, DOC has to be accountable to the people of New Zealand for its actions.
- More fundamentally, DOC must be concerned with economics as well as biology or ecology. It is an organisation using financial and other resources to achieve “economic ends” in the sense of providing services of value to the New Zealand people. Its management and operating practices, like those of other organisations, need to be scrutinised for effectiveness in providing value for the resources it uses.

Our interest, first and foremost, is in how resources can best be used to satisfy the demand for environmental amenities, recreational opportunities and the maintenance of natural and historical assets, bearing in mind that people usually also have a demand for competing uses of the same resources. Accordingly, this study first concentrates on broad issues of how society determines the allocation of resources to competing ends, what the goals of conservation activity should be, and how those goals can best be achieved in practice. We only discuss the performance of DOC after these more basic questions have been thoroughly examined. The final chapters focus on issues related to the *Treaty of Waitangi* and the conservation of historical heritage.

2. MARKETS, POLITICS AND VOLUNTARY ACTIVITY

In a modern market-based economy, such as in New Zealand, three types of institutions are used to allocate resources: markets, government (through regulation, spending and tax policies) and voluntary actions. Most goods and services are purchased through markets supplied by privately-owned firms. In some instances, “quasi-market” institutions are used. For example, government-owned corporations or not-for-profit institutions might supply the output with most or all of their operating expenses covered through “user charges” or prices that also play a predominant role in rationing demand to match the available supply.

In what we might call “pure political resource allocation”, compulsion is used to extract taxes that are then used to fund activities that are nominally determined through a process of majority voting. These activities typically provide benefits at little or no direct monetary cost to the recipient (although there might be other costs of receiving benefits, such as the expenditure of time). We emphasise that the process of determining the uses of tax revenues is only nominally one of majority rule for a number of reasons. First, explicit or implicit restrictions often prevent the majority from doing what they want with tax revenue. Second, for a number of reasons (detailed below) not all policies implemented by democratically elected parliaments are favoured by a majority of voters. Third, even when parliaments specify a course of action, or an expenditure of funds, there is no guarantee that the policies implemented by the bureaucracy will correspond with the intentions of the legislators.

We referred to “pure political resource allocation” above because we acknowledge that legislatures have a fundamental role influencing resource allocation *within* markets. General laws relating to competition, fraud, consumer protection, employment contracts and so forth can greatly affect market outcomes. Taxes used to fund explicit government expenditure programs also have indirect, and often unintended, effects on market outcomes. More fundamentally, in a modern market-based economy, political action is essential for defining and enforcing property rights, without which markets could not function.

The third major set of institutions that have an influence on resource allocation are voluntary activities. Clubs of various sorts provide many services that individuals value greatly. Parents and citizen associations,

church groups and other voluntary organisations make substantial contributions to the provision of education, health and welfare services. Even individuals acting alone often provide voluntary services that assist in achieving better community outcomes. For example, disapproval of “anti-social” activities can assist in minimising acts, like littering, that deliver benefits to the perpetrator that fall short of all the costs imposed on others.

Each of these resource allocation mechanisms is ideally suited to different tasks. The remainder of this chapter discusses the relative merits of the different mechanisms in a broad context.¹ Its primary goal is to explain to non-economists the framework that economists use to discuss resource allocation. Readers might prefer to focus on the case studies and skim the remainder of the chapter – perhaps returning to read about some of the issues as they are referenced in later chapters.

MARKETS AND THE ENVIRONMENT

The effectiveness of markets

The middle decades of the twentieth century (1930-1980) were characterised by decreasing reliance on markets, and increased reliance on governments, to allocate resources.² Of course, the USSR from 1917, and the other communist nations after World War II, represented the most ambitious experiments in centralised control of economic activity the world has seen. Even in the nations of Western Europe, North America and Australasia, the period following World War II, and particularly the period from 1960-1980, was characterised by increasing government control of economic activity. In most of the nations of Western Europe, government expenditure is now in excess of 50% of GDP, while in Sweden it is well over 65%.

Economists provided intellectual underpinning for the growth of government after World War II. Development of the theory of public goods and externalities suggested a growing role for the state in allocating resources. The Keynesian model of business cycles also justified activist fiscal policy, and excused chronic budget deficits, accumulating government debt and excessive monetary expansions.

The last two decades of this century have, however, witnessed a resurgence of confidence in market processes as effective mechanisms for

¹ This discussion draws on many previous papers published by the Tasman Institute. Readers are referred in particular to Hartley and Porter (1991) and Moran *et al.* (1991).

² These trends are documented in Tanzi and Schuknecht (1995).

mobilising resources to provide the myriad goods and services demanded by consumers. The demise of the USSR and the former communist governments in Eastern Europe, and the subsequent revelations about their parlous economic situations, played an important role in this process. Transformation of many Asian economies, and other developing nations such as Chile and Mexico, through greater reliance on market processes, also helped reinforce the lessons about the value of decentralised market processes that had been learned in Europe in the nineteenth century. The two decades following 1969 provided strong evidence that interventionist fiscal and monetary policy does more harm than good. Finally, the results of the wave of privatisations and deregulation that swept the world from 1980 also demonstrated that government-owned businesses perform relatively poorly when measured either in terms of minimising the costs of production or providing good service to customers.

It is important to recognise, however, that the superiority of market processes is based not on their ability to deliver higher levels of GNP growth, or other such measures of aggregate economic activity. Rather, the relevant test is whether resources are used to produce high and growing levels of individual satisfaction, or standards of living *broadly defined*. Measured increases in the quantity, or value, of marketed goods and services are but one indicator of changes in this “true” underlying standard of living.

The goal of efficient resource allocation

Economists use the concept of *efficiency* to measure the extent to which resources are being used to maximise community well-being. More specifically, an allocation of resources is said to be efficient³ if the resources cannot be transferred to other uses to make someone better off without making anyone else worse off. Resources include natural resources (land, water, air, plants, animals, minerals and so on), capital (plant and equipment, buildings, infrastructure and so on), labour (including the education, training and experience embodied in the labour force), knowledge (scientific understanding, and knowledge of production processes, management techniques and so on) and inherited institutions and cultural values.

The normative appeal of efficiency as a social goal is that an inefficient allocation of resources represents, in a sense, “waste”. If someone could be made better off without making anyone else worse off, why not make the change?

³ More accurately, this is the definition of a *Pareto optimal* allocation of resources.

To achieve an efficient use of market goods and services, it is essential that:

- consumers have accurate information about the present and future costs of meeting their demands;
- enterprises providing goods or services have accurate information about benefits and costs, where benefits include the gains to present and future customers; and
- both consumers and enterprises (in particular, enterprise managements) have incentives to respond to cost and benefit information.

If consumers do not know the costs of meeting their demands, they might be able to increase consumption and obtain benefits in excess of the costs incurred, or reduce consumption and release resources that have a greater value in alternative uses than the value of the consumption forgone. Producers also need accurate information about costs and benefits in order to produce an efficient level of output. Output ought to be supplied up to the point where the marginal cost of an additional unit just equals the marginal benefit to consumers. In a competitive market, these marginal costs and benefits are signalled by current prices, expected future prices and interest rates.

We hasten to add, however, that where markets do not achieve an efficient allocation of resources, for example because prices do not accurately reflect marginal costs or benefits, there is no presumption that any alternative mechanism can do any better. In other words, efficiency refers to an *imagined* state of affairs, not necessarily one that is *practically attainable*. In particular, it is difficult to see how alternative resource allocation mechanisms can achieve a more efficient allocation of resources in situations where markets fail when those alternative mechanisms are even worse at eliciting information about costs and benefits. We shall return to consider the efficiency of different resource allocation mechanisms in different situations in more detail after we have discussed alternative goals to efficiency.

Alternative goals

While economists focus on efficiency as an important goal for resource allocation, they acknowledge that it is not the only goal of society. For example, efficiency says nothing about the distribution of well-being across different individuals. In addition, most people value liberty, or individual freedom, in its own right and not as a means to the end of efficient resource

allocation. Indeed, it has been argued that efficiency and liberalism might be conflicting goals in some circumstances.

One of the longest standing traditions in political philosophy is social contract theory. This attempts to derive the purposes or goals of political activity by examining the type of government institutions that rational and free individuals would voluntarily consent to accept in their own self-interest. The approach was particularly popular in the seventeenth and eighteenth centuries as represented, for example, in the writings of Hobbes, Locke, Rousseau and Hume. For example, Hume (Barker, 1962, p 211) describes the origin of the social contract as follows:

When we consider how nearly equal all men are in their bodily force, and even in their mental powers and faculties, till cultivated by education, we must necessarily allow, that nothing but their own consent could, at first, associate them together, and subject them to any authority. The people, if we trace government to its first origin in the woods and deserts, are the source of all power and jurisdiction, and voluntarily, for the sake of peace and order, abandoned their native liberty, and received laws from their equal and companion. The conditions upon which they were willing to submit, were either expressed, or were so clear and obvious, that it might well be esteemed superfluous to express them. If this then be meant by the original contract, it cannot be denied, that all government is, at first, founded on a contract, and that the most ancient rude combinations of mankind were formed chiefly by that principle ... A man's natural force consists only in that vigour of his limbs, and the firmness of his courage; which could never subject multitudes to the command of one. Nothing but their own consent, and their sense of advantages resulting from peace and order, could have had that influence.

Modern proponents of social contract theory include Rawls and Nozick. For example, Nozick (1974, p 3) begins his work on political philosophy by defending social contract theory as a way of reasoning about the goals and purposes of political activity:

If the state did not exist would it be necessary to invent it? Would one be *needed*, and would it have to be *invented*? These questions arise for political philosophy and for a theory explaining political phenomena and are answered by investigating the "state of nature", to use the terminology of traditional political theory ...

The fundamental question of political philosophy, one that precedes questions about how the state should be organised, is whether there should be any state at all. Why not have anarchy? ...

Which anarchic situation should we investigate to answer the question of why not anarchy? Perhaps the one that would exist if the actual political situation didn't, while no other possible political one did ...

Were this description awful enough, the state would come out as a preferred alternative, viewed as affectionately as a trip to the dentist. Such awful descriptions rarely convince, and not merely because they fail to cheer. The subjects of psychology and sociology are far too feeble to support generalising so pessimistically across all societies and persons, especially since the argument depends upon *not* making *such* pessimistic assumptions about how the *state* operates ...

More to the point, especially for deciding what goals one should try to achieve, would be to focus upon a non-state situation in which people generally satisfy moral constraints and generally act as they ought. Such an assumption is not wildly optimistic; it does not assume that all people act exactly as they should. Yet this state-of-nature situation is the best anarchic situation one reasonably could hope for. Hence investigating its nature and defects is of crucial importance to deciding whether there should be a state rather than anarchy. If one could show that the state would be superior even to this most favoured situation of anarchy, the best that realistically can be hoped for, or would arise by a process involving no morally impermissible steps, or would be an improvement if it arose, this would provide a rationale for the state's existence; it would justify the state.

This investigation will raise the question of whether all the actions persons must do to set up and operate a state are themselves morally permissible. Some anarchists have claimed not merely that we would be better off without a state, but that any state necessarily violates people's moral rights and hence is intrinsically immoral. Our starting point then, though non-political, is by intention far from non-moral. Moral philosophy sets the background for, and boundaries of, political philosophy. What persons may and may not do to one another limits what they may do through the apparatus of the state, or do to establish such an apparatus. The moral prohibitions it is permissible to enforce are the source of whatever legitimacy the state's fundamental coercive power has.

Social contract theory thus views all social institutions, including government, as modes of interaction that have been invented by people to achieve ends that cannot be achieved more effectively through other means. Importantly from the perspective of considering efficiency as a goal of political activity, social contract theory also goes beyond examining end states. *Means* are also important, and if noble ends are arrived at through immoral means, the actions are nevertheless reprehensible. The goals, purposes and legitimacy of government actions therefore are seen as being derived ultimately from the goals, purposes and moral precepts of the people who consent to be governed.

From these perspectives, efficiency might be viewed as an important, but not necessarily the most important, goal of society. People could voluntarily consent to allow the coercive power of government to be used to improve the

efficiency of resource allocation were that feasible. Given the nature of actions that *could* be taken to increase efficiency, however, this is not likely to be the sole, or even the major, role of *government*.⁴ Nevertheless, when goals other than efficiency are being pursued through government action it is still important to know what the costs are when measured in terms of the opportunities forgone. Efficiency of resource allocation thus remains relevant even when efficiency is not the main goal of concern.

Among the alternative goals of government activity, economists have spent most effort studying distribution. A concept they have developed in this regard is the notion of *horizontal equity*. This argues that individuals in similar circumstances ought to be treated in a similar manner. It embodies the notion of anti-discrimination. Only differences in circumstances justify any difference in treatment. Personal traits that are irrelevant for the policy under consideration ought to be treated as such. Anti-discrimination policy, in so far as it relates to the position of the Maori people in New Zealand, is discussed in detail in chapter 8.

The notion of horizontal equity has important implications for tax and transfer policies. It also is relevant in the conservation area, however, particularly with regards to political control over what individuals might be able to do with property they own.

Horizontal equity would imply that individuals with the same wealth ought to pay the same levels of taxes. By introducing orders under endangered species acts, or historical preservation laws, governments can restrict what people can do with their property. Any such restrictions on use that were unanticipated will change the market value of the property. If governments do not have to compensate for the resulting change in market value, they can effectively impose an additional tax on the owner. The cost of the “public policy” is borne entirely by a single property owner – a situation that clearly violates the notion of horizontal equity.

Another equity concept economists have discussed is *vertical equity*. The claim here is that differences in individual welfare justify differential treatment in order to reduce inequalities.⁵

⁴ As we argue below, government is unlikely to be an effective instrument for increasing the efficiency of resource allocation compared with decentralised competitive markets, the common law or even private voluntary organisations.

⁵ While vertical equity and efficiency are usually thought to be in conflict, this need not be so. Redistribution can be viewed as a type of “social insurance” whereby people voluntarily support welfare payments for others temporarily in financial difficulty in the expectation that they too would be supported were they to fall on hard times.

One practical difficulty with this idea is that differences in welfare are impossible to measure. Instead, policies focus on what can be measured – usually, differences in access to market goods and services. These do not, however, correspond to differences in individual welfare, appropriately measured. For example, some people who have chosen a bohemian lifestyle, largely avoiding both labour markets and the consumption of market goods and services, presumably have done so in the expectation that they are better off. To use their lack of access to market goods and services as a justification for redistributing income from others could then exacerbate inequality in a more fundamental sense.

Another practical difficulty with the notion of vertical equity is that, strictly speaking, it ought to apply to *lifetime* measures of living standards. It could be argued, for example, that taking income from average families to pay for the education of doctors and lawyers who will become very well-off members of society in the future actually exacerbates inequality. While university students, and young people in general, might be measured as one of the poorer sections of the community, most of these people will have a future standard of living that greatly exceeds that of current taxpayers. Redistribution based on current measured material living standards may therefore increase inequality in lifetime welfare levels.

There is also a conceptual problem with the notion of vertical equity. Two more fundamental motives can underlie support for redistribution. People could be concerned about inequality because they are *compassionate* and care about the less privileged members of the community. Alternatively, some support for redistribution could be motivated by *envy*. Compassion leads to a focus on policies that provide “safety nets” and guaranteed minimum access to facilities like health care. Envy leads to a demand for reducing the standards of living of the better-off members of society even if that does nothing to help the poor and disadvantaged. These alternative motives are often conflated in public discussions of vertical equity. We would argue that many more people are sympathetic to the compassionate motive for redistribution than would support envy as a legitimate basis for public policy. Chapter 8 also discusses income transfers in the context of reducing the vertical inequity between the Maori people and other people in New Zealand.

Information, incentives and efficiency

Maximisation of the gains from exchange is at the heart of efficient resource allocation. It requires accurate information on the values buyers place on

things. It also requires accurate information on the costs producers incur, which, in turn, depend on the values attached to alternative uses of particular resources.

By and large, essential information about costs and benefits is known to large numbers of separate individuals. In a market economy, each of these individuals has an incentive to transmit private information to other decision-makers by responding to prices. The prospect of gains from trading exclusive rights to use and to transfer resources, and to deny access to others in the absence of agreed payments, prompts individuals and firms to reveal cost and benefit information. Prices therefore signal the value of producing goods or services to firms, and the costs of meeting demands for goods or services to consumers.

Prices primarily operate by encouraging consumers and producers to *substitute* one activity for another. When economists refer to the *incentive effects* of prices, or price changes, they are emphasising that buyers will tend to *substitute away* from goods or services with relatively high prices, while sellers will tend to *substitute toward* those same items. It is the incentive, or substitution, effects that are primarily responsible for demand curves sloping down (so lower prices raise demand) and supply curves sloping up (so higher prices raise supply). This is discussed further in appendix 1 to this chapter.

Markets are all about delivering goods and services to people at least cost in terms of forgone alternatives. The price system can be thought of as an information mechanism signalling to consumers the costs of satisfying their desires in particular ways and signalling to producers, or potential producers, the relative values that consumers place on different types of goods or services.

By comparison, bureaucratic planners operating under “command and control” generally lack information on current and future costs or benefits for the large numbers of individuals, households and firms who experience or anticipate those costs and benefits. The disparate individuals who know costs or benefits often have no incentive to reveal what they know, and may even have strong incentives to conceal their knowledge. When buyers and sellers don’t have to “put their money where their mouth is” they can often gain by distorting the information about costs and benefits that they provide to others. For example, where individuals can shift the cost of provision onto others, they will have an incentive to exaggerate the benefits of a good or service. Thus, in general, markets utilise more accurate cost and benefit information than will be available to bureaucratic resource allocators.

In addition, efficient resource allocation requires that decision-makers *respond* to cost and benefit signals. This is rarely a problem with privately owned and managed firms. Even in joint stock companies, share prices provide an easily observed and current source of information about managerial performance. The ability to purchase ownership shares and mount a take-over encourages managers in the private sector to manage firms efficiently and provide a competitive return to shareholders. Furthermore, managerial rewards and sanctions are usually closely linked to profits and share prices, which, in turn, depend on responsiveness to cost and return signals. Managements of commercial enterprises therefore have strong incentives to minimise the costs of production. This requires managers to devote skill and effort to finding inputs for the lowest feasible cost and achieving cost minimising contracts with input suppliers.

Enterprise efficiency also involves producing quantities and qualities of goods and services to match customers' preferences. This requires responding to information, signalled through markets, or other channels such as customer complaints, about how well production is meeting people's demands. Again, managers trying to maximise enterprise value have strong incentives to respond positively to such signals, for example, to take steps to accelerate enterprise response to customer complaints.

Although public sector managers are responsible for meeting customer demands at a satisfactory cost, their incentive to do so is diluted in comparison with that of commercial managers facing profit goals as bottom line performance requirements. The reasons include poorly specified enterprise objectives, a multiplicity of contradictory objectives, external parties' involvement in management, inadequate monitoring of managerial performance and lack of a clear relationship between performance and rewards or penalties for managers. The management of public sector enterprises is discussed in more detail in appendix 2 to this chapter.

Finally, giving planners access to the necessary information along with strong incentives to use it would not be enough to achieve efficient outcomes. The computations necessary accurately to compare costs and benefits, in order to allocate goods and services to those who value them most, are too complex to be performed centrally.

Economic and ecological systems

It may be instructive for readers who are more familiar with biology than with economics to compare a decentralised market economy to an ecosystem. A market economy contains "niches" or "profit opportunities"

analogous to the niches available within an ecosystem. The niches in a market economy are opportunities available to an entrepreneur to earn a living by providing some good or service that is in demand.

In an ecosystem, selective pressure is applied to plants and animals so that genetic characteristics that favour survival in the current environment are more likely to appear in the next generation. Gradually, the whole complex of plants and animals adapts in response to each other and to changes in the external environment (such as climatic changes).

Similarly, systematic selective pressure is applied in a decentralised market economy. Firms that are “maladapted” will find it difficult to make profits and will go out of business. Successful firms, on the other hand, will spawn imitators, and the production techniques or products that have helped make them successful will spread more widely throughout the economy. Often, the adaptations will take the form of small modifications to existing practices. The substantial inherited history of successful technologies, conventions, standards and managerial techniques will change gradually with the accretion of successful new innovations and the disappearance of unsuccessful old ones.

While both economic and ecological systems are characterised by systematic selective pressure that promotes adaptation to a changing environment there is a major difference between the two types of systems. In biological systems the mutations that introduce new genes appear to be largely random and not necessarily adaptive. It is the selective pressure that tends to make the organism better adapted over time (or eliminates the organism altogether and allows a better-adapted replacement to occupy its former niche). By contrast, in an economic system entrepreneurs are perpetually searching for changes to their businesses that they believe will be adaptive. To be sure, there are large random elements in the invention of new technologies, products or ways of doing things. Yet decision-makers consciously decide where the most productive avenues of investigation or research are likely to be. Higher market returns for “better adapted” innovations provide *incentives* to search out the most productive “mutations”. Decision-makers also *choose* whether or not to follow up fortuitous events by implementing them in practical production processes. The “mutations” that are applied in an economic system therefore are consciously chosen in the belief that they will be adaptive. They are not entirely random events.

In a sense, *homo sapiens* as a species has the ability to *consciously create* niches for itself. More than any other species, humans can adapt to different

environments and ecological niches by using clothes, buildings, fire and tools. Humans invent technologies to economise on the resources they need to survive – new crop varieties or animals through breeding or genetic engineering, improved fertilisers and irrigation, new water purification technologies, hydroponic farming to economise on soil, advances in medical science to help control diseases, new building materials, substitution of new metals for old ones, new mining techniques making it feasible to exploit poorer mineral deposits, better recycling technologies and so on.⁶

An implication of the difference between biological and decentralised economic systems is that successful innovations in technology and practices, and economic growth rates, are very high relative to the speed of evolution in most biological systems. Only microbiological systems, where the time gap between generations is very short, have a similar rate of evolution to market economies.

The revolution in genetic engineering and other biological sciences will no doubt speed up the evolution of biological systems in future decades as genetic changes that are adaptive (in the sense that they promote the survival of the species) are deliberately chosen by biotechnology companies. Even so, most biological evolution will remain a much slower process than economic evolution.

⁶ Colinvaux (1980) elaborates on the point that *homo sapiens* as a species can create its own ecological niches because its behaviour is learned rather than largely instinctive. We should be careful, however, not to *equate* economic opportunities with ecological niches. For example, the argument for biological limits to economic growth relies on a flawed analogy between *economic* growth and *population* growth. Many biologists believe that economic growth cannot continue forever. Given the resources that an individual member of a species needs to survive and reproduce, a particular environment can only support so many individuals before food scarcity, disease, or growth in predators causes the population to collapse – an environment has a limited *carrying capacity* for any one species. However, much economic growth takes the form of *adding value* to previously supplied products while not changing – or even *reducing* – their resource content. When people switch from eating at home to eating out, the amount of food or other resources consumed may not change. Eating out may have higher *value* to the consumer because of the freedom from having to cook and wash the dishes, the restaurant has an improved ambience, the chef can create new taste sensations and so on. As another example, measured GDP would increase if we all switched from scratching our own backs to scratching each other's backs for a fee. Yet the resources used in the process may not change at all. Much of the growth in GDP in modern economies is a growth in *services*. The continual fall in the real price of commodities indicates that the relative scarcity of commodities has been declining over time, not increasing as the limits to growth thesis would imply.

The analogy between economic and biological systems is instructive for another reason. It suggests that it is no easier for a “central planner” to design a functioning market system than it would be to design a functioning ecosystem. Both systems grow over time by incorporating numerous small changes that respond to local threats and opportunities. While these local responses have wider “global” consequences, it would be very complicated to attempt to construct an entire system that takes all these interactions into account.

Markets and environmental amenities

While markets and private enterprise are very effective at mobilising resources to satisfy consumer demands at least cost, they are not without their defects. Most observers claim, for example, that “unfettered” market processes do not result in an efficient outcome with regard to air and water pollution. The level of pollution observed under such circumstances is claimed to be inefficiently excessive in that the costs of reducing pollution will fall far short of the benefits that would thereby accrue to the otherwise affected residents.

The basic problem with air and water pollution is that *clean* air and *clean* water are natural resources that are used up in the production of many marketed outputs, but the cost of using those resources typically is not reflected in the prices consumers have to pay.⁷ Since clean air and clean water are not owned by anyone, no-one has to pay to use them. When resources are unowned, they are viewed as limitless and get over-exploited. This is the “tragedy of the commons”.

Similarly, users will tend to under-value natural resources that are provided to them without charge. Attempts to preserve these natural resources to provide benefits to citizens (such as cleaner air to breathe, or cleaner water to drink or swim in) are then seen as imposing costs without delivering any measurable benefits in return. As Craig (1997) notes:

Ecosystem loss, fragmentation and degradation are just symptoms of societal values that include economic rewards for ecosystem degradation and economic disincentives for those who care for natural systems. For most people, conservation is discretionary. Birds (and nature) are considered priceless – too valuable to include in the market – but because they are outside the market, have no cost and hence are of no value.

⁷ The example of air pollution is discussed in more detail below.

There are perhaps no more dramatic examples of the “tragedy of the commons” in operation than the pervasive over-fishing of oceans that has occurred around the world.⁸ A similar fate may have been inflicted on land animals in Australasia upon the arrival of the first human inhabitants. In an influential book,⁹ Flannery (1994) has described the first human inhabitants of Australia, New Zealand, and the Pacific Islands as “future eaters”. His thesis is that when these peoples first arrived in ecosystems unaccustomed to the existence of humans they found an extraordinary richness of food resources and a sudden release from pressure by predators that had evolved to exploit humans as a food resource. The universal response to this situation, according to Flannery, was a short-run over-exploitation of the available resources, accompanied by a population explosion. The over-exploitation then produced mass extinctions and a dramatically reduced standard of living for the people.

In discussing the situation of New Zealand in particular he notes (p 195):

Of all the extinctions that have occurred in the ‘new’ lands, none was so striking or is as well documented as that of New Zealand’s moas ... over the length and breadth of New Zealand, but particularly in the prime moa habitat in the south-east of the South Island, are found Maori cooking sites which are literally packed with moa remains. Hundreds of sites are known ... One of the most extraordinary sites was discovered among the sand-dunes at Kaupokonui in the Taranaki District of the North Island. There the remains of at least three species of moa, along with 55 other species of bird (many now extinct) have been found in and around ovens ... Analysis of the site suggests that the wastage of meat was enormous ... Gizzard stones are rare, suggesting that the great birds were gutted where they were killed, their innards being discarded ... The piles of uncooked heads, necks and other parts had clearly been left to rot, while only the leg bones are often found in oven pits, indicating that the haunches were the preferred meat ... [these sites] were occupied by very large numbers of people. Indeed, following the extinction of the moa, such dense aggregations of people were never to inhabit these areas again until after the arrival of Europeans.

Later in the book, Flannery adds (p 243):

With the extinction of the moa, the Maori were forced to rely upon other, more difficult-to-obtain resources. The smaller birds bore the brunt of the hunting effort

⁸ Fishing is also discussed in more detail below and in appendix 3 to this chapter.

⁹ It is curious to note, however, that the “tragedy of the commons” appears nowhere in Flannery’s book. He does not see the source of the problem as being a lack of private property rights. Rather the problem is a lack of collective (social or political) action to “change our ways before we have consumed all of the future that we are capable of”.

on land and many either became extinct or suffered dramatic range reductions. The huia, for example ... was nearing extinction by the time of European contact ... Likewise the takahe ... had vanished from everywhere except for a few lonely valleys in Fiordland, while the meaty kakapo, formerly the most common of birds, had been exiled to the remote mountains and remained tolerably abundant only in Fiordland. New Zealand's marine mammals had also suffered a dramatic decline due to over-hunting ... The three tonne elephant seals were early victims of over-exploitation and their breeding colonies vanished quickly. They were followed rapidly into local extinction by the half-tonne sea-lion ... But the smallest species, the 200 kilogram New Zealand fur seal ... hung on – just ... Even fish populations were affected by over-exploitation. Snapper ... for example, was fished early on in the South Island, but then vanishes from the archaeological record, suggesting a local extinction. The average size of snapper declines throughout its distribution in New Zealand with time, suggesting that the fishery was being over-exploited by the Maori. Interestingly, the average size of fish hooks also decreases, although whether in response to a decrease in fish size, or a shortage of moa bone ... is not clear ... Even such humble resources as shellfish show signs of over-exploitation ... Large limpets ... all but vanish from the Coromandel Peninsula and many other mollusc species decline in size throughout New Zealand.

The Maori inhabitants of New Zealand also foreshadowed another mistake made by the later European invaders. They brought an animal with them that also devastated the native fauna (p 245):

While humans had been devastating the larger land-based species, the Pacific rat ... or kiore ... was wreaking havoc among the smaller fauna that people might eventually have turned to in order to sustain themselves. The largest frogs, the tuatara and some of the smaller birds, were doubtless their victims, for many such species survive today only on rat-free islets.

Flannery goes on to describe the reduction in living standards that accompanied the mass extinctions of edible wildlife:

By the sixteenth century the human population of New Zealand ... were left with frighteningly few resources. Their agriculture was based essentially on tropical species which grew best in the warmer parts of the North Island ... Because of the lack of resources, the sweet potato, a humble staple elsewhere, became an exalted food in the north of New Zealand ... For want of alternatives, people were forced to survive upon the root of the bracken fern – reckoned inedible or a famine food elsewhere – but prized in New Zealand. By the early historic period it had become the staple crop of the Maori, even though in the south it was rarely of edible quality. There, the sugary base of the New Zealand cordyline ... was relied upon as a major food. Everywhere, the flesh of dogs and rats was highly valued, while the declining fish and shellfish resources provided most of the protein.

Similarly, the Ministry for the Environment (1997b, p 9.29) reports that:

The pressures on the remaining indigenous species intensified with the arrival of the Europeans, beginning with the release of rats, pigs and goats by Captain James Cook in 1769. Cook was followed several decades later by sealers and whalers who quickly devastated the remaining seal and sea lion populations and also drove the Right whale to the brink of extinction ...

By 1920, the new settlers had converted half the remaining forests [as of 1840] into farms and towns and had introduced legions of plants and animals, some of which displaced or preyed upon the indigenous plants and animals. Wetlands, dunes and estuaries were also invaded and converted into pasture or urban settlements.

The destruction of native habitat continued into the 1980s and still occurs at lower levels today ...

Since European settlement, 16 land birds (9 species, and 7 subspecies) have been driven to extinction, together with a native bat, 1 fish, at least a dozen invertebrates and possibly as many plants ...

It is often thought that such stories of the plunder of natural resources are evidence of the uncontrolled exploitation that occurs under “free enterprise”. There is a “free for all” scramble to grab resources before anyone else can get them with no thought for others or for the future.

However, other evidence tells a contrary story. It certainly has been of great value to cattle, pigs and sheep as *species* that people like to eat them. Farming has also greatly advantaged the survival of plants that provide food or other resources of value to people.

The key difference between these examples is that in one case the resources are unowned and therefore are free for all to overuse and waste, while in the other case they are owned. In particular, any one hunter or gatherer has no incentive to take account of the costs increased harvesting imposes on others. It is rational for each individual to expend effort up to the point where the individual marginal cost of additional food gathering activity just matches the marginal benefit. However, additional hunting or gathering reduces the amount of resource available for everyone else today and in the future and so raises the time it takes them to obtain a suitable harvest (or denies them an opportunity to harvest at all). Any one individual has no incentive to take account of these costs. Too much gathering occurs and the resource is depleted.¹⁰

¹⁰ This is discussed in more detail in appendix 3 and in a section below on the New Zealand fishing industry.

By contrast, owned resources are husbanded – maintained and developed to enhance their value and provide their owner with a better livelihood. The introduction of barbed wire and cattle brands to the American plains gave individuals an incentive to improve pastures, increase stock water supplies, develop new, more suitable, breeds of cattle and so on. In Zimbabwe, the granting of property rights in wildlife has given people an incentive to treat wildlife as an asset, just like cattle, rather than a “pest” to be eliminated so that income-earning cattle can be raised instead.¹¹

In summary, goods or services that can be consumed or owned *to the exclusion of others* have their worth verified by individuals’ acts of purchasing. Paradoxically, the ability to *exclude* individuals from enjoying a good or service unless they offer something in exchange is likely to guarantee more of the good or service is actually made available. Supply will be encouraged because the supplier can use whatever is offered in exchange to satisfy other desires.

Air and water pollution and other environmental problems are thus fundamentally a consequence of there being *too few* markets. In this regard, many critics of a market economy are completely mistaken. For example, the Ministry of Fisheries (1996) claims:

The market economy is a very efficient and flexible way to allocate many resources to meet individual needs and preferences. Society benefits from the innovation and dynamism that the market secures. But not all the outcomes of a market economy are necessarily beneficial. The market can create harmful spillover effects, as well as benefits.

It is not “the market” that creates the harmful spillover effects but rather the *absence* of suitable markets. The New Zealand Ministry of Agriculture and Fisheries should be one of the first organisations to recognise this fact. As we discuss later in this chapter, the introduction of the tradeable fishing quota in New Zealand has, in a sense, introduced a market in property rights to fish and produced a more efficient outcome than the previous system of open access.

In some cases, valuable goods or services are not *excludable* for technological reasons. It may be impossible, or too costly, to prevent anyone from enjoying the benefits of the good or service. In other cases, exclusion may be feasible but it may not be practised because the law does not recognise that anyone has the right to exclude others in the absence of a

¹¹ See the discussion in chapter 4.

payment in return. Property rights have a legal, as well as a technological, dimension.

Where exclusion from enjoying the fruits of a good or service is impossible or illegal, decentralised market mechanisms are unlikely to reveal the true worth of that good or service. Individuals will have an incentive to *free ride* on others. Since they will receive the benefits of whatever amount of the good or service is provided whether they contribute or not, they will have an incentive to offer nothing. The total amount forthcoming to pay for the good or service will fall short of the amount consumers would in principle be willing to pay and the good or service will be under-provided.

Similarly, when unowned and unpriced resources are used to provide a good or service, consumers will be unaware of the true cost of their act of consumption. They do not have to pay for effectively taking resources from, or imposing costs on, others and they will over-consume. With well-defined and enforced rights to resources, market prices would automatically reflect the true (marginal) costs of production and consumers would only indulge themselves up to the point where the (marginal) benefits of consumption no longer exceed those true costs of production.

The very effectiveness of privately-owned firms in maximising revenues and minimising costs can become a disadvantage when revenues or costs do not reflect all items of value. Firms might then increase revenues by increasing marketable output at the expense of unvalued items or characteristics. They might also decrease costs by economising on priced inputs at the expense of unpriced ones.

This may be one reason for using zoning laws or other restrictions on what can be done with historic buildings. The benefits of providing an historic building for people to look at are difficult to price in a market. Usually, people cannot be excluded from enjoying the architecture so long as the building is left standing. On the other hand, the commercial benefits of a building site are all reflected in the market price for the block of land. Private owners might then have an incentive to sacrifice the public historic values of a building in order to maximise the market value.

On the other hand, it should be recognised that there will be efficiency as well as equity consequences if owners are not compensated for *changes* in restrictions on the use of their property. Such changes will alter the market value of the property, since their consequences for the value of the site would not have been bid into the price the current owner paid to acquire the property. Changes in restrictions on use will be like a particular, individual-specific, tax that is used to provide the specific public good of the historic

building. Such a tax would violate the notion of horizontal equity – that individuals in similar circumstances should be treated similarly.

Uncompensated restrictions on the use of private property are also likely to have efficiency effects. Other individuals with buildings *likely* to be classified as having historic value will have an incentive to destroy those buildings, or allow them to rapidly deteriorate, before restrictions are put in place. By doing so, they can limit the amount of “discriminatory taxation” they may have to pay, but the cost will be a greatly reduced incentive to conserve any historic resources that have not yet been placed under conservation orders. A preferable way of conserving historic buildings is to allow them to be used for a purpose, such as tourist accommodation or a restaurant, that allows the owner to receive a market value for providing an interesting building for people to experience.¹²

If it is impossible, or very costly, to ensure all items of value are reflected in costs or prices, one response aimed at limiting the consequential damages is to reduce the incentives of firms to minimise costs or maximise revenues. This might be a reason some people favour government ownership in some circumstances. They might admit that a government-owned enterprise would waste market resources (such as labour and capital) relative to a private firm. But they would argue that the concomitant reduced incentive to exploit unpriced non-market resources would compensate for this reduction in efficiency.¹³

We believe that on balance these arguments are usually overshadowed by other considerations. As we shall argue in more detail below, government ownership of business enterprises is a very wasteful way of attempting to

¹² Conservation of cultural heritage assets is discussed further in chapter 9.

¹³ A related point occurred to us on one of our visits to New Zealand. It was remarked that the attitude of many people toward telecommunications infrastructure in New Zealand appeared to have changed with the corporatisation of Telecom and the entry of Clear into the market. It was asserted that the government-owned telecommunications carrier used to face little opposition to the construction of microwave towers and the like on the tops of hills or mountains. In recent years, however, the corporatised and private firms had faced substantial opposition. A possible explanation for this change in attitude is that some people may believe that the profit maximising entities have a stronger incentive to construct facilities that are profitable, even if they are not socially desirable when the (unpriced) environmental effects are taken into account. By contrast, the government-owned firm had reduced incentives to take actions that maximised profits regardless of the unpriced consequences and more of an incentive to respond to political pressures to take environmental effects into account.

cope with environmental effects. In fact, the waste of market resources associated with government ownership could be far more damaging to the attainment of economic efficiency than any reduced waste, or over-use, of non-market resources. More to the point, there are many better alternatives available for achieving superior environmental outcomes, including, for example, taxes or legislative constraints on the actions of private firms.

The evidence is also largely inconsistent with the claim that government-owned enterprises are more responsible in environmental matters than privately owned enterprises. The environmental problems in the former USSR and communist countries of Eastern Europe were far worse than the problems in western market-oriented economies at roughly the same level of economic development. In addition, many of the most publicised “environmental battles” in western countries have involved large engineering projects being proposed or undertaken by government-owned entities. Government ownership of forests in many countries has also resulted in waste and inefficiency in the markets for timber and non-timber environmental amenities.¹⁴

Finally, many private firms promote their “green image” as a form of advertising. They enter into voluntary recycling programs, sponsor

¹⁴ The controversy over the spotted owl and the timber industry in the Pacific Northwest of the United States provides a recent example of one of these “battles”. Epstein (1995, p 302) discusses this controversy. He uses it to illustrate the tendency for political decision-making processes to produce exaggerated claims of costs and benefits and to distort incentives in other ways:

The political process leads to grandiose claims of environmental necessity and dire predictions of economic stagnation. The present process of decision-making treats the value of the first acre of public land as the same as the value of the last, making it impossible to acquire information as to the marginal value of each acre in its alternative uses ... There is no effort to distinguish between virgin tracts of old growth and other tracts that have been compromised by prior cuttings. There is no effort to examine whether second-growth timber might also provide a suitable habitat for the spotted owl. And there is a perverse incentive to underestimate the number of owls in the wild and their hardiness – because to do so would weaken the case for keeping the lands undisturbed.

Epstein equally observes that public ownership of forest lands affects the incentives of the timber companies:

Private owners have incentives to harvest that timber which is easy to replace and can be removed with little damage to other parts of their property. But the companies who harvest on public lands care little about the replacement value of the timber they cut. Worse still, since they do not own the land outright, they care little about the damage that their cutting causes to the forest itself. The same companies that harvest their own lands with an eye toward recreational use will take far less care in harvesting on public lands because they collect none of the gains of good husbandry and all of the gains from quick cutting. It is not enough to have mixed uses; the uses must be well coordinated.

conservation projects (including recovery programs for rare and endangered birds in New Zealand), promote recreational use of suitable facilities and go beyond legal requirements for pollution control. In other words, many companies have found that it can be profitable to be seen as taking a responsible attitude on environmental matters.

PROPERTY RIGHTS AND THE LAW

Recognition and enforcement of property rights is essential to a market economy. It can be argued that the credible, independent legal system in the United Kingdom was by far the most important factor in the industrial revolution starting in that nation.

It can also be argued that the major impediment to economic growth in developing nations today is the lack of secure property rights. Why should anyone invest in market production when there is a strong presumption that they will not be able to enjoy the fruits of their efforts? Widespread bribery and corruption are one manifestation of insecure property rights. Numerous minor government officials who are in a position to extract bribes or impose onerous regulations or reporting requirements in effect have been granted an ill-defined and uncertain share in private property. The implicit taxes they extract undermine economic incentives.

Similarly, the lack of enforcement of law and order in the slum areas of major United States cities probably bears some of the blame for making these environments resemble third world cities more than the developed world. The high costs of doing business when theft and vandalism are rampant reduce employment opportunities and raise consumer prices. Individuals also face greatly attenuated incentives to accumulate skills, knowledge and property.¹⁵

The crucial features of a property right from the perspective of promoting efficient resource use are that it be exclusive, transferable and secure (see also Clough, 1993). If a property right is not exclusive, it is in a sense not a right at all. Others can benefit from the resource without having to offer something in exchange and the resource will have no market value. Similarly, a right needs to be transferable if it is to have market value. Owners of resource property rights that have a positive market value will receive any benefit from improving, and suffer any losses from degrading, resource value. They therefore have an incentive to use resources to greatest benefit, or else transfer them to someone else who can make better use of them. Rights that

¹⁵ See the related discussion in chapter 8.

are not secure will not provide appropriate incentives to trade off future uses against current uses. If owners believe their rights may disappear, they will have an incentive to increase current values even if future values are degraded to a much greater extent.

The legal system actually recognises different types of property rights. A property right can be seen as a public recognition that a defined object is in the possession of a particular individual who thus has the right to use it, alienate it or otherwise dispose of it as he or she sees fit.¹⁶ The object thus recognised could be physical, as in a defined parcel of land, or it could be intangible, as in a patented idea, or a copyrighted piece of music or work of art. The right to possess and use something entails the right to exclude others from possessing or using the same object. Thus, property rights as defined here also confer a right to exclude others from access.

The legal system also recognises a type of implicit property right. In particular, the law of tort gives individuals a right to be compensated when damages are inflicted upon them. In a sense, individuals have a right to enjoy their “life, liberty and happiness” and can demand compensation for infringement of that right, although the right is not alienable or transferable to others.

The different rights enforceable under the legal system can, and often do, come into conflict with each other. For example, the owners of two neighbouring properties might wish to use their properties to undertake activities that are in conflict with each other. The proposed use by one of the parties might produce smells, noises, or sights that interfere with the neighbour’s proposed use of their own property. Recognising the rights of one of the neighbours to use property as he or she sees fit then inevitably interferes with the same right possessed by the other neighbour. Similarly, allowing individuals to do whatever they desire with their property could infringe on the rights of others to be free of vexatious acts. For example, while the law recognises that I own my knife, it does not give me the right to use it to stab you.

Rights of use and enjoyment of private property can also be restricted by statute. In fact, the courts have held that if the restrictions are extreme, property rights cease to exist. For example, a California statute limits the use of excised body tissue and mandates its method of disposal. The California Supreme Court ruled that “the statute eliminates so many of the rights

¹⁶ Richard A. Epstein, “Possession as the Root of Title”, 13 GA. L. Rev. 1221 (1979).

ordinarily attached to property that one cannot simply assume what is left amounts to 'property' or 'ownership' for purposes of conversion law".¹⁷

Property rights to land and other resources

Ownership of land in particular usually confers privileges and obligations relating to the use of a *bundle* of resources. Many of these associated resources could be covered by separate tradeable property rights. Indeed, land that is owned publicly, such as the areas managed by DOC, often has particular *defined and limited* rights, such as grazing leases, water abstraction rights, timber rights, hunting licences and so on, that are traded separately. These rights usually carefully specify exactly what the owner is allowed to do. By contrast, freehold title essentially enables the owner to do anything with the resources *except* for certain activities that are prohibited – usually because they interfere with the rights of others.¹⁸

A great benefit of freehold title is that it leaves the owner with very strong incentives to find *new* uses for resources. Specific leases or rights are, by contrast, more static and tend to maintain particular forms of resource use even when they may no longer be the preferred use.

Nevertheless, freehold title is not always superior to leasehold. For example, some firms and individuals lease cars as opposed to owning them. These arrangements might reflect distortions arising from the tax system, but they might also reflect a cost advantage the supplier has, for example in maintaining the vehicles. Similarly, some people prefer to rent, rather than own, their house. Costs in buying and selling real estate can be substantial, so people who believe they may not live in the one area for long enough to justify the fixed costs can find it cheaper to rent. There is also considerable under-diversification risk associated with having a large part of one's wealth invested in a single asset. This risk can be avoided by renting. On the other hand, the widespread popularity of home ownership attests to the costs involved in monitoring rental agreements.

¹⁷ See *Moore v. Regents of the Univ. of Cal.*, 271 Cal. Rptr. 146, 159 (Cal. 1990), cert. denied, 449 United States 936 (1991) cited in Epstein (1979).

¹⁸ Epstein (1996b, p 64) argues, however, that:

after successive generations of Supreme Court opinions, it has become clear that the protection of *existing* uses counts for far more than the protection of future uses, which is why, for example, amortisation of existing land structures receives far greater constitutional respect than does a prohibition against a new use for a site which already has an existing use, as in all the landmark preservation cases.

When leases or licences are transferable some of the gains associated with freehold title can be captured. In particular, the owners then have an incentive to enhance the value of the licence or lease by investing in technological improvements, monitoring illegal infringements and so on. The owner does not have an incentive, however, to seek out alternative uses for associated resources that would decrease the value of the original licence or lease.

Defining and allocating property rights

It is not costless to define and enforce property rights. In consequence, the potential gains in efficiency from recognising and enforcing the rights can fall short of the costs. Society is better off if the rights are left undefined and unenforceable. This was noted by Coase (1960):

the reason why some activities are not the subject of contracts is exactly the same as the reason why some contracts are commonly unsatisfactory – it would cost too much to put the matter right.

Since both the costs and the benefits of defining and enforcing property rights can vary over time, however, what is recognised as private property can also evolve. Consider, for example, the case of environmental amenities such as clean water. All natural waterways and soils have some capacity to neutralise the effects of pollutants in the water inflow (see, for example, Collier *et al.*, 1995). When the amount of pollution entering the ecosystem is small the effects on water quality may also be very small. The benefits of controlling water pollution in that environment then might not be large enough to compensate for the costs of establishing a system to measure, and charge for, the discharge of pollutants.

As the local economy expands, however, the water pollution load may increase beyond the natural assimilative capacity of the environment. The pollution may begin to impose substantial costs in terms of reductions in water quality. In addition, there is considerable statistical evidence that recreation activities such as swimming and boating, and the enjoyment of environmental amenities, such as hiking, are “luxury goods”. That is, the demand for such goods, or the “willingness to pay” for them, tends to increase more than proportionately with income. Thus, the damage done by a given amount of pollution may also rise as economic growth raises material standards of living. The rising amount of damage in physical terms, and the rising cost of it in economic terms, will both tend to raise the value of defining and enforcing rights to clean water as the economy grows.

Changes in monitoring technology can also change the value of enforcing, and therefore of defining, property rights. In the case of water pollution, for example, sophisticated new chemical measuring techniques can identify sources at relatively low cost. All chemicals contain trace elements, or minute quantities of chemical compounds, that distinguish them from other sources of superficially identical chemical substances. Spectrographic analysis can be used to identify these “contaminants” and thus reveal the sources of chemical pollutants. It then becomes feasible to enforce property rights to clean water.

The introduction of barbed wire is another frequently cited example of a new technology that affected the costs of enforcing property rights. Barbed wire allowed large grazing properties to be fenced at relatively low cost. In turn, this made it feasible to control the breeding of animals so that strains that were more suited to particular regions could be developed. Also, since “free riding” farmers and wild animals could be excluded, it became more worthwhile to improve stock watering facilities as well as pasture and soil quality.

Changes in monitoring technologies can also make it feasible to define new types of goods or services – in effect, property can be unbundled into new types that can then be bought or sold. For example, electricity used to be sold essentially as a volume of energy taken over a given period of time (such as a month), although there might also have been a charge for the maximum amount of electricity that could be delivered to that site. Modern electronic meters have enabled electricity consumption to be monitored on a more or less continuous basis, so that it is now feasible to charge different prices depending on the time of day, season and so on, and thus have prices more closely reflect the costs of supply.

The role of transactions costs

The Coase article referred to above is often trivialised in the economics literature in the form of a “Coase Theorem”. This theorem says that, if there are no costs of defining,¹⁹ enforcing and transferring property rights (commonly referred to as *transactions costs*), then the allocation of property rights between an injurer and a victim will make no difference to efficiency. When transactions costs are zero, the transfer of rights between parties

¹⁹ These costs could include the costs of determining who the owners of a right are, searching for the owners and organising a mutually satisfactory “deal”.

necessarily will be costless, so the right will always be held by the party who values it most highly.

If the injurer has the (implicit or explicit)²⁰ property right, the victim will be willing to bribe the injurer to reduce activity to the point where the marginal benefit of undertaking the activity for the injurer just equals the marginal cost imposed on the victim. Alternatively, if the victim has the (implicit or explicit) property right, the injurer will be willing to pay the victim to permit the activity to be undertaken up to the point where the marginal gain to the injurer from the activity in question just equals the marginal cost to the victim. The only difference between the two outcomes would be the different income distribution and any effects that might have on the marginal costs or benefits of the activity at issue.

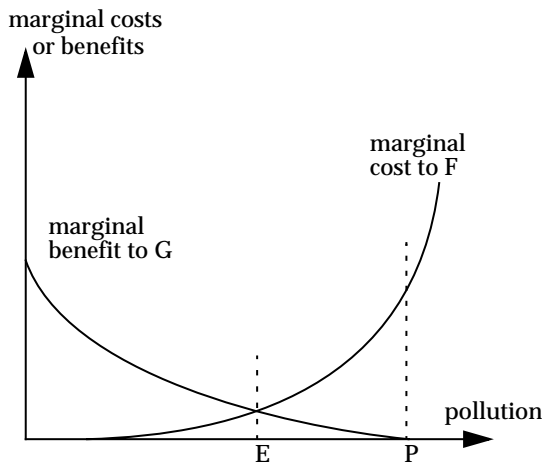


FIGURE 2.1: Marginal cost and benefit of pollution control

The argument might be clarified with the aid of Figure 2.1. Suppose we are talking about two individuals who share a lake. One individual, F, likes to fish while the other, G, would like to be able to avoid the cost of preventing pollution from getting into the lake. The marginal cost of pollution to F may be zero over a small range because the environment can assimilate a certain amount of pollution from G. Beyond that point, however, marginal costs may mount rapidly as the pollution begins to affect the fish. Similarly, the

²⁰ A right would be implicit if there is no “title” or other document testifying to ownership yet the right is enforceable in a court of law, or the court of public opinion or social sanction (for example, the “right” to be served first if you are at the head of a queue is a right enforceable by appeal to social sanction in some communities).

marginal costs of controlling pollution output for G might initially be quite low since simple measures will suffice to reduce pollution by a small amount. As the amount of required pollution reduction increases, however, the marginal costs of additional reductions will mount. These costs of pollution *control* are represented in Figure 2.1 as a marginal benefit of permitting greater pollution *output*.

If F cannot pay G to reduce pollution and there are no constraints at all on the behaviour of G (and G does not himself suffer losses from pollution of the lake – that is G does not *internalise* some of the spill-over, or external costs) pollution would expand to the level P on the diagram. The *efficient* level of pollution in this example is represented by the amount E on the diagram.

If the property rights are allocated to G, F could pay G to reduce pollution output below P. The amount G would demand for marginal reductions in pollution output is represented by the marginal benefit of pollution curve in the diagram. The amount F would be willing to pay is represented by the marginal cost of pollution curve. Thus, F would be happy to pay G to reduce pollution to the point E but no further.

Now suppose instead that the property rights are allocated to F. If F were to insist on zero pollution of the lake, the costs to G would be very high (the entire area below the marginal benefit curve and between the origin and the point P). The polluter G could bribe F to allow an increase in pollution up to the point E. Beyond this point, the benefits to G of additional pollution (that is, in terms of reduced cost of control) would not be sufficient to compensate F for the increased cost of pollution so no further deals between them would be possible.

In either case, pollution would end up at the point E. Resource allocation would be efficient no matter which party had the property rights.

While we have represented the outcome E as being identical under the two allocations of property rights, strictly speaking this need not be the case. Even though either allocation of property rights will achieve an efficient outcome under the current assumption of zero transactions costs, the distribution of income will differ in the two cases. When F is allocated the rights, G will pay F to be allowed to cut back on expensive pollution control. When G is allocated the rights, F will pay G to undertake pollution control up to the point E. If differences in income make a difference in the marginal value of pollution control to F, or the marginal cost of pollution control to G, the two curves in Figure 2.1 will be different under the different allocations, and so will be the efficient outcomes.

We have said that the Coase Theorem trivialises the main point Coase is making in his article. Most of the article actually discusses the more relevant situation where there are positive transactions costs. It makes the point that the allocation of property rights *can* make a difference to the *efficiency* of the outcome when transactions costs are non-zero.

We can again illustrate the argument with a variant (Figure 2.2) on the above diagram. Suppose now that while there is just one potential polluter G, there are a number of individuals F who are all affected by pollution of the lake. Any reduction in pollution will be enjoyed simultaneously and jointly by *all* the individuals in the group F. The marginal benefit of *reducing* pollution output (or the marginal cost of pollution) will therefore be the *sum* of the benefits accruing to each of the individuals alone.²¹ We can again determine the efficient level of pollution output in this case as the point of intersection of the (new vertically-summed) marginal cost of pollution with the same marginal benefit curve discussed above.

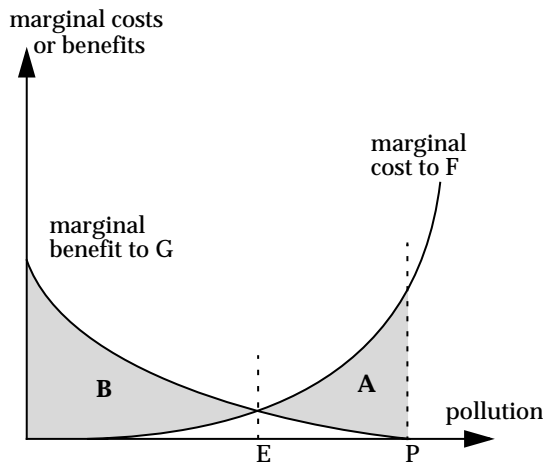


FIGURE 2.2: Marginal costs and benefits with many beneficiaries

Figure 2.2 also includes two shaded areas, A and B. Area A represents the net gain, *in the absence of transactions costs*, of moving from unrestricted pollution output at P to the intersection of the two curves at E. Area B represents the net gain, *in the absence of transactions costs*, of moving from zero pollution

²¹ Pollution reduction in this example is then an example of what economists call a *joint good*. Joint goods are further discussed below.

output to E. The point Coase emphasises, however, is that it is not costless to move from the output P, or the output zero, to the output E.

Recall that the move from P to E requires the beneficiaries of reduced pollution to compensate G for the costs of pollution control. There will be costs involved in arranging this transaction between the members of the group F and the polluter G. In addition, the beneficiaries would need to monitor G to ensure the polluter keeps to the bargain, and such monitoring will also be costly. The total gain in moving from P to E will therefore not be area A but rather area A *minus* the transactions costs of getting from P to E. We will use T_G to denote the transactions costs when property rights are allocated to G.

Similarly, if the property rights are allocated to the group of individuals F, the potential polluter would like to increase pollution output (reduce pollution control) to point E. To do so, G has to compensate the individuals in F for the cost of the increased pollution. There will be costs of negotiating and making these compensation payments to all the individuals in group F. Suppose these transactions costs, when the rights are allocated to F, are T_F .

The transactions costs T_G are likely to differ from the costs T_F . When the group F has the rights, a single polluter has to arrange compensation for each of the potential affected parties F. This could be done with each member of the group separately. If G is allocated the rights, however, individuals in the group F will need to coordinate to arrange a *joint* payment to G. Since any reduction in pollution will benefit all individuals in the group whether they contribute or not, any one individual will have an incentive to free ride²² on the contributions of others. There may be considerable transactions costs of over-coming these free rider problems. The conclusion is that, in this case where there is one member of the group G and many members in the group F, we are likely to have $T_G > T_F$.

Since the transaction costs are real costs that represent a loss of valuable resources (such as time), the two allocations of property rights result in different net gains in efficiency. We shall measure the net gains in efficiency relative to the situation at P.

If the rights are defined and allocated to G, and the transactions costs $T_G < A$, pollution will be at E and the *net* gain in efficiency will be $A - T_G$. If $T_G > A$, defining and allocating property rights to G will have no effect on pollution, which will therefore be at P.

²² Free riding is also discussed in more detail later in this chapter.

Conversely, if the rights are defined and allocated to F, and $T_F < B$, pollution output will again be E, and the net gain in efficiency relative to the situation at P will be $A - T_F$. If $T_F > B$, defining and allocating the rights to the group F will effectively ban G from producing any pollution, so pollution output will be zero. The net gain in efficiency relative to the situation at P will be $A - B$.

The efficient outcome, taking transactions costs into account, now depends on the relative sizes of the areas A and B, and the transactions costs T_F and T_G .²³ Coase discusses how the courts allocated property rights in a number of famous cases and he argues that the resulting decisions were most likely to have promoted efficiency.

The common argument that “polluters should pay” does not necessarily result in an efficient use of resources.²⁴ This is an argument based on distributional considerations, not efficiency ones. It claims that property rights should *always* be allocated to those wishing to have zero pollution regardless of the efficiency gains from altering pollution output or the transactions costs involved.

In addition to the potential efficiency problems of such a rule, it may be less “equitable” than it appears. For example, suppose a factory sets up operations in an area with few existing residents so the social cost of the

²³ If the rights are allocated to G, the net benefit relative to P will be $\max(A - T_G, 0)$, whereas if they are allocated to F, the net benefit will be $\max(A - T_F, A - B)$. For example, if A and B are both large relative to T_F and T_G

$$\max(A - T_G, 0) = A - T_G < A - T_F = \max(A - T_F, A - B)$$

and rights should be allocated to F. Conversely, if A and B are both small relative to transactions costs and $B > A$ then

$$\max(A - T_G, 0) = 0 > \max(A - T_F, A - B)$$

and rights should be allocated to G. Clearly, other cases are also possible.

²⁴ For example, the Ministry of Fisheries (1996) states that, “Fisheries management policy should ensure that the unpriced environmental and spillover effects (or external costs) associated with fishing are ‘internalised’, that is, they are assessed and consistently charged, where appropriate, to those who cause the effect”. This is a modification of the corresponding principle 4 in chapter 3 of the Ministry for the Environment (1995a). The Ministry for the Environment version states that the “unpriced environmental effects” should be “charged to users and consumers who benefit from them”. Again the focus appears to be on equity rather than efficiency. Although the Ministry for the Environment claims that their principle is equivalent to the “polluter pays principle” allocating rights (or responsibility for damages) according to who benefits could produce a different outcome than allocating rights according to who caused the external effect.

pollution is low. Following the establishment of the factory, new residents may move in, raising the damage done by the pollution. Some might argue that the new residents knew about the situation when they voluntarily chose to move, so they should not now be entitled to claim compensation for the pollution damage they are suffering. Furthermore, in a sense, the additional damage was “caused” by the individuals moving into the area, not the original decision of the factory owner.

Regardless of one’s views of such “equity” arguments, they focus on the wrong issue. The appropriate criterion for allocating property rights should be the minimisation of efficiency losses, including the transactions costs likely to be incurred.²⁵ The “polluter pays” principle instead places the focus on equity issues that are better handled by tax and transfer payments.

Common law as a decentralised evolutionary system

The Coase article is one of the founding articles in the law and economics literature. The idea that the common law tends to promote efficient resource allocation has been extended to many areas of law, including the common law rules of tort, property and contract.

The essential idea is that, if a legal rule is inefficient, then the affected individuals could rearrange rights and obligations so that the gains to one party more than compensated for the losses to the other party. An efficient legal rule, on the other hand, can only be overturned by redistributing from one party to the other. There are no net gains that could be used for compensation. This is really nothing more than an implication of the definition of efficiency. The implication is, however, that inefficient legal rules will tend to be challenged much more often than efficient ones. Cases will be brought forward to have the old rule overturned and a new precedent established.

In many cases, the inefficiency of an old rule will become apparent only as it is applied in a particular context. It will be impossible to predict all the implications of a particular rule in all the situations it is going to apply. Under the English common law, the process of testing out laws, and establishing new precedents, is a decentralised one. Just as with a market economy or a biological system, the common law will evolve over time and

²⁵ The property rights allocation might also affect efficiency by altering incentives for future behaviour. For example, if the residents were over-compensated for pollution damage, people would be encouraged to put themselves in harm’s way and the policy might have the perverse effect of *increasing* the damage done by pollution.

adapt to new technologies and situations. There is also a presumption that there will be a tendency for the system to evolve toward an efficient outcome.

We have argued that markets served by privately owned firms are a powerful mechanism for producing goods and services at minimum cost and for providing incentives for suppliers to seek out new products or preferred ways of serving customers. We also noted, however, that the market is unlikely to produce efficient outcomes where property rights are undefined or expensive to enforce.

The common law legal system, however, has a tendency to introduce new rights when it is efficient to do so. In addition, where explicit property rights are absent, injured parties can seek to obtain redress through the law of torts. The possibility that a firm will be sued for damages should also encourage it to take actions to avoid potential harmful effects on others.

POLITICAL ACTION

While the combination of the privately-owned firms operating within a market economy and the common law legal system are powerful engines for achieving efficient resource allocation, they cannot operate in a vacuum. Most importantly, property rights, and the legal system that underpins them, need to be enforced. Enforcement requires coercion, or the threat of coercion.

In a modern western economy, government is the only organisation with a legal right to coerce others. Making the right to coerce a monopoly right avoids continual, and extremely debilitating, struggles between powerful competing groups.

Of course, a monopoly power to coerce has a potential to be abused. In western democracies, the danger of abuse of power by governments supposedly is constrained by the fact that the right to exercise coercion has to be sanctioned by periodic elections involving two or more competing potential governing groups. Furthermore, the activities that the government is permitted to undertake are often constrained by a written constitution, or set of inherited laws and conventions, that are interpreted by a legal authority that is largely independent of the government of the day. The government is given the capacity to introduce changes to the legal system, but its own actions are also subject to a rule of law.

Governments have become involved in much more than the maintenance of internal law and order, the administration of justice and the enforcement of contracts. As we noted at the beginning of this chapter, in most of the nations of Western Europe, government expenditure is now in excess of 50% of GDP.

Public goods

Economists have argued that there may be a category of goods or services, called *public goods*, that are unlikely to be efficiently supplied in a market economy and where the coercive power of the state might be used to obtain a more efficient outcome. A pure public good has two characteristics.

First, it is *non-excludable*. This implies that it is impossible to prevent anyone from consuming the good or service once it has been produced. Such a situation makes market supply difficult, since the producer cannot recover revenue to pay for the costs of production.

Second, consumption of a pure public good is *joint*. Once the good or service has been provided, an additional consumer can be allowed to benefit from it without imposing any costs on existing consumers (including reducing their benefits). Since additional consumers can benefit from the good or service without imposing any cost, even if they *can* be excluded they *ought not* to be. For to exclude them would make them worse off without affecting anyone else. The use of resources would not be efficient.

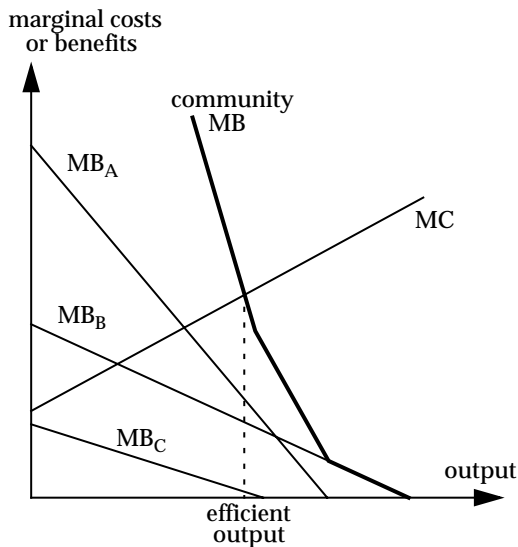


FIGURE 2.3: Efficient output of a pure public good

The efficient level of provision of a public good was analysed in a famous article by Samuelson (1954), although there are less formal treatments in the economic literature dating back to the nineteenth century. Since the good is provided jointly to all consumers at the same time, the community-wide marginal value of an additional unit of output is the *vertical sum* of the

individual marginal values for each consumer. The efficient level of provision then occurs where this community-wide marginal value of output equals the marginal cost, as illustrated in Figure 2.3 for three joint consumers of the good.

The efficient level of provision for a public good can be contrasted with the case of a private good. For a private good, efficiency requires that the marginal value of additional consumption for each of the consumers is equal and also that this common value equals the marginal cost of production.

The most commonly cited example of a pure public good is national defence. Once measures have been taken to provide a national defence force, residents of the country cannot be excluded from benefiting from the protection thereby afforded. Furthermore, the protective service is joint since protection for an additional person does not affect the amount of protection provided to any existing resident.²⁶

An important point to keep in mind when considering public goods is that demonstrating that there are “spill-over” benefits that are not reflected in market prices may not be sufficient to argue that the market outcome is inefficient. What is needed is that market prices do not reflect *additional benefits* from *further expanding* production beyond levels produced by markets.

For example, suppose most people expect their life will be better if they live in a community where everyone can read, write, do basic arithmetic and are familiar with the economic, legal, and political institutions. Obtaining a basic level of education that imparts these skills would then confer benefits on other individuals. These benefits would be joint and non-excludable. It does not necessarily follow, however, that the level of education that would be undertaken in private markets would be inefficient. For suppose that the *private benefits* of education for any individual are so high relative to the costs that everyone would purchase more than the basic level in any case. The public good benefits of *additional* education beyond this basic level could be zero. Even though the basic education is providing spill-over benefits to others, the market outcome would not be inefficient.²⁷

²⁶ While national defence has the characteristics of a public good, it might be provided by government partly because it would be impractical to have a government monopoly on internal law enforcement while private parties competed to provide external protection.

²⁷ This argument is strengthened when we recognise that “market outcomes” can include voluntary subsidies paid, for example, to educate children of parents with lower incomes. A separate section below further discusses voluntary actions.

The point might also be relevant for conservation policy. It is quite likely that there is wide dispersion in the extent to which individuals value non-excludable and joint services provided by wildlife. Individuals with a high value for wildlife might voluntarily preserve so many natural ecosystems that, even though a large number of others are simultaneously benefiting, each of these people may have such a low valuation that the private outcome remains efficient.

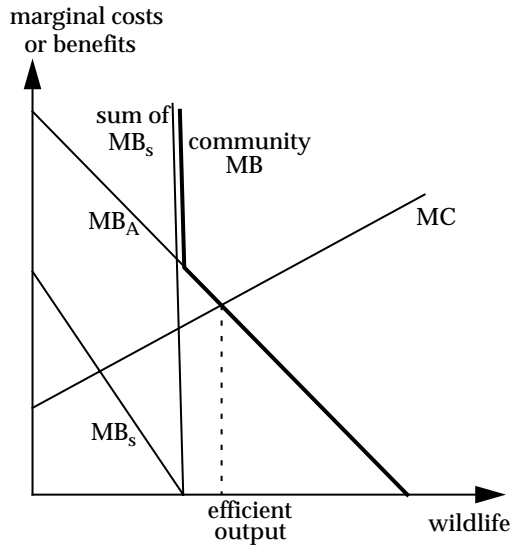


FIGURE 2.4: An efficient market outcome despite externalities

The point can be illustrated with the aid of a simple diagram. In Figure 2.4, individual A has a high valuation of wildlife. All remaining individuals in the economy have the relatively low demand MBs. Since there are a large number of these individuals, however, the vertical sum of their marginal benefit curves will be very steep. Since individual A values the good so much, he or she would choose to provide it up to a level where his or her own *private* marginal benefit matches the marginal cost of provision. At this large output, the *marginal* benefits for the myriad of remaining consumers is zero. Even though individual A is providing huge “spill-over” benefits to everyone else in the economy, this is no argument for producing more of the good than A would choose to provide voluntarily.

We do not mean to suggest that in practice there are sufficient individuals with a high demand for conservation services to ensure an efficient outcome for such services. However, we shall argue below that providing the services

through government action will itself be inefficient, so the relevant question becomes whether the market solution is more inefficient than the public alternative, not whether the market solution can achieve the best outcome imaginable. In particular, there may be enough variance in demand across individuals to ensure that the market outcome would not be too inefficient, or at least that a modest public subsidy of private conservation efforts might be sufficient to achieve the most efficient *practical* outcome. For example, a recent story in the *Houston Chronicle* (Florio, 1997) reported that:

All the land ... belongs to media magnate Ted Turner, and nearly all of it is being restored to its natural state, in effect becoming the private version of a national park, one roughly the size of Grand Teton in Wyoming. And in his own larger than life way, Turner is part of a trend. He is among 16,000 land owners around the country working to restore wildlife habitat on their property, said Mitch Snow, a United States Fish and Wildlife Service spokesman. An additional 2,000 are on the waiting list for help in setting up a similar program.

"There has been dawning recognition there is no way that Fish and Wildlife and the (National) Park Service could team up and buy all the land necessary to maintain the current level of migratory birds, songbirds and other species," says Hans Stuart, who works for Fish and Wildlife in Santa Fe, N.M. Stuart and Snow help administer a program called Partners in Wildlife which provides start-up money and expertise to people who want to convert their land into wildlife habitat. The program is a decade old ...

In the last eight years, Partners in Wildlife has spent \$4.3 million to restore nearly 89,000 acres of wildlife habitat in Arizona, New Mexico, Texas and Oklahoma, said Stuart, whose office deals with those states ...

Turner consults closely with state and federal wildlife biologists on how to restore his ranches to pristine prairie ... His three New Mexico ranches alone make up more than a million acres, about 1 percent of the state – more than double the combined size of all the national park land in the state.

As with all his ranches, Turner's plan for his New Mexico properties is to make the land self-supporting. Not for sheep and cattle, but for the bison, desert bighorn sheep, pronghorn antelopes, mountain lions and other animals that thrived there before Spaniards and Anglos settled the region ...

Studies were done to determine how many bison and desert bighorns the ranch ... could support. The animals would need water, requiring the installation of miles of water lines and the restoration of creaky wooden windmills that stood in various states of disrepair around the ranch ... A shepherd – actually, a biologist studying the sheep – was hired to protect the lambs [from the mountain lions].

Accustomed to government red tape, with a comfortable time lag between a plan's conception and its realisation, not to mention a chronic shortage of funds that stretched the lag even further, [former Fish and Wildlife officer] Waddell now

had a boss who wanted everything done yesterday – and gave him the money to do it.

Public goods and government action

What do public goods have to do with the government? Since it is difficult to charge a price for a non-excludable good, it is hard to see how a private entrepreneur could cover the costs of producing it. Beneficiaries could obtain the benefits whether or not they pay, so they would have an incentive to free ride on the contributions of others.

The incentive to free ride can be explained using the game theory concept of the prisoner's dilemma. In the prisoner's dilemma, there are two prisoners being separately interviewed by the police. The police are offering a reduced sentence if a prisoner agrees to provide evidence against his alleged accomplice:

- If neither prisoner provides evidence, the police case will be based on circumstantial evidence alone. The police have sufficient evidence, however, to ensure both prisoners can expect to receive a sentence of, say 2 years in prison. Call this the cooperative outcome C.
- If they both provide evidence, the police will have an extremely strong case, so despite the promise of a reduced sentence both will be in prison for, say 4 years. Call this the mutual defection outcome D.
- To make confession a more attractive option the police promise that if just one prisoner provides evidence, that prisoner will be promised no prison term. The remaining prisoner would in that case get no benefit from cooperating and so will receive the harshest sentence of 5 years in prison. Call the outcome for defecting when the other player cooperates the traitor's return T, and the outcome when a player cooperates but his partner defects the sucker's payoff S.

Consider the situation from the point of view of either of the prisoners acting alone. If he believes his accomplice will confess, he faces the choice of 4 years in prison if he confesses, 5 years if he remains silent. His best option is to confess. If he believes his accomplice will remain silent, he faces the choice of 2 years in prison if he remains silent but zero years if he confesses. Again, his best option is to confess. If each prisoner acts rationally in his own self-interest, therefore, each will confess and the result will be a total of 8 man-years of prison. From the point of view of the two of them together, this is the *worst* possible outcome – the other alternatives give a total of either 5 or 4 man-years in prison.

The prisoner's dilemma game is used to show how decentralised rational action might not produce the best joint outcome. Enforcing cooperation might be able to produce a better joint return to the participants in the game. For it to arise, the alternatives for the prisoners have to be ranked in the order $T > C > D > S$ and also²⁸ C exceeds the average of T and S .²⁹

Applying the prisoner's dilemma to the provision of public goods, the idea is that the best joint outcome involves players contributing to the provision of the good in accord with the benefits they obtain from it. If others are contributing, however, any one individual can make himself better off by defecting and refusing to contribute. From the individual's own point of view, this is the best outcome, T above. Furthermore, if one player keeps contributing while the other defects the player left contributing does not get as much of the public good but forgoes the full amount of the private good consumption associated with the cost of his contribution. This is the worst outcome, S above. If none of the public good is produced, everyone gets to consume a higher amount of private goods, leading to outcome $D > S$. The best outcome for everyone as a group, however, is the cooperative outcome C where everyone gets some public good and some private good too.

It is argued that the coercive power of the state is needed to force people to contribute to the cost of providing the good and achieve the best outcome C . Furthermore, because the good is joint, even if it were excludable, so a price *could* be charged for access, the threat of exclusion *should not* be exercised for to do so would be inefficient.

²⁸ If the average of T and S exceeds C , the players could choose cooperation or defection with some probabilities and obtain a better *expected* outcome. For example, they could agree before they are caught that they will each toss a coin to choose their strategy.

²⁹ We should note that the incentives to defect in the prisoner's dilemma game are reduced when the game is *repeated* many times. When the game is repeated, defectors can be punished in subsequent rounds. If the players *know for sure* that the game will end in a finite number of periods, then in the last period there will be an incentive to defect, since there will be no following period in which punishment can be inflicted. Knowing defection will occur in the last period, the threat of punishment for defection in the next to last period may not be credible (since defection in the last period is the worst outcome anyway), so defection will also be expected in the next to last period. But then defection will also be optimal in the second to last period and so on. Through backwards induction, players could conclude that defection will be optimal all along. Such a scenario requires considerable foresight, however, when the number of periods before the end of play is large, and will be less likely where no definite ending period can be foreseen.

The conditions required for the validity of the prisoner's dilemma show, however, that free riding is not inevitable. Even if there is no coercion, private individuals might supply a certain amount of the public good – especially when the game is repeated over a number of periods.³⁰ For example, suppose someone attempts to free ride on the provision of possum eradication services by a voluntary association of his neighbours. There will be underfunding of possum eradication services compared with people's true preferences and too many possums in the next period. Others who were contributing might become discouraged and would be likely to reduce their efforts, maybe also as part of a strategy to punish the defector. With the number of free-riders increasing, the eradication efforts would become even less effective, further increasing the incentives to defect. If several periods go by with the same outcome, the free-riders would begin to accept that if they do not make their contributions match their true preferences outcomes are going to become truly sub-optimal relative to those preferences. Would not most of them despair of this situation and begin to contribute more?

The presumption that voluntary activity cannot be relied upon to provide a tolerably efficient level of public goods output might appear more reasonable to readers living at the end of the twentieth century than it would have to readers at the end of the nineteenth century. One has only to consider, for example, the huge number of educational, artistic and other cultural facilities funded by private charitable contributions in the United States during the nineteenth century.

Economists have argued that this observation suggests that government provision of public goods may *displace* private provision. People conclude that they are paying taxes to finance the provision of public goods, so there is little reason to contribute additional resources through voluntary activity. Statistical studies have indeed found government actions and private voluntary actions to provide public goods to be substitutes for each other.³¹ Thus, the common opinion that voluntary activity will lead to under-provision of public goods may be as much a *result* of the growth of government as an *explanation* for it.

³⁰ See also the discussion in the previous footnote of the effect on incentives to defect of repeating the game.

³¹ Brendan Moyle pointed out in correspondence with us that “membership in the Royal Forest and Bird Protection Society has fallen considerably since its peak (roughly coinciding with the formation of the Department of Conservation).”

A situation that is particularly conducive to private supply of a public good is where the benefits obtained from the public good vary greatly across individuals. An individual with high demand might continue supplying the good in the face of free riding, perhaps withholding supply every so often in order to discourage the free riding.

When the number of individuals benefiting, or primarily benefiting, from a public good is small, and the jointness is local, people can, and often do, form voluntary associations or use other voluntary mechanisms to ensure an efficient level of the good is provided. For example, Epstein (1996b, p 43) notes that:

Many planned unit developments contain restrictions that go far beyond those required by the law of nuisance, both with regard to the aesthetics and environmental ambience. The explanation is clear enough: it is in the interest of the developer as the original common owner of the property to impose these restrictions universally on all units before sale. His own objective function is simply to maximise the revenues from the project, wholly without regard to any high-minded ecological or environmental crusades. But in order to achieve that result he has to cater to the consumption preferences of his potential purchasers. Ordinary consumers buy a bundle of private and common elements. In general it would be odd for potential purchasers to place a very high value on the amenities found within their own units, and very low value on those appurtenant to common areas located nearby. Indeed one reason why people, particularly people of means, buy in planned unit developments is to obtain the security that their neighbourhood will not move in unwelcome directions without their consent, or at least the consent of their like-minded (and equally endowed) representatives. To be sure, any set of restrictions, set-asides and dedications imposes costs on the individuals who are subject to them. But each buyer at the time of purchase makes his calculations on the net position. If the restrictions imposed on others are worth more to a given buyer than the inconvenience that similar restrictions impose, then he will sign on to the plan. The original developer therefore has the right incentives to seek value maximisation, and the buyers can sort themselves out among developments ...

Such “free market” town planning can in fact extend far beyond “planned unit developments”. To this day, the City of Houston (population 1,702,086 in the 1994 census, and area 586.86 square miles) does not have any zoning laws. Developers include covenants with housing blocks that restrict many of the things home owners can do. The covenants also typically specify a method for changing their provisions through a vote of residents (usually more than a simple majority is required). Different developers compete for customers by specifying different features in the deed restrictions.

Residents in the Houston area also usually pay fees to neighbourhood associations that are charged with enforcing the deed restrictions and perhaps providing other functions such as beautifying neighbourhood streets, planting trees and so on. In some neighbourhoods, households also voluntarily contribute to employ additional police (who are usually off-duty City or County police) to patrol neighbourhood streets and respond to burglary or other calls. The response time of such neighbourhood police is much faster than the City force and crime rates in the locally patrolled areas accordingly are much lower. Local public goods clearly can be provided through mechanisms other than the political system.

In some situations, market supply of a non-excludable good or service may be facilitated when consumption of that good or service can be tied to the consumption of another good or service that is excludable. Lighthouses provide an interesting case in point.

Case study – the provision and pricing of lighthouse services

Coase (1974) discussed lighthouses in another famous article. He quoted Samuelson as arguing in his introductory economics textbook (Samuelson, 1964) that lighthouse services are an example of a public good. The service is non-excludable because “lighthouse keepers cannot reach out to collect fees from skippers” who use the service. Furthermore, the service is joint because, says Samuelson,

even if operators were able ... to claim a toll from every nearby user ... it costs society zero extra cost to let one extra ship use the service; hence any ships discouraged from those waters by the requirement to pay a positive price will represent a social economic loss.

Coase observes:

There is an element of paradox in Samuelson’s position. The government has to provide lighthouses because private firms could not charge for their services. But if it were possible for private firms to make such a charge they should not be allowed to do so (which also presumably calls for government action).

He then discusses the historical record on the provision of lighthouses in the United Kingdom, focusing most of his attention on England and Wales. He notes that

the principal lighthouse authority in England and Wales is Trinity House ... It seems to have evolved out of a medieval seamen’s guild ... Letters patent ... granted in 1514 ... gave Trinity House the right to regulate pilotage, and this, together with its charitable work, represented its main activity for many years. It

did not concern itself with lighthouses until much later ... Early in the seventeenth century, Trinity House established lighthouses at Caister and Lowestoft. But ... in the period 1610–75, no lighthouses were erected by Trinity House. At least 10 were built by private individuals.

Coase remarks that the private promoters presented a petition signed by ship-owners and shippers who would benefit from the lighthouse and attesting that they would be willing to pay the toll. The Crown then granted a patent empowering the promoters to build the lighthouse and levy tolls on ships presumed to have benefited from it. While Trinity House “wanted to be recognised as the only body with authority to construct lighthouses ... it was reluctant to invest its own funds”. Later in the seventeenth century, Trinity House adopted a policy “which maintained its rights while preserving its money”. It would apply for a patent to operate a lighthouse but would grant a lease, for a rental, to a private individual to build the facility and collect the fees, usually for a specified period of time after which all fees would accrue to Trinity House.

Of particular interest to us is the method the private operators (and Trinity House) used to finance their lighthouses.

The tolls were collected at the ports by agents (who might act for several lighthouses), who might be private individuals but were commonly customs officials. The toll varied with the lighthouse and ships paid a toll, varying with the size of the vessel, for each lighthouse passed ... Later, books were published setting out the lighthouses passed on different voyages and the charges that would be made.

In effect, while the use of the lighthouse service was itself non-excludable, a complementary product, namely use of the ports, was excludable. Denial of access to the port facilities could then be used to force payment for lighthouse services. Coase observes that this early history shows that:

contrary to the belief of many economists, a lighthouse service can be provided by private enterprise ... The lighthouses were built, operated, financed and owned by private individuals, who could sell a lighthouse or dispose of it by bequest. The role of the government was limited to the establishment and enforcement of property rights in the lighthouse. The charges were collected at the ports by agents for the lighthouses. The problem of enforcement was no different for them than for other suppliers of goods or services to the shipowner.

In later years, and up to the time Coase was writing, lighthouses in England and Wales were all built and operated by Trinity House, “a private organisation with public duties”. While the light dues came to be specified

by Parliament, “the service continued to be financed by tolls levied on ships”.

Although Coase gives few details of the earlier tolls, it is interesting to observe that the toll specified in the *Merchant Shipping Act 1898* was quite efficient. Ships were charged on a sliding scale based on the number of voyages per year:

In the case of ‘Home Trade’ ships, there is no further liability for light dues after the first 10 voyages in a year and in the case of ‘Foreign-going’ ships, there is no further liability after 6 voyages ... The light dues are ... such that, for a ship of a given size, 10 voyages for a ‘Home Trade’ ship yield approximately the same sum as 6 voyages for a ‘Foreign-going’ ship.

Since “the vast majority of ships will not need to pay light dues on their last voyages in the year” and, for those that do, “payments into the General Lighthouse Fund form a very small proportion of the cost of running a ship” Coase concludes that “the form of the toll and the exemptions mean that for most ships the number of voyages will not be affected by the fact that light dues are paid”.

Coase contrasts the institution used to provide lighthouse services in England and Wales with support out of general taxation revenue “which seems to be what Samuelson would like”:

First of all, it would increase the extent to which the British government and particularly the Treasury would feel obliged to supervise the operations of the lighthouse service, in order to keep under control the amount of subsidy. This intervention would tend to reduce somewhat the efficiency with which the lighthouse service was administered. And it would have another effect. Because the revenue is now raised from the consumers of the service, a committee has been established, the Lights Advisory Committee, representing Shipowners, Underwriters and Shippers, which is consulted about the budget, the operations of the service and particularly about new works. In this way, the lighthouse service is made more responsive to those who make use of the service and because it is the shipping industry which actually pays for additional services, they will presumably support changes in the arrangements only when the value of additional benefits received is greater than the cost ... It is difficult for me to resist the conclusion that the benefit [in the form of additional voyages] that would come from the abandonment of the light dues would be very unimportant and that there would be some loss from the change in administrative structure.

We have quoted this study in some detail because it demonstrates a number of important points about public goods. First, non-excludability is not necessarily an impediment to market provision. So long as the good or service is complementary with another product that is excludable, charges

can be levied. Second, the example emphasises again that charging a price for a product not only enables costs of provision to be covered. It also reveals important information about the value of the good or service to consumers. This information is not available when the product is given away at no charge. Third, the example shows that *price discrimination*, or charging different prices to different consumers, can be used to increase the efficiency of provision of a joint good.

Some other examples of privately-provided joint goods

The role of price discrimination in aiding the efficient supply of jointly consumed goods might be further illustrated by considering some other examples. Many privately provided services are characterised by a degree of jointness. For example, many sporting and music events are held in venues with large, but limited, seating capacities. Until the facility becomes congested, additional consumers can be admitted to the event at little or no cost to the existing patrons. The actual performance is jointly provided. Exclusion is possible, however, so private provision is feasible.

A similar situation applies with mass transport, including airline services. The fuel and other costs of an additional passenger are usually trivial compared with the fixed costs of operating the service.

In these situations, we find the suppliers offering services to customers at different prices. Seasonal subscribers to a series of concerts or sporting events obtain their seats at a different price. Different passengers on an airline or train service often travel for a different fare.

Operators have an incentive to allow as many patrons as possible to consume the service. Until the facility becomes congested, operators will want to give discounts to marginal customers to encourage them to fill the vacant seats. While the marginal cost of allowing an additional consumer remains low, the supplier will have an incentive to charge a low price.

Customers with a high demand for the service can be charged a high price without them choosing to forgo consumption. In this way, the large fixed costs of providing the service can be covered without compromising efficiency.

The major difficulty for suppliers is that they have to prevent high demand customers taking advantage of the low priced seats. They do this by differentiating the product in some way. For example, only the higher paying customers can be offered other excludable and non-joint goods or services such as better views, better program notes, the chance to speak to performers, the ability to book and obtain a seat at the last moment and so on.

Another common method of instituting price discrimination, as with the lighthouse example discussed above, is to differentiate between customers on the basis of the amount consumed. Patrons can pay a fixed charge and then are offered additional units at the very low marginal cost. Occasional users are asked to pay a price much higher than marginal cost – as a contribution toward covering the fixed overheads – but the inefficiency of the lost consumption may be small since these users are not the main beneficiaries of the service in any case. Offsetting the efficiency costs of lost consumption is the advantage that charging for the service gives a market test of its value to consumers. If the services were provided out of general taxation revenue, and then practically given away at low marginal cost, there would be little information about whether the benefits more than covered the costs of provision.

The costs of taxation

Another problem with financing the provision of public goods out of general taxation revenue is that taxation itself is inefficient. As a result, any gains from the more efficient provision of public goods have to be balanced against the losses from taxation. Taxation is inefficient because it drives a wedge between the buying and selling prices of the taxed good or service. The value of the good or service to the buyer then exceeds the cost for the seller by the amount of the tax. Production and consumption of the taxed good or service will be too low, and the losses incurred by the market participants will exceed the revenue raised by the government as a result.

This is illustrated³² in Figure 2.5 where E represents the market equilibrium in the absence of taxation, t is the tax rate, p is the tax-inclusive price paid by consumers of the good or service and Q is the output under taxation. The lighter shaded area bounded by $p(1-t)$, B , E and F represents the cost of the tax (the forgone revenue minus cost savings)³³ to suppliers. The darker shaded area bounded by p , A , E and F represents the cost of the tax to demanders (the forgone benefits of consumption less expenditure savings).

³² In practice, the efficiency costs (or excess burden) of taxation are best calculated in a general equilibrium framework as was done for New Zealand by Diewert and Lawrence (1995). The partial equilibrium framework presented in the diagram is merely to illustrate the idea of excess burden.

³³ Since the supply curve also represents marginal production costs, the area under the curve represents total costs. Similarly, since the demand curve represents marginal benefits of consumption, the area under the curve represents the total benefits.

The revenue raised by the tax is pQt , or the area of the rectangle bounded by p , A, B, and $p(1-t)$. Since the revenue raised by the government falls short of the costs imposed on suppliers and demanders, the tax imposes *efficiency losses*.

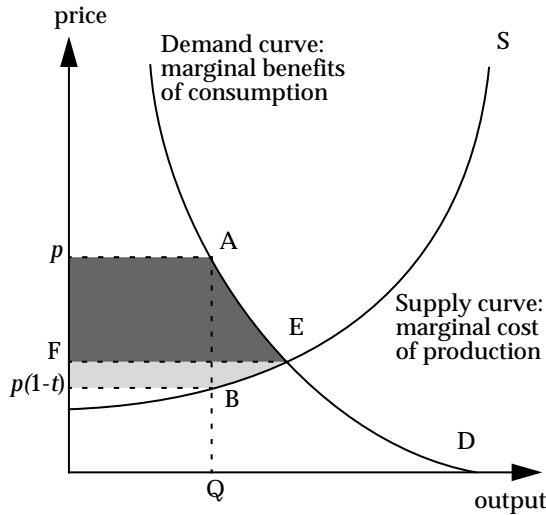


FIGURE 2.5: The efficiency costs of taxation

Indications are that the efficiency losses associated with raising the *marginal* \$1 of revenue using the current tax system in New Zealand are at least 20¢.³⁴ *In addition*, there are *costs of administering* the tax system that are borne by the government, and *compliance and avoidance costs* that are borne by individuals (in terms of expenditures on accountants and lawyers, and additional record keeping and so forth). These are also wasted resources since they could instead have been used to provide other valued goods or services. Diewert and Lawrence (1995) report that in New Zealand these are at least 8% of

³⁴ Diewert and Lawrence (1995) calculate the efficiency costs of *labour* taxation at 18% and of *consumption* (through the GST) at 14%. These estimates ignore taxes on *capital*, which represent about 15% of total revenue in New Zealand. Allowing for capital taxation is likely to substantially increase the efficiency costs of the tax system. New Zealand is just one among many destinations for investment funds. A small change in the after-tax return on investment in New Zealand produces a large reduction in the net foreign capital inflow. The supply curve in the market for investment funds corresponding to Figure 2.5 is very flat and the resulting distortion from taxation very high. The efficiency cost of the *marginal* \$1 of revenue is the marginal efficiency cost of the *most inefficient* source.

revenue raised. Thus, the current tax system in New Zealand imposes deadweight losses of at least 28¢ for the *last* \$1 of revenue raised. To produce a net gain in efficiency, therefore, \$1 of *marginal* government expenditure has to deliver a benefit of at least \$1.28.

We conclude that the existence of public goods provides much less of an argument for using the coercive power of the state than is commonly supposed. Divorcing the finance for providing a public good from a market test of its value to consumers can result in an inefficient level of output. Furthermore, financing the provision of public goods through taxation itself imposes efficiency losses. While the market solution might not be the best imaginable, financing provision through taxation may not be able to do any better, and might do far worse.

Government as a producer of goods or services

The discussion so far has only considered using taxation to finance the provision of public goods. Even if it is thought that provision of a good or service is best financed from taxation, however, that is no reason for the government to *own and operate* the production facility. Appendix 2 discusses in more detail some of the efficiency costs associated with government ownership and operation of production facilities in a democracy.

While it would seem to be difficult, or unwise, to contract out the essential coercive roles of law enforcement and tax collection, there is little difficulty with contracting out a great many other government services. By relying on the private sector to provide a good or service, the government can still take advantage of the strong incentives within the private sector to minimise the costs of production. This is particularly so where it is possible to arrange a competitive service supply market.

A related point is that subsidies from tax revenue can be used to overcome inefficiencies without getting the government involved in producing a good or service. For example, the output of a desirable good or service may be below the efficient level when it is difficult to exclude non-paying customers. Subsidies can be used to artificially stimulate output while the market is otherwise left intact. Of course, raising tax revenue to pay the subsidies still imposes efficiency losses as discussed above.

Natural monopoly

Another argument often used to justify government production of goods or services is that some industries are *natural monopolies*. In a natural monopoly, the average costs of producing output decline as the level of output (or the

range of goods produced) expands. The technology is said to display *increasing returns* to scale (if average costs fall as output expands) or scope (if average costs fall as the range of products produced increases).³⁵

It is argued that, when technologies display increasing returns, production by a single firm will result in lower costs than production by several firms. This is what makes the monopoly “natural”, and can be distinguished from cases where monopolies are “created” by government policy – for example, by granting patents, banning imports or imposing penalties for competing (as is the case with the post office).

An entrant will have difficulty competing with an incumbent natural monopolist. Typically, the entrant will be producing a smaller output than the incumbent and so will have higher costs. The incumbent therefore will be able to raise its prices by reducing output below the efficient level.

It is claimed that, under these circumstances, production by a government-owned monopoly firm will result in a more efficient outcome. The argument seems to be that, since a government firm has less of an incentive to maximise profits and more of an incentive to respond to political influences (see the further discussion below), it will be less effective at exploiting its monopoly power.

A corollary of the reduced incentive for a government enterprise to maximise profits is that the government firm also has less of an incentive to minimise costs, and less of an incentive to raise revenue by providing better service to customers, or discovering new products, markets and technologies. These efficiency losses associated with government ownership need to be balanced against any potential efficiency gains from lower prices and a higher level of output. In most cases, a more efficient outcome can be achieved by using contracting out, subsidies or regulation of the private sector. Wherever possible, the government should regulate business using general rules relating to competition, or the laws of contract, tort and fraud.

Appendix 2 to this chapter discusses natural monopoly and the losses associated with government ownership in more detail. It also discusses the rationale behind many of the reforms to government activities that were made in New Zealand in the 1980s and how these reforms may have ameliorated some of the inefficiencies of government operations.

³⁵ The potential for natural monopoly production is related to the idea of *jointness* discussed above. The reason average costs can decline as output, or the range of products, increases is that some production facilities are jointly used and need not be expanded to cope with additional production.

Political competition

We can conclude from the discussion thus far that there are situations where coercion exercised through the political system may have the *potential* to improve the efficiency with which resources are allocated. It is another matter, however, to claim that actual political processes are able to realise that potential.

The claim that democratically-elected governments will, in practice, correct market failures is often based on a “public interest” view of politics. This holds that democratically elected governments will do all and only those things that are in the general public interest. We would identify promoting efficient resource allocation as being at least part of the “general public interest”. In that case, however, how can we explain obviously inefficient, and sectionally motivated, government policies like tariffs or subsidies?

The economic approach to explaining democratic political outcomes instead views politicians, voters and bureaucrats as rational actors pursuing their own private interests. Voters will favour policies that make them better off. Politicians will compete to gain the right to implement their preferred vision of how society should operate, or even for the privileges or prestige of office – but to gain office they need to appeal to voter self-interest. Bureaucrats will have their own goals such as maintaining their employment and its conditions, but will be constrained to some extent by being held accountable for their actions by the government or parliament. While this approach can explain many policy outcomes, it conflicts with the language used in political debate, which constantly refers to the public interest. Policies usually need at least the appearance of serving some public purpose to command widespread support.

The public interest and the economic approaches to explaining democratic political action can be reconciled to some extent. One of the founders of the economic approach, Downs (1957), noted that competition between parties for office will tend to promote efficient policies. In a world where information was costless, only efficient policies could garner majority support. By definition, inefficient policies could be changed to efficient ones by making some voters better off and no others worse off. While competing parties might propose policy packages with different distributional implications, none of the policies in any winning package could be inefficient.

In practice, information is costly, and information is very deficient in the political marketplace. Voters have weak incentives to become informed,

because making a more informed choice is likely to make little difference to their individual or family welfare.

Furthermore, information about candidate or party performance is difficult to obtain. Many voters (and journalists) economise on information costs by judging politicians on *intentions* rather than performance. When a problem is identified in a modern Western democracy, it seems natural to conclude that remedial action, understood usually in terms of government spending, will have a positive effect; with that effect following from the *intention* of the intervention. Public monies provide the inputs and the implicit belief is that such inputs will be sufficient to produce improved outcomes. Public policy is seen as a matter of “intent + resources = results”. It is almost as if politicians have to be *seen* to be doing something about a problem, not that they actually achieve a desirable outcome.

Rational Ignorance and the Quiet Life

The intent + resources = output model is, for the general public, a means of dealing with ignorance. Measuring results is difficult and costly, and no doubt would be irrational for most people. Intentions are easy to grasp, as are expenditures (at least in a comparative sense: \$1 billion is a big program, \$1m a small one, \$300m is less than \$500m, and so on). So the dialogue of politics is conducted in terms of intentions, responding to the (rational ignorance) of the public. Endorsement of intentions is also an easy way of salving the conscience.

For bureaucrats, on the other hand, it can be a device for an easy life. A possible answer to every problem is more money and the question of actually putting effort into working out better ways of doing things need not arise. (In particular, the question of whether it is an appropriate role for government is often not asked.) Thus annual reports of Departments and statutory bodies typically have statements of activity rather than measures of actual results.

The tendency to focus on resources and intentions rather than results indicates, of course, a major weakness in political mechanisms. They are poor at processing information and at producing appropriate incentives to improve the processing of information.

This perspective can also explain the media focus on the ethics and values of politicians. Voters are interested to know what motivates political decisions, not details about the effectiveness of different policies, the former being a lot easier to be informed about than the latter.

Corresponding to the political focus on intentions rather than outcomes, government enterprises also display a tendency to measure and report inputs rather than outputs. For example, Craig and Stewart (1994) examined a 1994 publication of DOC and found:

Under fire control there is a record of land burned and the cost of fighting fires but no record of what was saved or how strategic placement of fire control capability had minimised loss of more sensitive areas.

Craig (1997) also comments:

The current listing of conservation activities rather than outcomes as occurs in New Zealand provides little reassurance that effectiveness is a primary motivation of management.

Similarly, a collection of DOC Fact Sheets (*Greenprint*, Department of Conservation, 1996a) outlines the key issues for the Department. At the front of the collection, *DOC at a Glance* outlines DOC's budget, the land and marine reserves it manages, the programs it has put in place, the offices and staff numbers it manages, facilities such as tracks and structures it owns and so on. About the only fact that is an output rather than an input is the number of "visits that were made to DOC offices".

At the back of the same publication (almost the last section) are the Department's "output classes". The various output classes are described as follows:

1. policy advice and ministerial servicing;
2. implementation of legal protection of areas;
3. statutory planning and coastal responsibilities under the RMA;
4. management services (fire control, pest and weed control and so on);
5. species recovery programs and habitat restorations;
6. managing concessions, leases, and licences including developing national policies and guidelines, and issuing, monitoring and enforcement;
7. policy development and management with respect to "appropriate provision and use" of huts and camp grounds and the provision of other facilities and services for visitors;
8. management of visitor centres, visitor events and information services, and events and activities to encourage public participation;
9. production of conservation management strategies and plans; and, finally
10. responding to the Cave Creek Commission of Inquiry.

What is interesting about this presentation by DOC is first, that outputs are not mentioned until very late in the *Greenprint* document. Second, quite a few of the "outputs" would really seem to be more in the nature of inputs.

Policy advice, ministerial servicing and policy development could be categorised as outputs only if the *government* is the “customer” of the Department rather than the members of the public. However, government actions ought to be assessed on the basis of the value they provide to taxpayers.

More importantly, we fail to see how activities such as “implementation of legal protection of areas”, “species recovery programs”, “management services”, “managing concessions, leases, and licences” and “producing management strategies and plans” can be considered as outputs. These activities are not ends in themselves but rather inputs or means to the end of providing the conservation services that are valued by the public. The appropriate measure of output ought to be the value the public places upon the conservation services produced by these activities. Similarly, “statutory planning” of coastal areas is a means to the end of raising the total value of coastal resources for the people of New Zealand.

By comparison, a business would list the total value of goods or services *provided to customers* as its primary output. We would expect to find among the Department’s outputs a list of quantifiable targets for service outputs provided to the “real customers” (for example, changes in numbers of visitors to DOC areas, a measure of how much each of these customers values the experience, surveys of satisfaction with DOC performance, species or habitats restored and the value placed on them and so on). Chapter 7 discusses the structure and performance of DOC, including measuring its outputs, in more detail.

The high information costs in the political market place have other consequences. In so far as there is any interest at all in the effects, as opposed to the intention, of policies the focus tends to be on the immediate, obvious and dramatic effects. There is a systematic tendency to ignore the unintended and gradual effects, even if these are, in the long term, of greater consequence.

The high costs of information in the political market place also can explain the tendency for democracies to cater to vested interests at the expense of the general public interest. If the voter is going to spend time and other resources monitoring government policies, the resources will have a greater return if the monitoring effort is focused on the voter’s special interests. Politicians will be able to gain, and retain, office by putting together a package of policies focused on numerous (and perhaps even competing) special interests even while they ignore the general public interest.

Policies that affect a voter's special interest include policies that affect the industry the voter is employed in, or to which he or she supplies capital or other goods or services. For example, forestry policies in many countries have in the past tended to subsidise logging operations at the expense of alternative uses of the resources. Similarly, many countries, including Australia and New Zealand, have, in the past, subsidised land clearing and agriculture at the expense of other land uses. Special interest policies could also be focused on the voter's interests as a highly specialised consumer of certain goods or services. For example, the voter might have a much higher than normal demand for health care, sporting or cultural amenities or recreational opportunities. In the conservation arena, hikers have a demand for a specialised resource that they would like to have access to at low cost or preferably free of charge.

High information costs in the political market place can also be exploited to hide the true intention of policies. For example, regulatory controls on land use often are aimed at producing outcomes of interest to vested interest groups, with the costs borne by particular land owners and thus more "hidden" than direct transfers out of general tax revenue.

Even if voters were well-informed, the effectiveness of political competition would still be limited by other factors. Elections are held only infrequently, leaving governments with a period of time where they do not have to pay close attention to voter sentiment. Typically, elections are fought over packages of policies and also often involve a small number of candidates. This will make it difficult for most voters to match their own preferred outcomes with the policies on offer.

Majority voting also suffers from fundamental defects as a decision-making process. First, it can deliver an inconsistent set of choices. The so-called Arrow impossibility theorem has shown that the majority in a group of voters who have well-defined rational preferences over three outcomes A, B and C can prefer A to B, and B to C but nevertheless also prefer C to A. For example, the desire of a majority of voters for fiscally responsible budgets on the one hand, but no changes in either taxes or any particular spending programs on the other hand, might be an example of such a set of inconsistent outcomes.

High information costs also make it difficult for politicians and bureaucrats to know what people want. Epstein (1995, p 301) discusses some of the consequences for determining the use of public lands in particular:

One approach recognises the distinct preferences of the state's many citizens, and charges its administrative staff with the responsibility of collecting information

about citizen preferences to figure out whether they are capable of simultaneous satisfaction, and if so how. The administrative process guides the collective choice. This process, however, carries with it the enormous disadvantage of inducing everyone to overstate preferences and understate costs. Since no one pays any price for an exaggerated claim, everyone should calculate, "I know my chosen ends; now the means to achieve it is to overstate the intensity of my preferences and to indicate that only one outcome is acceptable to me. If the other side does the same, then I have neutralised its tactics. If it does not, then I have secured a clear advantage". There is thus a single dominant strategy – an antisocial solution to the prisoner's dilemma game. All conservationists need only announce that they regard the environment in its natural state as sacred, and decry any form of alteration as tantamount to corruption. Developers and miners should take equally extreme positions on housing and jobs. Both sides know that if they are successful the costs of their venture will be borne in part by those opposed to their position.

A related problem with deciding resource allocation issues through majority voting is that it can often result in a "tyranny of the majority" or, even worse, a "tyranny of the decisive voter or party". The winning coalition does not have to compromise with interests represented by the opposition party or parties and they can be ignored. By contrast, markets tend to cater to all groups of consumers, not just the winning majority.

Finally, even if election outcomes faithfully reflect the wishes of the majority, there is an additional problem in ensuring that policies are carried out. The difficulties politicians have in controlling bureaucrats have been lampooned most effectively in the "Yes Minister" television series. While this undoubtedly exaggerates the lack of control by the politicians, the gap in information between the minister or government and the bureaucracy is often extremely large, giving bureaucrats wide latitude to pursue their own self-interest or preferences at the expense of the wishes of the government of the day. Even when bureaucrats are attempting to pursue what they genuinely see as the social interest, there are systematic tendencies that can drive a wedge between perception and reality (Epstein, 1996b, p 24):

Bureaucrats often ask the question of how *they* can best maximise the social welfare, instead of the relevant social question of whether the rest of us can get along quite well thank you, without their intervention. [emphasis in original].

If the democratic political mechanism is unlikely to deliver efficient policies, we can ask if it is worthwhile discussing general policy rules, such as whether the government should or should not be involved in supplying public goods or owning and operating natural monopoly firms. There is reason to believe, however, that democratic mechanisms may produce more

efficient policies when “constitutions” or “rules of the game” are at issue. In fact, many politicians welcome rules that bind them from pandering to short-term political interests. No doubt voters and their representatives all recognise that conventions or constitutional rules have a more pervasive effect and are much harder to change. If they are inefficient, therefore, they are likely to be more damaging than inefficient policies. Conversely, the benefits of constitutional or quasi-constitutional rules are difficult for a voter to predict because the circumstances of the voter, or his or her descendants, are likely to change.

The New Zealand reform process

As we noted at the beginning of this chapter, the last two decades have witnessed a change in attitudes toward the role of government in the economy. The most dramatic manifestation of this change has been the demise of the Soviet Union and the formerly centrally planned economic systems of the socialist world. The change in attitude has also been reflected in New Zealand:

Since 1984, New Zealand has conducted the most radical economic reform program in the Western world in modern times. The protectionist and *dirigiste* policy regime of the previous 50 years has been swept away. Subsidies and monopolistic privileges have been removed, and the economy opened up to international trade and investment. State-owned enterprises have been corporatised and in many cases privatised. (James, 1996).

The conceptual framework driving the reforms in New Zealand was summarised in a report on funding options for conservation prepared by Ernst and Young (1994) for the then Ministry of Tourism:

- i. A narrower definition of a public good. By this we mean the attempt to draw a sharper demarcation between goods or services which are more effectively provided by the state than by private providers. The presumption is that the state should only undertake activities which would provide net benefits to the economy as a whole *and* which would otherwise not be undertaken privately.
- ii. Users of public goods to meet a higher share of their costs. Where free goods have been provided there is a pronounced tendency for over-use and taxpayers face an escalating burden. In some cases the users of particular free goods tend to be in higher income groups and the provision of free goods can have a redistributive and regressive tax effect.
- iii. To use market instruments rather than regulation wherever possible to achieve policy goals.
- iv. Public sector administration to be both transparent and accountable.

The Ernst and Young report also comments that:

Our understanding of government policy towards industry is that it is seeking to achieve neutrality in terms of assistance between sectors and industries ... For this reason, the farm subsidies have been phased out and protection to secondary industry significantly scaled down.

One could add to this list the removal of subsidies for land clearance, excessive logging of native timbers and other practices that were environmentally destructive as well as economically inefficient.

The policy principles underlying the New Zealand reform process are clearly consistent with the conceptual framework presented above. Appendix 2 to this chapter discusses in more detail some of the economic analysis of government enterprises, private enterprises and corporatised entities that underlay many of these reforms. One goal of this report is to examine the extent to which conservation policy is consistent with the general reform agenda in New Zealand and to suggest changes that are likely to make it more so. Again, these issues, as they relate to DOC, are discussed more extensively in chapter 7.

Politics and legal change

Our discussion of political activity has so far argued for a major role for government in the maintenance of law and order, the administration of justice and the enforcement of contracts. On the other hand, we have been very sceptical that there is a significant role for government in *producing* goods or services. Government needs to create a framework that is conducive to development of free, fair and competitive markets. Where businesses have major natural monopoly dimensions, where there are substantial externalities, or security or public health concerns, government also has a role in devising sound regulatory institutions, and monitoring and enforcement arrangements. Government thus has a role analogous to a referee in a sporting contest. It is not ideally suited to being one of the players in the game – and particularly so when it is simultaneously doing the job of referee.

We have also argued that, in a common law system, the rules of the game can be developed largely within a decentralised evolving mechanism that does not need a heavy guiding hand from government. Nevertheless, democratically elected governments have been given the right to intervene in the legal system and change the rules of the game. Some of these interventions have been advantageous, and have no doubt “short-circuited” a process that may have taken much longer to develop under the common

law. However, much legislation overturning legal principles established after hundreds of years of litigation has undoubtedly done substantial harm.³⁶

On the other hand, governments often can assist the development of new property rights that contribute to the efficient use of resources. As Young and McCay (1996, p 88) note in a recent World Bank publication:

Market-based property rights systems, usually in the form of an exclusive and tradeable license, lease, quota, or permit, are now being used in the management of conditionally renewable natural resources like fisheries, forests, wildlife, and grazing land. They are also advocated and used to control water and air pollution, to influence the use of renewable resources like water, and to control land use.

They observe (p 89):

Because market-based property rights systems rely on the incentive of guided self-interest more than command-and-control systems do, their effectiveness is a function of the value of the tradeable rights ... and it can be increased by making the rights:

- Transferable as much as possible so that opportunities to profit from the aspirations of others are maximised.
- Mortgageable and bankable with security. The security should be equivalent to that given to a land title; rights and any conditions that attach to them should be recorded on a central register, which would be the only way to complete any dealing associated with the right.
- Divisible or separable as much as possible so that the right is easily divided into its components and/or sold in small as well as large quantities. Irrigation rights, for example, will be more valuable if they are not tied to a specific parcel of land and can be moved from agricultural to urban sectors. Heavy metal emission rights will be more valuable if mercury rights can be separated from chromium emission rights.

The Ministry for the Environment (1995a) notes that:

An example of market mechanisms in New Zealand is the system of tradeable permits to import ozone-depleting substances ... New Zealand's Individual Transferable Quota system for sustainable fisheries management is another example. A mechanism which has been applied overseas with varying degrees of success is ... [trading] of air pollution permits ... within environmentally sustainable limits ... The *Resource Management Act* provides for use of some market mechanisms, for example, transferable water abstraction permits in section 136(2) ... At the direction of the government, the Ministry for the

³⁶ For an example, see the discussion of tort law in Hartley and Brito (1996).

Environment, in consultation with other central government departments, the Local Government Association and users, is monitoring the use of economic instruments under the Act and investigating any impediments to their use.

We shall briefly discuss two cases where governments have developed new property rights – tradeable pollution permits in the United States (where the aim is to limit an undesirable environmental effect) and the tradeable quota system for New Zealand fisheries (where the aim is to promote sustainable output of an otherwise unsustainably exploited commodity).

Case study – tradeable pollution permits

As noted above, the essential difficulty with air pollution is that the air is unowned, and therefore is overused as a universal dumping ground for various types of pollutants. We could ask why the legal system has not provided a remedy for this situation. If pollution from one party causes damage to another party, the latter should, under common law, be able to take legal action to recover damages.

The major difficulty here would seem to be that there are many polluters of the air and many individuals who are simultaneously affected by that pollution. More particularly, the damage imposed on any one individual from any single air polluter will usually be fairly small, and most likely significantly less than the costs of mounting a law suit. In many jurisdictions, victims may be able to recover explicit out of pocket costs if they win. However, even the non-monetary costs of mounting a law suit could exceed the benefits. Until recently, it was probably also not possible to identify the damage done by any one source of air pollution, making it difficult, if not impossible, to measure the damages inflicted by any one polluter.³⁷

³⁷ Chemical tracers or isotopes have been used to track the diffusion of exhaust gases. These experiments are usually one-off, however, and may not reflect the average pattern of gaseous diffusion. McGee and Block (1996) argue that the development of environmental forensics has been stifled by legal precedents where “the courts sided with the property rights violators in a number of nuisance cases”. They claim that “ever since the 1830s, it has not been illegal to trespass soot particles onto the property of other people”. They continue, “the present challenges look so daunting because we are bereft of some 150 years of R&D that would have taken place had the law upheld victims’ property rights in that bygone era”. Basically, these authors reject economic efficiency as a reasonable basis on which to allocate property rights. They instead take as an ethical axiom the proposition that “he who first uses a previously non-owned resource, by that fact alone arrives at a legitimate ownership right over it”. Even if a reassignment of property rights could increase efficiency (net of transactions costs), it is unethical to do so.

Another problem is that successful legal action by one victim would simultaneously benefit a large number of other victims. Reduced air pollution has the characteristics of jointness and non-excludability. Everyone would have an incentive to free ride on any legal actions taken by others, including class action suits (where such suits are feasible).

Mandatory quantitative controls on pollution output were the typical response to this situation in the recent past. Major individual producers, such as electricity generating plants, had to ensure that various pollutants (sulphur dioxide, nitrous oxide, particulate matter and so on) remained below specified concentrations. Often the government mandated not only that pollution be reduced to a certain level but also the way the pollution target was to be achieved, for example by installing mandated equipment on smoke stacks. It has been argued that many of these more specific interventions were various ways of pandering to vested producer interests.³⁸

Research in the United States has shown that the cost of controlling the same type of air pollution for different firms using direct “command and control” regulation can vary extensively.³⁹ This situation created potential efficiency gains by allowing firms with a relatively low cost of control to further increase their control and transfer the “rights to pollute” to other firms with very high costs of control. Allocating such rights has the additional advantage that it provides an incentive for firms to invest in new technologies that allow a given level of pollution control to be achieved at minimum cost.

To reduce costs of pollution controls that are aimed at reducing acid rain, Title IV of the *Clean Air Act Amendments* of 1990 instituted a market-based approach to reduce sulphur dioxide (SO₂) emissions. Hahn and May (1994) argue that the allowance trading system introduced by the 1990 *Clean Air Act*

³⁸ See, for example, the discussion by Ackerman and Hassler (1981) and Crandall (1981) of the “clean air, dirty coal coalition” in the United States. Incumbent firms may also favour direct quantitative controls if they indirectly reduce industry output and raise final prices. The environmental agency then helps cartelise the industry. Under direct controls existing firms, or the suppliers of the pollution control equipment, effectively obtain the rents that would otherwise have accrued to the owner of the scarce air resource had property rights been defined and allocated.

³⁹ Estimates of the potential cost savings from trading rights to emit SO₂, as instituted in the 1990 *Clean Air Act*, range from \$1 billion annually (Hahn and May, 1994, pp 28-37) to as much as \$3 billion annually, or over 50% of prior costs (General Accounting Office, cited by the Chicago Board of Trade, in “EPA Acid Rain Program Environmental Benefits”, available at <http://www.cbote.com/acid.htm>, April 1997).

Amendments not only reduced the costs of control but also enabled larger reductions in emissions:

It is highly unlikely there would have been acid rain legislation in the 1990 *Clean Air Act* without allowance trading. During the previous decade, attempts to move acid rain legislation in the Congress faltered because of difficulties in obtaining a consensus over which regions of the country should pay for the clean up. The allowance market provided a mechanism for reducing the cost of controlling emissions, thus making the aggressive environmental proposal put forth by the Bush Administration more palatable.

Phase I of the SO₂ program (1 January 1995 to 1 January 2000) affects 110 of the highest-emitting electric generating units in the United States, although other plants and industrial sources also can choose to participate. In Phase II, beginning in 2000, the program will be expanded to include most existing fossil fuel burning power plants. The Act aims to reduce annual SO₂ emissions by 10 million tons below 1980 levels by the year 2000.

The program has the following features:

- Producers were allocated allowances based on their past fuel usage and the use of “good practice” control technology as determined by the Environmental Protection Agency (EPA). Each allowance entitled a unit to emit one ton of SO₂ during *or after* the year specified in the allowance serial number – so allowances can be “banked”.
- Allowances may also be sold to any other market participant *except* where local SO₂ standards would be violated. Brokers, speculators or representatives of environmental groups can also buy allowances. An electronic system of accounts is kept containing information on unit balances and the corresponding allowance serial numbers held by each participant.
- At the end of each year, utilities are granted a 30-day grace period during which allowances may be purchased, if necessary, to cover each unit’s emissions for the year. If, after the grace period, the number of allowances a unit has is less than the total emissions of that unit for the year, the owner or operator must pay an automatic penalty of \$2000 (adjusted for inflation) per excess ton of SO₂. In addition, violating utilities must offset the excess SO₂ emissions with allowances in an amount equivalent to the excess – so the additional emission is “recovered” in a future period.
- Emissions of SO₂, NO_x and CO₂ as well as volumetric flow and opacity from each unit must be measured and recorded continuously using certified equipment that is checked periodically for accuracy. Hourly

emissions data for each unit must be reported on a quarterly basis and recorded electronically. The emissions monitoring and reporting systems are critical to the success of the program since they instill confidence in the existence and quantity of the commodity being traded.

- The Chicago Board of Trade (CBOT) has been selected by the EPA to hold an annual *direct sale* of allowances, beginning on June 1 of each year and continuing until January 30 or until all allotted allowances are sold. The direct sale offers allowances at a fixed price of \$1500 (adjusted for inflation), with qualified independent power producers (IPPs) being given first priority for these allowances. The guarantees for IPPs are awarded on a first-come, first-served basis and secure an option to buy a yearly amount of allowances over a 30-year span. This provision allows IPPs to assure lenders they will have access to the allowances needed to build and operate plants.
- The CBOT also has been selected to hold an annual allowance *auction* no later than March 31 of each year. Allowances allocated to direct sales and remaining unsold on January 30 are offered at the subsequent auction. Private holders can also offer allowances at the auction, although allowances from the Special Reserve are sold first. Subject to the constraint on local SO₂ standards, private parties are also free to trade allowances at any time.
- To supply the sales and auctions with allowances, the EPA withholds approximately 2.8% of the total annual allowances allocated to all units and places them in a Special Allowance Reserve. Specifically, during Phase I, when 5.7 million allowances annually are available, 150,000 allowances every year are made available for auction and another 25,000 for direct sales. During Phase II, when 8.95 million allowances are available, 200,000 allowances are to be offered annually for auction and 50,000 for the direct sales.
- Proceeds from allowance sales from the Reserve are apportioned on a pro-rata basis to those units from which allowances were originally withheld to create the Reserve. The claimed purpose of this procedure is to help make the market in allowances more liquid, to provide a price signal for private trades and to ensure potential participants in the generation market have access to allowances.
- The allowances offered in the direct sale in Phase I are known as *advance allowances* which become useable for compliance only seven years after the transaction date, although they can be *traded* earlier. *Spot allowances*

can be used in that same year for compliance purposes. Since the allowances withheld for the direct sales in Phase I are spot allowances, the direct sales mechanism effectively reduces emissions in early years of Phase I and allocates them to Phase II. From 2000, the direct sales will offer spot allowances. Private parties can offer either *spot allowances* or *advance allowances* for sale at the auction.

- Once bids to buy and offers to sell have been submitted to the auction, bids are ranked from highest to lowest bid price, while offers are ranked from lowest to highest sale price. The lowest sale offer and highest bid price are matched, with the sale occurring at the bid price. Matches are continued until all allowances have been sold, the number of bids is exhausted or the minimum price for the next allowance exceeds the purchase price of the next bid. Any allowances from the Reserve have a zero offer price.
- Sources not required to participate in the Acid Rain Program can nevertheless choose to enter the program. Voluntary entrants reducing their emissions below their production levels in 1985, 1986 and 1987 using the “best available technology” are allocated allowances for the reductions.⁴⁰ Such allowances can be sold into the allowance market. The production base years were chosen to be two to four years prior to the introduction of the *Clean Air Amendments* into Congress to eliminate the incentive producers might otherwise have had to artificially raise their output in order to get more allowances to sell into the market. Firms that voluntarily opt-in to the system cannot sell allowances if they subsequently cease production.

The program allows sources to choose their own method of compliance. They could reduce emissions by changing fuel quality,⁴¹ reassigning production from dirtier to cleaner units, reducing generated electricity, or adopting fuel efficiency measures in addition to using scrubber technologies (as mandated under the old system). Many of these strategies could also be altered in response to changing market prices. By allowing pollution output to be redistributed across producers, the program should also contribute to

⁴⁰ We have been told that oil refineries have chosen to enter the program.

⁴¹ Deregulation of the United States rail industry may have assisted this process by enabling low sulphur western coal to be shipped more cheaply around the country. The use of cleaner open cut coal from western states must also have been stimulated, however, by elimination of the “clean air, dirty coal” controls aimed at bolstering the demand for sulphurous Eastern coal while limiting the air pollution consequences.

achieving a given reduction in pollution at minimum cost. Already, the price of pollution allowances has begun to fall, while the allowance trading volume continues to increase from year to year.

Even so, the market in allowances has been made much more complicated, and much less efficient, than it could be. The auction mechanism appears to be aimed at ensuring units remaining in the Reserve are sold. It does not provide good information for private trades, and may limit the amount of trading that occurs through the auction mechanism.⁴² The mode of regulation of electric utilities by many state regulatory agencies also has not encouraged them to trade allowances (Bohi, 1994).

In the early stages of the program, trades may also have been inhibited by uncertainty about the permanence of the new regime. A firm with a high cost of control might have been reluctant to purchase additional allowances and increase pollution output for fear that it may provoke a return to the previous regime – with regulators asking why the firm is polluting so much more when it had previously demonstrated it could meet a higher standard. If the old controls were re-instituted the purchased allowances would represent a waste of money. Conversely, a firm with a low cost of control might be reluctant to reveal that fact by cutting pollution and selling allowances for fear that a return to the old regime might see their pollution target permanently and substantially reduced. These fears should fade, however, after the program has been in place for a number of years and the political costs of reversing it become very large.

The effectiveness of the program has also been compromised by a reluctance to completely abandon the older “command and control” approach. For example, the program retains:

- adherence to EPA determined “best practice” standards to determine initial allocations;

⁴² Hahn and May (1994) argue that the best pricing strategy for buyers and sellers in the auction “is not clear”. A buyer has an incentive to bid below the expected private market price, a seller an incentive to offer units only at a price in excess of the expected market price. However, buyers may know there are units on offer from the EPA at a zero minimum price and, if they need an allowance, they know that the higher their bid the more likely they will be to obtain an allowance in the auction market. Hahn and May report experimental evidence, and sketchy evidence from early trades, suggesting that allowance auction prices are likely to be biased downward relative to a competitive market and comment that “ironically the private market is likely to be more effective than the auction in helping to achieve a stable equilibrium”.

- controls on the aggregate level of localised emissions in addition to an overall constraint;
- measures to limit tradeable permits from being interpreted by the courts as genuine property rights – making them susceptible to confiscation without compensation and thus making firms with high costs of control wary of altering their production techniques based on their possession of the necessary allowances; and
- restrictions on allowance trading from firms opting-in to the program, which reduce its attractions for them.⁴³

Fortunately, the CBOT has committed itself to establish and operate a cash market for allowance trades. This is likely to reduce the transactions costs of making private trades and should facilitate additional trading. The CBOT has also recently been given approval by the Commodity Futures Trading Commission to establish and operate futures and options markets in SO₂ allowances. Futures prices will give firms valuable information for making investment decisions about control technologies, new sources of fuel and so on. Both futures and options contracts will also enable market participants to hedge the risks associated with future unforeseen changes in allowance prices. Finally, deregulation of the electricity market is proceeding apace in the United States, raising commercial incentives for generators to pursue more efficient production strategies, including less costly means of controlling their pollution output.

Unless continuing government regulation hinders it, the embryonic market in air pollution is likely to evolve into a genuine market. If it does, it will achieve better pollution outcomes at lower cost. This new market in valued environmental services may then spread to other environmental amenities.⁴⁴

⁴³ Rolfe and Nowlan (1993) discuss tradeable permit systems in chapter 5. They outline many of the equity, political acceptability and other concerns that no doubt lay behind many of these compromises with the most efficient arrangement. These authors advocate even greater restrictions on a permit trading system than are present in the current United States law.

⁴⁴ The CBOT also has a cash market, with an electronic bulletin board to determine prices, in recyclable products including paper, plastics, glass, tyres and other rubber products. Municipalities, rubbish companies and other suppliers of recycled material use the system to find manufacturers and other buyers, with the CBOT establishing standards and resolving disputes to make the market more efficient. As discussed in a later chapter, the CBOT is also investigating a market in habitats for rare and endangered species.

Case study – New Zealand fisheries⁴⁵

We noted above that fishing is a classic situation where non-excludability leads to inefficient outcomes. No individual has an incentive to take account of the effect of increased fishing activity upon the time and effort that it takes others to make a catch from the same resource. When the fish are unowned, each fisherman has an incentive to expand activity until the marginal *private* cost of the effort needed to catch an additional fish equals the current price of fish.⁴⁶

Similarly, no individual fisherman has an incentive to take account of the effect of his current fishing activity on the likely future stock of fish.⁴⁷ If the stock of fish were owned, the owner(s) would have an incentive to choose the *total* fishing effort to minimise the costs of landing a given sized catch and would also choose the size of that catch to trade off increased current revenue against future declines in catch volumes and revenues. An owner would also have an incentive to invest in the fishery in other ways that would not be rational for an individual operator with non-exclusive access. For example, the owner might feed the fish, or eliminate their diseases as is done in aquaculture ventures where property rights *are* secure.

A recent Food and Agriculture Organisation (FAO) report (Food and Agriculture Organisation of the United Nations, 1996a) analysed the dynamics of the 200 top marine fish resources of the world. The results indicated:

that in 1994 about 35 percent of these resources were in the ‘senescent’ phase (with declining landings), 25 percent more were in the ‘mature’ phase at a high exploitation level, and 40 percent were still ‘developing’; none remained in the ‘undeveloped’ phase ... A corollary is that there has been a gradual increase in the estimated amount of stocks requiring management, from almost none in 1950 to over 60 percent in 1994. The results underline the urgent need for effective measures to control and reduce fishing capacity and effort.

The recent report by the Ministry for the Environment on the state of New Zealand’s environment (1997b, p 9.85) noted that:

New Zealand’s annual marine catch peaked in 1992 at more than 650,000 tonnes, made up of more than 530,000 tonnes of fish and nearly 120,000 tonnes of invertebrates, principally squid. This excludes discards, illegal catches,

⁴⁵ The reader is also referred to Ackroyd and Hyde (1991).

⁴⁶ A brief mathematical analysis is presented in appendix 3 to this chapter.

⁴⁷ Again see appendix to 3 to this chapter for further details.

recreational catches and catches for customary Maori food-gathering. The year before, the total marine catch had been 608,000 tonnes and, the year after, it fell to 590,000 tonnes ...

Besides the commercial fish catch, a large number of inshore fish and shellfish are taken by non-commercial fishers and gatherers. About 390,000 people (16 percent of the population) engage in recreational sea fishing.

The most recent FAO report on *The State of World Fisheries and Aquaculture* (1997)⁴⁸ reported that while total supplies of fish expanded from 1994 to 1995:

provisional production figures for mariculture and inland aquaculture show an estimated increase from 18.6 million tonnes in 1994 to 21.3 million tonnes in 1995, more than offsetting a very small (i.e. 0.02 million tonne) decline in the harvest from marine and inland capture fisheries during the same period.

Since total landings by capture fisheries in 1995 were estimated to be about 91 million tonnes, aquaculture now accounts for almost 20% of the world's total fish catch each year.

Of course, the problems with open-access fisheries have not escaped the attention of the fishermen themselves. In many cases, they devised rules to reduce over-fishing and excluded new entrants from exploiting the resource, sometimes by using violence. For example, De Alessi (1996a, p 4) notes:

In the 1930s, shrimpers in Texas formed a union, excluded outsiders and succeeded in maintaining the health of the fishery. But newcomers who wanted to enter the fishery used the *Sherman Anti-Trust Act* to break the union and, consequently, stop the conservation efforts of the shrimpers ... The control afforded by property rights over resources is not anti-competitive, it is anti-destructive.

De Alessi (1996a, p 5) also observes:

Many successful common property institutions form around close knit groups, such as the lobster men of New England. Even though they cannot own areas underwater, the lobster men form "harbour gangs" that mark territories and turn away outsiders. As a result, lobster men in these gangs have higher catches, larger lobsters, and larger incomes than lobster men who fish outside the controlled areas.

Governments have also attempted to limit fish catches by restricting the type of fishing gear that can be used and the period of time fishermen are allowed to fish each year. These restrictions caused fishermen to find new technologies that allowed them to catch more fish in less time, and have distorted incentives and wasted resources in other ways.

⁴⁸ This is available at the FAO web site <http://www.fao.org/>.

Until 1986, New Zealand was no exception. As Ackroyd and Hyde (1991, p 196) pointed out:

The fisheries experience in New Zealand has certainly not been one of private property and free enterprise. The experience instead has been one of common property and state regulation. Common ownership has been maintained and fishing regulated in an attempt to counter over-fishing.

This was changed in 1986, however, when New Zealand introduced an Individual Transferable Quota (ITQ) system for regulating fisheries. An ITQ confers a right on a company or an individual to catch a set proportion, or percentage by weight, of the Total Allowable Catch (TAC) for a specified species in a specified area (quota management area or QMA) during one fishing year. For example, if an ITQ holder has quota for 6% of the TAC for a particular species in a particular area they will always be allocated 6% of the TAC (by weight). The actual catch in tonnes that they can legally take will vary from year to year as the TAC varies. Thus, while the total catch of each species of fish subject to quota remains controlled, quota holders are free to catch their quota as they best see fit. Constraints on fishing gear, fishing times and so on are gone.

The ITQ for a species are initially allocated to individuals or firms holding commercial fishing permits for that species. The allocation is based on the weight of fish the permit holder has caught over a “representative” number of recent years. In order to give fishermen long-term security, the quota are owned in perpetuity or until they are sold, leased or given away, just like a parcel of land. The 1996 Amendments to the *Fisheries Act* also allow quota to be mortgaged and hence used as security for a loan.

The market value of a quota is dependent on the demand for that particular quota and therefore the current and anticipated market value of the species, the anticipated future TACs for the species and anticipated changes in the costs of fishing for that species in the specified area. Advertisements in daily papers and in the seafood trade magazines have been used to sell quota in addition to personal contacts. Quota trades must be registered with the Ministry of Fisheries (MFish) (formerly part of the Ministry of Agriculture and Fisheries (MAF), which was split into a Ministry of Agriculture and a Ministry of Fisheries by the *Fisheries Act* 1996).

The *Fisheries Act* limits the quota for any one species that any one person or company can own to 35% for the deep water fisheries and 20% for the inshore fisheries. For rock lobster and paua the limit is 100% of a management area. The stated purpose of this restriction is “to ensure that no one company or individual can develop a monopoly on fishing in any one

area or for any one species". It is not clear to us, however, why a monopoly on fishing in any one area for any one species should be a policy concern. Such an individual or firm is still likely to be selling into a very competitive market for fish, particularly since more than 80% of the New Zealand commercial catch is exported.

Under the ITQ, individual holders retain an incentive to exceed their quota. Prevention of fishing by people without a quota is also a problem. The only way to counter this at present is through monitoring and enforcement. It should be noted, however, that making quotas transferable gives quota holders a stake in monitoring the fisheries to ensure the value of their quotas is not eroded by over-fishing. Quota holders also often have very good information about other individuals fishing in a given area. We have been informed by officials from MFish that quota holders have assisted enforcement by reporting violations.

The government monitors catches by having fishermen fill out a Catch Effort Landing Log, which must be available on demand to any fisheries officer or examiner. The government must also be provided regularly with a Quota Management Report detailing by area the quantity of fish caught for each species for which quota is owned or leased. Fish processors also have to submit a Licensed Fish Receivers Return (LFRR) at regular intervals to the government. This contains the quota holder's name and identification number and green weights for all species received. Presumably, these various records could also be checked against tax records, including those required to administer the value-added tax (GST).

The current method of setting the TAC is discussed by Peter Stevens in a recent editorial in *Seafood New Zealand* (September 1996, pp 4–5):

Since 1986 the law has required the Minister [of Agriculture and Fisheries] to consult with all interested parties prior to setting total allowable catches (TACs) for all of the quota species for the following year. That consultation is extensive and starts early in the year with a considerable number of stock assessment meetings. At these meetings, attended by any and all user/interest parties, all of the data is trotted out by the scientists and discussed. Non-scientific data is also accepted into the debates. The next step consists of plenary meetings where the data is further refined ... Once this is over, each of the numerous parties submits ... recommendations and the Ministry of Fisheries prepares and submits advice to the Minister. The Minister then meets in joint sessions with all of the groups involved ... All of the advice to the Minister from his officials is freely available to all parties and vice versa ... The Minister has to take many factors into consideration due to the inexact science of fisheries management ... but ... the emphasis is firmly centred on biology ... The Minister goes to considerable length

to explain the reasoning behind all of his TAC decisions as a matter of public record. His decisions, and thus his interpretations of the data and submissions, are open to challenge in court and this happens.

Also in this editorial, a subsequent editorial in the same magazine (November 1996) and an earlier article in *Seafood International* (Stevens, 1995), Peter Stevens discussed some of the benefits of the ITQ system. He claimed that the system had:

- Achieved the objective of halting the decline in fisheries with the result that “a number of species have rebuilt to the extent that scientific evidence has allowed for increases in annual catch. Many other species are scientifically considered to be stable. One or two are still doubtful in terms of what their long-term production rates might be”.
- Encouraged investment by quota holders in their fisheries – for example,
 - in order to increase squid sizes, trawl squid holders had mutually agreed not to trawl before 1 February 1995, while in 1993 they turned down a government proposal to increase catch limits by 25%;
 - orange roughly quota holders formed and funded a company to carry out stock surveys and oceanographic exploration;
 - an article in *Seafood New Zealand* (May 1995, pp 8–13) noted that, in anticipation of their industry being included in the quota system, which occurred in 1992, scallop permit holders funded a major enhancement program (harvest of spat for reseeded jumped from 81 million in 1988–89 to 630 million by 1990–91 with 83.7 sq. km of seabed reseeded); subsequently, in May 1994, they formed the Challenger Scallop Enhancement Company Ltd. which took over existing enhancement operations, reduced costs, and then expanded on them with major new investments, reseeded over 221 sq. km with 800 million spat in 1994–95.
 - rock lobster quota holders have funded a number of research initiatives and introduced voluntary closed seasons;
 - snapper quota holders are currently funding several research and management initiatives; and
 - freshwater eel fishermen have also established an enhancement program.
- Increased confidence in the future existence and stability of the industry and encouraged investment. The catching sector added more tonnage to the domestic fleet in the 18 months to April 1995 than had been added in the previous decade. Many of the new vessels have been designed to improve fish quality, including having full at-sea processing capability.

There has also been massive investment in port facilities through to processing plants. There has also been more investment in human skills with more people training through bodies such as the Fishing Industry Inspection and Certification Council, the Seafood Industry Training Organisation and the New Zealand Fishing Industry Board to obtain operating certificates and other qualifications.

- Increased exports of seafood from New Zealand. According to TradeNZ, New Zealand's seafood industry exports have grown from negligible amounts in the 1970s to being worth over \$NZ1.2 billion (\$US0.83 billion) in 1995. In 1995 export growth in Asian markets (excluding Japan) increased 14 percent in value. Exports to European markets grew 10 percent in 1995.
- Brought the factions of the industry together "at numerous forums to discuss fisheries matters. Marketing people are heavily involved in fisheries management and catching sector forums, just as fishermen and quota holders participate in marketing forums". Stevens claimed that many fish marketing people now held quotas.

According to the recent report by the Ministry for the Environment on the state of New Zealand's environment (1997b, p 9.97), fishing of 42 species or groups of species was controlled by the Quota Management System (QMS):

A little over 100 marine fish species are harvested commercially – 10 percent of our known fish species. Stock assessments are made on the 42 species harvested for Maximum Sustainable Yield (MSY)⁴⁹ under the Quota Management System (QMS). Stock assessments are also made on species such as Southern Blue Whiting, which are fished commercially, although they are not part of the QMS. Provision exists for a further 117 species to be brought into the system.

This system now covers most of the major fisheries managed within New Zealand's Exclusive Economic Zone, and it is intended that eventually all commercially fished species will be included in the Quota Management System. Discussions centred on introducing another group of species to the QMS were being conducted at the time of writing.⁵⁰ In addition, the government is investigating how recreational and Maori customary fishing could be brought within the QMS.

⁴⁹ This concept is discussed in more detail in the appendix 3 to this chapter.

⁵⁰ A cost of excessive delay in bringing new species under the QMS when initial allocations are made on the basis of recent catch levels, as happens in New Zealand, is that fishermen have an incentive to "fish for quota".

The ITQ system in New Zealand has certainly made a difference to the New Zealand fishing industry and also to the long-term survival of the species on which it depends. In the words of Ackroyd and Hyde (1991, p 206), hunters have been turned into farmers. Tradeable property rights give individuals an incentive to invest in the industry and allow the market to achieve a more efficient outcome.

As with the SO₂ allowances in the United States, however, the ITQ system for fisheries in New Zealand is not without its problems. Ackroyd and Hyde (1991, p 202) note that the cost of changes in TACs fall on quota holders, and risk of these devalues quotas. They claim (p 201) that:

The original plan had been for government to adjust TACs by buying and selling quota by tender ... In the event the *Fisheries Amendment Act* ... provided for the proportionate reduction of all ITQ, with the government compensating quota holders for the "fair market value of the individual transferable quota".⁵¹ The mechanism for TAC adjustment was changed yet again with the *Fisheries Amendment Act* of 1990 that enables proportionate cuts without government compensation.

A recent contentious example has involved the snapper TAC in the Hauraki Gulf. Snapper are prized by Maori, commercial and recreational fishers. The Ministry for the Environment (1997b, p 9.104) reports that:

Snapper have been caught commercially for many years, and the fishery is one of the largest and most valuable coastal fisheries in New Zealand. It is also one of the largest recreational fisheries. Recent surveys indicate that up to one-third of all snapper caught are taken by amateurs. Snapper are also part of the bycatch taken by the tarakihi, gurnard and other inshore fisheries. The customary Maori catch is unknown.

The national commercial catch expanded to a peak of 18,000 tonnes in 1978. In the Hauraki Gulf area, landings in the mid-1980s were about 8,500 tonnes (Ministry for the Environment, 1995a, p 39). According to the Ministry for the Environment, the introduction of the QMS in 1986 halted the decline in snapper fisheries overall, but stocks in the Hauraki Gulf have continued to decline. When the QMS was introduced, the TAC for the "Snapper 1" area (from North Cape to East Cape) was 4,600 tonnes. However, the total historical catch in this area exceeded the TAC. The government bought back and retired some quota and applied pro-rata cuts on remaining quota holders.

⁵¹ Commercial fishermen were compensated for the parts of the annual quota that were allocated to Maori in settlement of Treaty claims.

The cuts applied to quota holders were appealed, resulting in additional quota being issued. By 1991, the TAC had risen to more than 6,000 tonnes. In 1992, the TAC was reduced to 4,938 tonnes. The recreational take in the Hauraki Gulf, which was estimated by the Ministry of Agriculture and Fisheries to be 1,000 tonnes annually in 1994, was limited by reducing the daily bag limit from 30 to 15 fish. The minimum legal size for snapper caught by recreational fishers was also increased from 25 cm to 27 cm in 1994.

In September 1995, the Minister announced a cut of about 39% (from 4938 tonnes to 3000 tonnes) in the TAC in the "Snapper 1" area. At the same time, the daily bag limit for recreational fishers was further reduced from 15 fish to 9 and an allowance was made for a Maori customary take of 300 tonnes. A year-round minimum net size of 12.5 cm was instituted and a six-month closed season was introduced for the inner Hauraki Gulf.

The ITQ owners again took the Minister to court, claiming that the Ministry had failed to implement a Fisheries Management Plan in Area One, with the consequence that the non-commercial snapper catch was unlimited. Recreational fishermen supported the actions of the Minister. An interim injunction was granted by the High Court in October 1995 stopping the quota cuts, and thus allowing the commercial catch for 1995-96 to remain at 4938 tonnes. The Minister announced in September 1996 that the TAC for Area One would again be set at 3000 tonnes for 1996-97. He said that the previous legal action applied only to the 1995-96 season. The industry repeated its application for judicial review and interim orders in respect of the 1996 decision. Again the High Court granted the industry's interim application and the TAC remained at the pre-1995 figure. The Treaty of Waitangi Fisheries Commission announced in May 1997 that it would challenge the new cuts in the Court of Appeal on the grounds that they would reduce the value of Maori fisheries by at least \$14 million. In a press release on 18 September 1997, the Minister announced that the TAC will be reduced by 438 tonnes to 4500 tonnes for the start of the new fishing year in October.

The method for setting the TACs each year (discussed above) is also time consuming and cumbersome and provides many opportunities for outside interference. Ackroyd and Hyde (1991, p 209) argue that:

It would be much better if the TAC were set by quota holders each year instead of the government. Quota holders have the detailed information of the fishery that the government lacks, and with quota giving them a stake in the fishery, they have every incentive to adjust the TAC if the fishery is being either over-fished or under-fished. The decision would then rest with those who bear the cost. In taking responsibility for setting the TAC, quota holders would no doubt seek out

and employ fishery scientists who could assist them in making the decision. Fishery scientists would then work advising quota holders who have a direct financial stake in the fishery. The setting of the TAC by quota holders would require some form of voting procedure, and it would be preferable if voting rights reflected the extent of the quota holder's stake in the fishery. That is to say, voting rights would be set according to the amount of quota held.

Ackroyd and Hyde also note that the "nominal rental or tax on quota" had been increased over time, a justification being that "the rent the fishery earns (belongs) to the people of New Zealand". This tax also devalues quota and reduces incentives to enforce quota, invest in the fisheries and undertake the other favourable activities promoted by the ITQ system noted above. Ackroyd and Hyde argue that the tax on ITQs raises very little revenue while it has the potential to do great harm, so it would be best if it were abolished.

More recently, the "rental" or tax has been abolished but replaced by a larger impost – now justified as a "cost recovery" measure for MFish action and scientific research needed to operate the QMS. At a recent "Seafood Week" conference in Wellington, Begg (1997) argued that the "cost recovery" charges are inefficient. Since much of the research and enforcement activity is in the nature of a public good for the industry as a whole, the marginal cost of providing it to an additional user is close to zero. It is inefficient, she argued, to charge average cost (in excess of marginal cost) for the government activity.

The situation appears to be analogous to the case of lighthouses discussed above. Recall that in that case, Coase argued that funding by a special levy on the users was more likely to produce an efficient outcome than paying for lighthouses out of general revenue. Begg commented, however, that, unlike the case of the lighthouses discussed above, the fishing industry in New Zealand has little control over the amount of activity being funded. The benefits of having them face the "true cost" of government services are therefore considerably muted.

A minimum reform of the current system would make the research activity contestable to ensure it is provided at minimum cost. There is still an issue, however, of determining the overall expenditure on research and enforcement. It is reasonable to expect the ideal level of enforcement to vary with the price of fish. When fish are less valuable, a lower proportion of revenue should be allocated to research and enforcement activities. This suggests setting the rate of levy for funding research and enforcement as a sliding percentage of revenue, with a higher tax in periods of higher fish prices.

Theoretically, the ideal level of research and enforcement activity would be determined by maximising the value of the ITQs. Efficient enforcement would raise the market value of quotas above their value in the absence of enforcement. Excessive expenditure on research and enforcement funded by quota holders also would reduce the market value of quota below their maximum level. Since many factors affect the market price of quota, however, it is not clear how this efficient level of expenditure could be determined in practice. Perhaps allowing the industry as a whole a greater say in determining the overall expenditure level (as with the lighthouses in the United Kingdom) would help achieve a more efficient outcome.

Another way quota can be devalued by the government is by allocating new quota based on political favouritism. In an editorial in the June 1996 issue of *Seafood New Zealand*, Roger Beattie claims that:

The Primary Production Committee in its *Interim Report on the Fisheries Bill* recommended that any surplus quota in new Chatham Islands QMAs (after allocation on the basis of catch history and to the Maori) be allocated to the Chatham Islands Enterprise Trust. The Trust will then on-lease this quota to Chatham Island fishermen.

The effect of this measure will be to encourage fishermen and would-be fishermen to lobby for a share of the Trust quota. Beattie warns the industry against lobbying for allocations based on political motives:

A political allocation of quota ... appears attractive because it offers easy access to resources. All that fishermen and would-be fishermen have to do is vote for an income. The trouble with politics is that someone else can take political quota. Political quota is not secure. The rules under which political quota is allocated will change as will fishermen's circumstances. Someone who is eligible for political quota one year may miss out the next. Political allocations of quota will end up being win-lose contests. And the politicians will never have enough political quota to satisfy demand. The competition for political quota will make all property rights insecure. The incentive to conserve and invest in the fishery is thereby destroyed. Individual quota ownership (ITQ) and trade is a win-win situation. With secure ITQ everybody knows that the only way to get access to fish is to buy or lease ITQ. People pay a market price for the right to fish but the rights they receive in exchange are secure for ever and a day. With secure rights and freedom to trade fishermen can benefit from conserving and enhancing fisheries. Security of harvest ensures replenishment.

Ackroyd and Hyde (1991, p 208) suggest that a rule should be instituted that if the government wishes to give new quota to anyone, it must first *buy* the required ITQs on the market at current market prices. In effect, the same rules

should apply for the taking of ITQs as apply to the taking of land or other assets to be used for other “public purposes”.

The recently released Ministry for the Environment’s report (1997b) on the state of New Zealand’s environment argues that:

The overall success of the Quota Management System has still to be assessed. Economically, it has been hailed as very efficient, but, ecologically, the benefits are uncertain. The emphasis on scientifically based sustainable yield management is a distinct improvement on previous approaches and those used in many other parts of the world. However, it cannot, in itself, overcome some of the inherent difficulties affecting fishing management regimes. For a start, little is known about the extent and impact of illegal fishing practices, or the level of voluntary compliance with quotas and other restrictions. Illegal practices which are known to occur include bycatch dumping⁵² (i.e. discarding accidentally caught species for which the fisher has no quota), “high-grading”⁵³ (i.e. discarding less valuable fish in favour of more valuable ones), poaching, fishing out of season, and selling

⁵² We do not understand why this *has* to occur. The fish could be sold on behalf of others who have legal quota for the relevant species. The legal quota owner should be willing to pay something to avoid having to expend effort to fill the quota, and this amount should be more than the owner of the bycatch would require to land the fish rather than dump them at sea. Perhaps the transactions costs of “renting” quota, or transferring them, on a very short-term basis are too high. If there were a daily auction market for quota, parties wishing to sell a catch consisting of a particular mix of species could buy the necessary mix of quota on a daily basis. The prices of quota would then fluctuate depending on the mix of species being landed at a given time. If the ratios of TAC for different species are radically different from the “typical” or long-term average catch ratio, however, even an efficient and flexible market for transfers of ITQ probably would not prevent waste. A species that is “accidentally” caught in far greater volumes than its TAC would then have a zero market value even if the transactions costs of obtaining “temporary quota” are low. It would still tend to be dumped at sea. When TAC are set, therefore, the ratios for the different species need to approximate the “typical” shares that are actually caught if waste is to be avoided. A special case involves species for which there are as yet no quota. Even though some of these species (such as deep water sponges that may be useful to drug companies) might have a positive market value, it may not be legal to sell them so they are simply wasted. Extending the QMS to cover additional species would reduce such waste.

⁵³ Quotas apply to the tonnage of fish caught while consumers care about the *size* of fish and not just the total weight. Hence, there is an incentive to waste fish that represent a low value per unit of weight in order to maximise the value of quota. Again, the fundamental source of the problem may be insufficient flexibility in the QMS. Effectively, the market would like property rights to be a function of more than weight alone. Possibly altering the system to allow separate quota to *numbers* and *weight* of fish could introduce sufficient flexibility to reduce waste.

illegally caught fish and invertebrates on the black market. In the 1993-94 season, for example, more than 60 enforcement operations by the Ministry of Agriculture and Fisheries (MAF) led to eight major prosecutions against people and companies involved in quota fraud. It has been estimated that up to 80 percent of domestically sold fish may have been funnelled through the black market. The compliance problem is a feature of fisheries worldwide⁵⁴ and is being addressed by both government and industry.

A more fundamental question, however, concerns the impact of legal fishing. About half the QMS stocks are of unknown status, although most of these are the more lightly fished stocks. Of those whose status is known, most are still in the process of being “fished down”, so the system’s ability to maintain them at the MSY level has yet to be tested. For stocks that were near or below the MSY level when the system was introduced, results have been mixed. Several stocks appear to have stabilised or begun rebuilding, but some have declined below the MSY level (e.g. some orange roughy stocks) or failed to rebuild to it (e.g. some snapper stocks). Quotas for these stocks have now been dramatically reduced and improvements are expected, though they may take some time.

The other important environmental question about the QMS concerns its impact on non-target species and their ecosystems. Until the recent passing of the *Fisheries Act 1996*, the QMS had been relentlessly single-species in its focus, with each stock managed in isolation from the other species in its environment. When, for example, a stock was reduced by two thirds to boost its yield, no account was taken of the possible impacts of such a reduction on the associated predator and prey populations. Little account was also taken of the effects of bycatch, or vessel and net disturbances, on non-target fish and invertebrates. Nor was any account taken of the need to maintain key ecosystems (such as coastal mangroves and deep water seamounts) that act as nurseries, spawning grounds or feeding grounds for many target stocks. Now, however ... in line with the new *Fisheries Act* requirement to manage both the environmental impacts of fishing, as well as the yields, the Ministry of Fisheries is developing a long-term strategy entitled *Fisheries 2010*. The proposed cornerstone of the strategy will be a fundamental change away from resource management and toward ecosystem management.

An article by Mark Feldman in the November 1996 issue of *Forest & Bird* magazine places the blame for all the defects of the current ITQ system on “greedy short-sighted fishermen” and inadequate regulation:

⁵⁴ The Ministry does not acknowledge, however, that the New Zealand system changes the incentives of individuals and companies. ITQ owners have a personal financial stake in enforcing the rules and regulations – so long as the regulations are efficient and work to raise the market value of ITQ. These financial incentives can greatly ease the burden of policing appropriate restrictions on individual behaviour.

In practice, no one measures how many fish are actually caught unless Ministry of Fisheries observers are on board.⁵⁵ What is measured [except in cases where monitoring at sea occurs] is the number of fish that are brought into port. The difference between what's caught and what's landed at the dock is waste, and there's lots of it ... Trawlers can capture huge numbers of fish with each tow ... fish are damaged and have reduced market value. In addition, many young, undersized fish are trapped later in the tow because the bigger fish have clogged up the holes in the netting. Estimates of waste are around 20–30 percent – for every ten tonnes of snapper landed from a trawler another two to three tonnes of damaged and undersized fish are thrown overboard... The Ministry of Fisheries has attempted to reduce the waste by regulating the mesh size and design of the trawl nets, and banning the trawlers from areas where juvenile snapper are known to live in large numbers. But the fishing industry has fiercely resisted.

Another problem is a practice known as “high-grading” where high-quality, high-value fish are selected out. A snapper that weighs between 1.2 to 3.3 kilograms will fetch more money per kilo than a fish that's bigger or smaller. When fishers have fixed quotas they want to get the maximum money for their limited catch, so they are tempted to only land the fish that are within the ideal size range and throw back the less desirable fish.⁵⁶ A study by the Ministry of Fisheries has shown that high-grading is common in the snapper fishery – particularly with long line fishers. Some of the rejected fish do survive because being hooked on a long line is less traumatic than being crushed in a trawl net, but the death rate is still high. In an attempt to avoid bad publicity,⁵⁷ the industry used the courts to try and delay publication of the study's results.

Solutions to the high-grading problem are possible. One easy one is a hook designed by Paul Barnes of Auckland. Paul's hook would prevent gut-hooking (which usually kills the fish) and increase the survival rate dramatically. Earlier this year Doug Kidd [then Minister of Fisheries] indicated his support by funding research into the hook's effectiveness.

⁵⁵ This is almost a tautology since it can be paraphrased as, “no-one measures unless someone from MFish measures”. However, DOC or other inspectors *could* also measure catches. In practice, inspectors jointly selected by MFish, DOC and the industry *do* monitor boats on a regular basis – with the boats that are chosen for monitoring on any one occasion being selected at random.

⁵⁶ Young and McCay (1996) note that a management problem associated with “high-grading” is the loss of information needed to monitor populations. They note that the New South Wales quota system allows low-grade and over-quota fish to be landed and sold with 75% of the revenue surrendered.

⁵⁷ Unfortunately, the author does not cite the source of this revelation about the motives for the industry action.

Another possible solution is to force long-liners to use larger hooks so small fish cannot be caught. This would mean higher bait costs and a lower catch rate but it would save wasting hordes of small snapper. Since small snapper tend to live in shallow water, the catch of small fish could be reduced by closing all shallow areas of the inshore fishery to long liner [fishers].

Of course, if rules on hook size or style were introduced, their use would also apply to all amateur fishers. The recreational sector takes about a third of the snapper caught each year and also has a considerable waste problem, killing many thousands of small snapper each year because they're gut-hooked by inexperienced fishers using small hooks.

An alternative to greater regulation, however, is to rely more extensively on decentralised market processes.

The major alternative to management of harvesting of wild fish populations is aquaculture. As we noted above, aquaculture based on secure private property rights is a growing part of the world fishing industry. The CSIRO Division of Fisheries recently reported⁵⁸ that

The farming of marine species is one of the most rapidly expanding rural industries in the world. Animals and plants such as oysters, salmon and seaweed are now raised in a diverse range of environments, from cages, rafts and racks to ponds in coastal estuaries, bays and tidal inlets. In the past two decades, the production of fish and crustaceans in ponds has become an increasingly important farming method.

The Commonwealth Department of Primary Industries reports that the value of Australia's aquaculture industry is growing strongly. Since 1985, the gross value of production has increased from \$A49 million to about \$A303 million in 1993–94. In 1993–94, aquaculture production was about 20 percent of Australia's total fisheries and seafood products by value. Major aquaculture products in Australia include pearls, oysters, Atlantic salmon, sea run trout, rainbow trout, barramundi, prawns, tuna, abalone, marron and yabbies, mussels and scallops. The Australian Bureau of Agricultural Resource Economics estimated that aquaculture production in Australia would be worth more than \$A500 million within four years.

In New Zealand, aquaculture production has grown dramatically in recent years and focuses primarily on the farming of mussels, salmon, pacific oysters and paua. Aquaculture (farming mussels, oysters, abalone, scallops and salmon) earned \$NZ130 million (\$US90 million) in 1995, showing strong growth with a 6.9 percent increase over the previous year.

⁵⁸ They have a "fact sheet" available at <http://www.ml.csiro.au/>.

Future technological advances might extend the range of marine species that can be farmed using aquaculture techniques. For example, advances in biotechnology might facilitate the development of genetic markers that identify the source of fingerlings released into the ocean. Commercial catches could be routinely scanned for such genetic markers and the owners of brands could be compensated. Such a development would have an effect analogous to the effect the legal recognition of cattle brands had on cattle ranching in the American West.

A movement that is growing rapidly in the United States is the production of artificial reefs (De Alessi, 1996b). In 1984, Congress passed the *National Fishing Enhancement Act*, which encouraged the states to construct artificial reefs. Along much of the United States coastline, artificial reefs are being created by state conservation departments.

Alabama and Florida, however, designated areas where private groups or individuals could create their own reefs. Exclusive knowledge of where these reefs are located gives the private creators *de facto* property rights for a time. The first areas designated for private reefs were in Alabama in 1987. Thousands of reefs have since been created in almost one thousand square nautical miles of permit area. De Alessi notes that:

By 1992, with only a fraction of the Gulf Coast shoreline, the recreational catch of red snapper in Alabama was two to five times higher than in the other Gulf states. Alabama has only one and one half percent of the Gulf coastline, yet it produces 38 percent of the red snapper catch.

After observing the success of the Alabama initiative, three counties in Florida designated five large areas as sites for artificial reefs. In both Florida and Alabama, the states also create public reefs out of larger objects (such as old buses). While these reefs should, in principle, support larger fish and larger fish populations, they are always fished out.

The artificial reef and aquaculture examples show yet again that private property rights are an extremely powerful engine for ensuring the survival of anything people value. The problem with over-fishing, or over-harvesting, is not the result of too much commercialism – it is the result of insufficient commercialisation, of inadequate property rights and inappropriate incentives. When something of value is owned and can be produced, market incentives will ensure that there is no threat to its continued existence.

VOLUNTARY ACTIVITY

Most people spend a large proportion of their waking hours providing services for themselves and their immediate families. It could even be true

that the largest part of a person's well-being comes neither from market activity nor as a result of government actions but from what individuals do for themselves or for their close friends and families.

Many people also engage in voluntary activities in the wider community. People join churches, scout groups, service clubs, business associations, hospital or school auxiliaries, charitable organisations, volunteer fire brigades and so on. In a country like New Zealand, the number of such organisations, the amount of work people do through them, and the benefits they provide to individual well-being are staggering. Under the general heading of voluntary activity that affects resource allocation, we can also include customs, manners and conventions.

Many voluntary activities can be seen as a means of coping with market failure. For example, customs, manners and conventions may control activities that would otherwise have negative spill-over effects on others. While the cost to me of walking to a rubbish bin might be higher than the benefit of a clean beach, enough dirty looks from others on the beach could raise the private costs of littering to the point where I prefer to do the socially desirable thing and place the rubbish in the bin. Other voluntary activities might provide joint goods and a context where "peer pressure" can be used to discourage free riding. Since these activities are voluntary, however, as a method of coping with market failure they do not suffer from some of the more grave dangers associated with the exercise of political coercive power.

Like market activities, voluntary charitable activities allocate resources to satisfy desires of one sort or another. Unlike market activities, however, they do not usually involve an explicit exchange of one good or service for another. The fact that people are not receiving an explicit reward for participating in these activities will tend to select out volunteers with unusual motivations. In some cases, these people are exactly the ones who might be peculiarly suited to supplying the service in question.⁵⁹ Anyone may be willing to do something for money, but only a person dedicated to the cause, who can be trusted to do a good job when it is very expensive to monitor or supervise them, may be prepared to volunteer for no explicit reward.

DOC organises a Conservation Volunteers program available mainly to New Zealand residents "who want to do something practical for

⁵⁹ Unfortunately, in other cases volunteers may be the most ill-suited people possible for the job. For example, volunteer fire fighters have been found guilty of arson and scout masters of paedophilia.

conservation” (‘Conservation Volunteers’, in Department of Conservation, 1996a). Volunteers help undertake bird counts, building restorations, hut maintenance, weed control, fencing, tree planting, guiding visitors and giving talks among other tasks. Volunteer projects can last from a few hours to several days or longer. The number of volunteers apparently often exceeds the number of positions available since DOC informs potential volunteers that they may have to put their name on a waiting list. While it might seem irrational to deny the use of volunteer labour, DOC has to provide resources to supervise the volunteers, provide materials for them to work with and so on – so forcing potential volunteers to queue might be a rational strategy.

The importance of motivation and leadership

The fact that voluntary activities involve neither coercion nor an obvious and immediate *quid pro quo* can be seen as a weakness as well as a strength. In particular, it often jeopardises their continued existence. The difference between benefits and rewards is often very small, so a very small change in either component can discourage participation *en masse*.

Economists have discussed the problem of motivating people using the concept of “coordination failures”. This is a game theory concept that can be contrasted with the “prisoner’s dilemma” idea that was discussed above in the context of free riding.

In the coordination game, the impediments to cooperation are not nearly so severe as they are with the prisoner’s dilemma. Again suppose there are two players and two possible strategies. For example, there might be a joint production process or activity with the following characteristics:

- If both players put forth their best effort, they will each get a net output of 4 units.
- If they both decide to use a less satisfactory strategy that nevertheless requires less effort, their net return will only be 2 units each.
- The worst possible situation occurs, however, when the players are uncoordinated – with one playing the high effort strategy and the other the low effort strategy. In this case, the high effort player might *lose* 4 units on net while the low effort player gets a net outcome of zero.

In this case, if one player is playing high, the other player is also better off playing high. Unlike the prisoner’s dilemma game, there is no individual incentive to defect from the dominant cooperative strategy when both players know that will be their partner’s action.

The coordination problem arises, however, when players do not have confidence in their partners. The worst outcome for either player occurs when the first plays the high effort strategy while player 2 chooses the low effort strategy. If a player believes his partner will definitely choose the low effort strategy, then his dominant strategy is also to choose low effort. The result will be coordination on the inferior outcome – players’ worst fears about their partners will be confirmed *ex-post*, and they will congratulate themselves on not underestimating the timidity of their fellow players!⁶⁰

The coordination game can be used as a model of the role of a good manager or group leader. The manager or leader needs to give the players confidence that all the other contributors will be putting forth their best effort. It is then individually rational for each player to cooperate and ensure the best possible outcome is achieved. If the manager or leader “loses the plot” players start to defect and the outcome is likely to be coordination on the low value strategy.

Case study – Restoration of Tiritiri Matangi Island⁶¹

Many enthusiastic volunteers played a critical role in the restoration of Tiritiri Matangi Island. This case study also reveals other important information about conservation strategies in New Zealand. Thus, while the focus of our attention in this example will be on the role of voluntary effort in achieving desirable conservation outcomes, we will nevertheless discuss some other important issues.

Tiritiri Matangi is a 220 ha (2.2 square km) island in the Hauraki Gulf, approximately 25 km north of Auckland city. European farming began on the island in the 1850s with extensive burning. The last fire occurred in 1964 and the grazing lease was terminated in 1971. All stock were removed in 1972 (except for a small area around the 1864 lighthouse) and most of the island was soon covered by rank grass.

⁶⁰ A variant on this game, called “the battle of the sexes”, can be seen as “somewhere between” the prisoner’s dilemma and coordination failure games. In the battle of the sexes game, if one player chooses high, the other is also better off playing high, while if one chooses low, the other is also better off playing low. In this respect, the game is like the coordination failure game. However, the pay-offs in the two cooperative states are asymmetric. One player prefers to cooperate on the “both play high” strategy, while the other prefers to cooperate on the “both play low” strategy. This is likely to make agreement on a preferred joint outcome more difficult than in the coordination game, and provide more of an incentive for defection.

⁶¹ This section is largely based on Craig *et al.* (1995b).

In 1940, less than 6% of the original forest cover remained on the island, with a further 2% covered by bracken fern and regenerating scrub. After the stock were removed, regeneration of native vegetation proceeded extremely slowly. A study by a University of Auckland student showed that (Craig *et al.*, 1995b, p 536) “even though forest and shrub seeds were transported to all parts of the island, the thick mat of rank grass precluded contact with the soil and hence prevented natural regeneration”.

In early 1974 a tropical cyclone led to the release of captive reared kakariki (red-crowned parakeets) on Tiritiri Matangi rather than at the original planned site. Following the release, John Craig, from the University of Auckland, visited the island.

The high density of birds in the small forest patches and the presence of high densities of kiore [the Maori rat] suggested research possibilities not available elsewhere. Regular trips including graduate students began late in 1974 and a research link has continued ever since.

Craig *et al.* (1995b, p 536) summarise some of the subsequent research that was done by faculty and students at the University of Auckland:

- the proliferation of nectar-feeding birds was limited by the availability of food and natural regeneration was unable to provide food soon enough to guarantee long-term survival;
- the presence of large amounts of grass seed allowed extremely high densities of kiore; and
- shortage of grass seed in winter led kiore to eat regenerating trees and shrubs and invertebrates – so the presence of kiore with large amounts of grass seed slowed regeneration.

After the Hauraki Gulf Maritime Park Board designated the island as a scientific reserve in 1980, they offered to close it to the public if that would assist the scientific research (Craig *et al.*, 1995b, p 536). Craig and Mitchell believed, however, that the public should have access to threatened and rare wildlife. They had also concluded from the research that active revegetation was needed. Craig and Mitchell therefore proposed an alternative plan to:

- revegetate over half of the island over 10 years with an estimated 300,000 trees using volunteers (leaving up to 40% of the area to regenerate naturally as a control);
- use the island as a sanctuary to assist long-term conservation of rare birds and tuatara – only some of these animals were known to have been on the island in pre-human times; the other species were believed to need an island sanctuary to survive; and

- allow open public access so they could see rare birds and actively participate in the restoration process.

The plan was circulated for comment and Craig *et al.* (1995b) record some of the opinions in Table 1, p 537. The public conservation groups were all positive and encouraging. They were particularly supportive of the proposal to allow day visitors to see rare species in the wild. By contrast, the scientists:

- expressed doubt that replanting was necessary or even helpful;
- urged more experimentation before proceeding; and
- questioned the wisdom of allowing public access.

Professional conservation managers also suggested that the plan should rely on regeneration of existing vegetation because it was “predominantly indigenous”. They also argued that the revegetation plan would be “a large undertaking” and “the artificial re-forestation ... can be labelled ... experimental”.

Environmental scientists and managers of conservation properties in New Zealand had, by this time, had some experience with island restoration. The earliest reference we have been able to find to such efforts in New Zealand is Merton (1972) discussing the restoration of Cuvier Island, a 170 ha (1.7 square km) island in Hauraki Gulf 40 km east of the northern extremity of the Coromandel Peninsula. Merton records that (p 9):

After a preliminary survey in 1959 during which 160 goats were destroyed, a team of four hunters spent a month on the island in June 1960 and shot a further 333 animals. A year later the extermination was complete ... The next logical step was to control the domestic stock from the lighthouse station ... Two wildlife officers were sent to the island for a month in June 1963 and a new fence was erected across an isthmus. Surplus sheep and cattle were disposed of, and there have been no domestic animals on the reserve since then. As a result, bush species are regenerating spectacularly and ... the menace of erosion has been almost completely halted.

The feral cat population on the island was eradicated between 1960 and 1964 and the last domestic cat was removed in 1970. The rare North Island saddleback was introduced onto the island in 1968 and at the time Merton was writing it was plentiful in wooded areas.

In a recent paper (Mansfield, 1996), the then Director-General of DOC, Bill Mansfield, continues the story of the restoration of Cuvier Island. He reports that red-crowned parakeets were introduced to the island in 1974. Much more recently:

With the development of new rodenticides, special bait spreaders for use under helicopters, and satellite navigation systems to ensure complete coverage with baits, the eradication of Pacific rats [kiore] from Cuvier Island was completed by Department of Conservation staff in 1993. The last tuatara, rescued from the island before removal of the rats, are now breeding in captivity and when their numbers are high enough will be returned to the island ... Some challenges remain. Despite 30 years free of predation by cats, most of the burrowing seabirds have not returned even though they are present in huge numbers on islands nearby. Since the guano from seabirds acts as a nutrient driver for the entire system, restoration of this island ecosystem will require further innovations to encourage seabirds to return.

Mansfield also discussed Mangere Island (113 ha), which is a member of the Chathams group of islands. After sheep, goats and rabbits were introduced the island was “largely denuded of forest vegetation except for 5 ha of fragmented scrub and forest”. Cats introduced to Mangere eliminated the rabbits by 1950, but also “at least two species of seabirds and most forest birds” including the black robin.

Mangere Island was purchased by the government and established as a wildlife refuge in 1966. Sheep were removed in 1968 and 80,000 flax and shrubs were planted between 1974 and 1979 to “form the nuclei for expanding areas of coastal scrub”. The entire surviving population of seven birds (two breeding pairs) of black robin was transferred to Mangere from Little Mangere in 1976–77 and after intensive care have since expanded to about 200 birds on Mangere and nearby South East Island. Chatham snipe were reintroduced in 1970 and Chatham Island tits were re-established by 1972. Mansfield comments (p 6):

The restoration program on Mangere Island is most unusual: forest-dwelling species were reintroduced to an island from which almost all forest had been removed and where much of the original bird fauna was extinct. The efforts on Cuvier and Mangere Island have only been possible because public access could be restricted. This was necessary to reduce risks of reinvasion by pests, protect fragile habitats and provide security for species management projects such as the breeding areas for black robins.

Within this context, the radical elements of the Craig and Mitchell plan to restore Tiritiri Matangi were its emphasis on active planting of forest canopy species and species to enhance the populations of pollinating and seed dispersing birds, including some that were no longer represented on the island, the extensive use of volunteers, the introduction of some rare animal species not thought to have ever been present on the island, and the insistence on continuing public access. It is not surprising, perhaps, that each of these

elements of the plan drew criticism from the scientific and professional conservation communities.

Craig *et al.* (1995b, p 537) report that an initial grant of \$NZ40,000 from the World Wide Fund for Nature along with a 2:1 matching government subsidy provided the funds needed to establish a nursery and employ island based staff. A public organisation, Supporters of Tiritiri Matangi Inc., was established in October 1988 with the primary aim of establishing the original "open sanctuary". The organisation had over 400 members and a budget in excess of \$NZ60,000 in 1994. The formation of an independent charitable organisation encouraged other donations, including \$NZ50,000 from Du Pont (Craig *et al.*, 1995b, p 538).

In addition to planting over 240,000 trees in the ten years to 1994, volunteers have constructed paths and board walks, removed weeds and contributed financially. For example, the Supporters of Tiritiri Matangi financed the eradication of kiore from the island by DOC staff in 1993 using the techniques also used on Cuvier Island.

The importance of motivating volunteers and providing effective leadership is revealed in the following passages:

Planting in the first years was akin to work gang efforts. Members of the public, especially those from conservation groups such as the Royal Forest and Bird Society, were urged to help and planted without a break between arrival on the island and departure. Not surprisingly, few of these people returned. After two years, the work-gang mentality was modified by the arrival of another of us (BW) who changed public participation to always include at least one hour of "getting to know your island". This change in approach has built up a group of visitors who began to accept responsibility for the island and wanted to protect their efforts. (Craig *et al.*, 1995b, p 537).

Volunteers have been the major work force on the island and are made to feel an important part of the project. All are given time to enjoy the island as their major reward. Volunteers and researchers are housed in the same accommodation as visiting public to ensure that there is maximum communication between the different groups that visit the island. In this way, the views and needs of the different groups become known and communicated. (Craig *et al.*, 1995b, p 539).

All people involved in the island are keen to see this achievement rewarded and celebrated by the introduction of another rare species that will further the restoration of the likely past community. (Craig *et al.*, 1995b, p 540).

Management structures can be both an important incentive or barrier to maintaining effective participation. (Craig *et al.*, 1995b, p 540).

A telephone survey of public opinion on Tiritiri Matangi and Little Barrier Islands in 1993 found that people who had been to Tiritiri Matangi were

willing to pay more to preserve the island than those who had not visited it. By contrast, visitors to Little Barrier, “where the primary focus is on the protection of endangered wildlife”, were willing to pay less than those who had not visited. The authors comment (Craig *et al.*, 1995b, p 539):

The difference in part reflects the different management focus but also the visitor focused approach of the conservation staff on Tiritiri Matangi (BW and RW). Visitors are treated as individuals, made to feel that the island is theirs and where they can enjoy aspects of their natural heritage previously unavailable to them ... Eco-tourism groups are taken on walks in groups of 15 or less and these groups see and recognise more with a guide. School groups are dealt with in groups of up to 50 per guide. With the exception of the small eco-tourism groups, people are introduced to the island concept, then given an introductory short walk to show them the range of species present and then the groups are left to explore at their own pace. Special care is taken with older people and infants to ensure that they do not feel a burden on others.

Schools and the University of Auckland now use Tiritiri Matangi regularly. Researchers from the University of Auckland continue to study a wide range of conservation issues on the island. Annual numbers of visitors to the island now approach 16,000 compared with as few as 100 before the restoration began (Craig *et al.*, 1995b, p 534).

The growing sense of shared ownership among the volunteers “produced a feeling of shared responsibility” that assisted with policing activities of visitors that would otherwise be difficult to control:

Once the island began to reward those who came to plant and they were able to readily see endangered birds, the island visitors became self-policing and smoking, fires and dogs became issues of the past.

The release of rare species onto Tiritiri Matangi also provides some additional lessons for conservation strategies in New Zealand:

- Red crowned kakariki were once considered a forest bird, but on Tiritiri Matangi they “fed extensively on the weeds that grew in large numbers on ground disturbed by the mowing of bracken prior to planting or disturbed by the construction of walking tracks”.
- Early attempts to release the saddleback, an endemic wattle-bird, on Tiritiri Matangi “were met with arguments that the island was unsuitable because suitable habitat was believed to include tall trees”. Following their eventual release on Tiritiri Matangi in 1984, however, it was found that “saddleback use areas of regenerating shrubs in addition to tall trees. Moreover, on Tiritiri Matangi reproductive output far

exceeded that recorded anywhere else ... Saddleback on Tiritiri Matangi have reached a population of over 350 in 10 years”.

- Brown teal were released on the island in 1987 and again in 1990. While suitable habitat was believed minimal, “the species bred at a faster rate than had been recorded previously”.
- Whiteheads, a small communally breeding forest insectivore, were released in 1989. “Even though this species is only locally rare, there were still difficulties obtaining permission for the release.”
- Takahe were first released on the island in 1991. At the time the recovery plan for Tiritiri Matangi was written, there was just one remaining small population of takahe in Fiordland (1,000 km further south). “The idea of establishing a population on an island was met with derision in the early years. Even after birds were successfully breeding on other islands, there was extreme resistance to allowing birds to be moved to Tiritiri Matangi because the weather was warmer, the island appeared too small and people had free access.”
- Robins were released on Tiritiri Matangi in 1992. This was the first release to involve a school class, iwi, DOC officials and university researchers. Iwi have now increased their involvement with the island and particularly with the species translocation program.
- Little spotted kiwi was also included in the original plan but was not finally released on the island until 1993. Like the takahe, it was considered never to have been present on the island in the past, but appears to be surviving there without difficulty.
- Another wattle-bird, the kokako, was requested from DOC in early 1991 “but met similar opposition to that experienced with saddleback and takahe”. It has now finally been released on the island.

The history of the restoration of Tiritiri Matangi demonstrates a number of things:

- Habitat that is very degraded from the perspective of supporting rare and endangered species can be restored to the point where it proves very suitable for those species in quite a short period of time.
- Feral animals appear to be extremely significant in destroying native species. While many features of Tiritiri Matangi might not appear ideal for supporting some of the rare species released there, its one great advantage was the absence of many of the predators present on the

mainland. The ability to prevent re-infestation by ferals is one of the great advantages of an island.

- There appears to be a very strong bias within the professional conservation community against active human management to achieve conservation outcomes. Natural regeneration appears to be favoured over planting merely because the process is “natural” instead of “artificial” and not because it has been proved to deliver superior outcomes.
- Similarly, the existing range, or set of habitats, occupied by a rare species is given inordinate status in deciding where the species might be able to survive and prosper. Most species appear more adaptable to new environments than this view would suggest. Craig and Stewart (1994, p 166) observe that “translocations have demonstrated a flexibility in habitat use that was not previously considered ... ‘alpine’ gallinules have shown that they can survive longer and reproduce more rapidly on predator-free islands at sea level ... and songbirds previously found living in tall forest where they nested in holes can do better on islands with low regenerating shrubs and where they often have to nest on the ground”.
- Craig and Stewart (1994, p 165) observe that “misinterpreted theory from overseas” led to “the early adoption of the number 500 in species recovery plans ... islands too small to support a population of this size were considered unsuitable even though the ‘recommended’ numbers were for total species numbers rather than for each sub-population”. Local knowledge that “many of the small islands had supported isolated populations of organisms for long periods of time” was ignored.⁶²

⁶² In correspondence with us, Brendan Moyle commented that:

It is because knowledge about a species can be widely distributed and fragmentary that a command-and-control approach does not work well. Southern African countries such as Zimbabwe and Botswana have managed their elephants well because they have used the dispersed knowledge about populations effectively. Kenya for much of the eighties did not.

He adds:

I also find it ironic that the genetic rule of thumb (500 individuals) was used as a block for the Tiritiri Matangi program while, at the same time, genetic concerns were being ignored for rare bird species with populations less than 100 (black robin, Chatham Island pigeon, kakapo etc.). This asymmetry – where genetic concerns “block” private initiatives but provide no barrier to public sector initiatives – appears frequently in conservation efforts in New Zealand.

As we note in chapter 5, the same asymmetry is evident in reactions to some private sector conservation initiatives in Australia.

- The DOC monopoly of the supply of rare species gives it enormous power to dictate policies at the local level. Even if volunteer groups with substantial local knowledge believe there might be more appropriate management strategies for the reserve, they are reluctant to criticise DOC for fear they will not be given access to new specimens.
- On the other hand, the project could not have succeeded without the support of successive government departments. Furthermore, while the volunteers have disagreed with these government departments over the best strategies to pursue, equally there have been disagreements within the group of volunteers and between different officers within the government departments. For a project as innovative as this one, it would be unusual, and probably counter-productive, if there hadn't been disagreement about the best way to proceed.
- According to some volunteers we spoke to, DOC undervalues voluntary effort in conservation, or at least the need to provide benefits to volunteers to keep them motivated. Visitors appear to be seen more as "threats" than as "opportunities". When they are treated as customers to be served with a product, as in a business, they are willing to contribute much more in exchange.
- A sense of pride in contributing to a successful outcome creates a sense of ownership that can be used to assist with enforcing appropriate behaviour of visitors.
- An island is also useful for a conservation reserve because the relatively easy excludability of people provides a means of encouraging people to contribute to the supply of the conservation services. Measures of the passengers carried by the ferry to the island also provide a direct measure of demand for the service being supplied, which is useful for gauging whether the service being supplied meets the needs of customers.

One of the biggest problems faced by the Supporters of Tiritiri Matangi is how they can turn the enterprise into an on-going concern that is not dependent for its survival upon a few critical individuals. In our view, this could best be achieved by vesting real ownership of the island in the Supporters group. The ownership title could restrict use of the island for conservation purposes.

Tiritiri Matangi could be used as a demonstration program for a new type of "Homesteading Act". Groups of volunteers who take over a degraded habitat, and then rehabilitate it successfully so that it can support rare or

endangered species, could be granted a title to operate the property as an eco-tourism venture, charging visitors, offering free visits or discounts to volunteers, employing professional managers or tour guides and so on, as they see fit. DOC's role would become much more one of regulating the terms and conditions under which such reserves operate and much less a provider of services to the public.

CONCLUDING REMARKS

We have argued in this chapter that decentralised market activity is a very powerful means of mobilising resources to provide goods and services that individuals value. There can also be market failure, however, when goods are non-excludable and jointly consumed. A proviso in the latter case was that jointly consumed goods that remain excludable (such as music and sporting events, sporting clubs and so on) can be provided by markets and, in practice, markets might be able to do about as well as any institution at ensuring such goods are provided as efficiently as possible.

We noted the pivotal role of the legal system in defining and enforcing property rights. Without legally defined property rights, markets will not produce an efficient outcome. Again, in some cases, it might not be possible to improve on an outcome that is less satisfactory than one could imagine. The cost of defining and enforcing the rights might exceed the efficiency gains from doing so – rights are then best left undefined.

In other cases, there could be gains from introducing new rights. A feature of the legal system, however, is that it tends to evolve rather slowly. It has to if property rights are to remain secure. If new cases could easily overturn prior assignments of rights, the system will begin to resemble one where there are no rights at all.

A consequence of the slow evolution of the legal system, however, is that the designation of property rights can lag behind changes in the value of different uses of resources, the costs of different uses, or changes in monitoring and enforcement technologies. The possibility of gains from introducing new property rights is one avenue through which the centralised political mechanism might be able to improve on the decentralised market and legal systems.

Politics also has a central role to play in enforcing legal decisions. By establishing a monopoly on the legal exercise of force and coercion, on setting and enforcing rules of interaction, the government discourages wasteful battles for power and authority and encourages people to pursue their own ends within a secure legal framework.

Market failure might also provide an opportunity for government actions to increase efficiency. The problem here, however, is that politics is a very blunt instrument for registering individual preferences, even in a democracy. The government monopoly on coercion also creates a very strong power that can be abused when government plays a large role in allocating resources. When the rule-setter also starts playing the game, it quickly becomes a dominant and disruptive player.

Voter control of politicians and political control of bureaucracies are also very weak. The result is that government is not well suited to operate business enterprises. The usual experience with such endeavours is that their costs of production are substantially in excess of the best attainable, while they also give much poorer service to customers than their privately owned counterparts. Government attempts to correct market failures are more successful when the government adheres to modifying market outcomes rather than replacing them. Even with such more limited interventions, however, the cure can be much worse than the disease.

Fortunately, markets, the law and politics do not exhaust the range of institutions available to achieve the many desired ends of the community. In most countries, a great deal of resource allocation is effected through voluntary activity. Such voluntary activity can be important in the conservation area and can greatly assist in achieving better outcomes.

The critical issue we need to address later in the report is how best to use the various strengths of these different resource allocation mechanisms. We also need to be mindful of the potential defects or problems associated with each mechanism. While political action, or a greater reliance on markets, might have the *potential* to better provide for some desired uses of resources, the defects of these mechanisms in other respects could more than offset these potential gains and ensure that the overall outcome is in fact worse.

APPENDIX 1 – SUBSTITUTION AND INCENTIVES, KEY ECONOMIC CONCEPTS

Suppose the supply of a raw material that is fundamental for producing a particular good or service becomes relatively scarce. The price of the raw material will rise as producers bid for the reduced supply. The increased price will give producers an incentive to substitute other raw materials where they can, to redesign the product so that it uses less of the scarce raw material, to invent new technologies that economise on the raw material and so on. The increase in the price of the raw material might also give producers

of that raw material an incentive to find more of it, exploit less favourable sources of it and so on.

Despite these efforts, however, the supply of the *final* good or service might still contract. Since the demand curve is downward sloping, the fall in supply will raise the price of the final good or service – consumers will bid up the price in response to the reduced supply. This rise in price will encourage increased production by, for example, allowing the producers to use less satisfactory substitutes for the raw material whose reduction in price started the adjustment process, hiring better trained workers to produce more output with the same inputs and so on.

In addition, however, the increase in the price of the final good or service will encourage consumers to substitute away from that good or service toward other goods or services that are now relatively more attractive. The change in prices *signals* to consumers that it is now more expensive to satisfy their demand than it used to be, so they ought to value the good or service more highly if they are going to continue consuming it. The higher price also *signals* to producers that it is now relatively more valuable to produce this particular good or service, so they ought to think about how they might be able to do so.

Many non-economists believe that an increase in prices reduces demand primarily by making items “less affordable”. This is what economists call an “income effect”. A consumer with unchanged money income facing higher money prices for an item cannot buy as much of the item as before. This observation, and the usual discussion of income effects in elementary economics texts, substantially *overstates* the magnitude of the income effect.⁶³

An increase in demand, or drop in supply, of some good will change the price of that good *relative to* the prices of other goods and services. The change in *average* nominal prices, and average money incomes (that is, the overall inflation rate) depends on the supply of, and demand for, *money*. After all, the *average* level of nominal prices just represents the *purchasing power* of money. Changes in the market for any one good or service will *usually*⁶⁴ have only a negligible effect on the overall inflation rate.

⁶³ The unfortunate tendency for textbook writers to get this analysis wrong is perhaps another unwelcome legacy of Keynesian economics. In the Keynesian model, nominal price changes are the same as real price changes because, by assumption, some nominal price – usually a wage rate – is assumed to be constant.

⁶⁴ The possible exception allows for goods, such as fossil fuel, that have such a pervasive effect on the economy that the overall level of economic activity, and hence the demand for money, depends on fluctuations in their supply.

A supply or demand change that requires the *relative price* of a particular good to rise normally will be reflected in a *higher than average* increase in the nominal price of that good and a *lower than average* increase in the nominal prices of all other goods and services. The “income effect” as measured in the elementary texts ignores the beneficial effects on purchasing power of the lower than average price increases for the remaining goods and services. It thus overstates the magnitude of the fall in real income resulting from the relative price increase.⁶⁵

Apart from the fact that an increase in the *relative price* of a particular good or service will reduce *real income* by only a small amount, the effect on demand of the real income change that does occur will also be small. Any change in real income will generally change the consumption of *all* goods and services. The reduction in consumption will be spread across all items because the marginal benefit derived from consuming more of any one item decreases as a larger amount is already being consumed. The upshot is that a reduction in real income tends to have minor effects on the consumption of each item. The consumption of *each* item will decline, but less than proportionately to the decline in real income.⁶⁶

⁶⁵ In practice, demand curves are estimated as functions of the price of particular goods *relative to* the consumer price index or some other deflator, and of nominal incomes *relative to* the same price index or deflator – so-called *real income*. The “income effect” that is measured with demand curves *as estimated in practice* is the income effect of a *relative price* change holding *real income* constant. The usual analysis of income effects confuses *nominal* and *relative* prices and *money* and *real income*. Thus, elementary textbooks usually measure the income effect by examining a rotation of the consumer budget line about one of its end-points (an intercept with an axis). Empirically estimated demand curves effectively measure the effect of a rotation about the *bundle of goods* that make up the consumer price index or other price deflator.

⁶⁶ Income elasticities of demand usually are close to 1. Algebraically, the budget constraint of an individual consuming goods x_i at relative price p_i (nominal price P_i divided by a price index P) and with real income y (nominal income Y divided by the same price index P) is given by $y = \sum_i p_i x_i$. If this is differentiated with respect to y , we obtain

$$1 = \sum_i p_i \frac{\partial x_i}{\partial y} = \sum_i \frac{p_i x_i}{y} \left(\frac{y}{x_i} \frac{\partial x_i}{\partial y} \right) = \sum_i s_i \eta_i$$

where s_i is the *share* of income spent on good i and η_i is the *income elasticity of demand* of good i . For most goods, $\eta_i > 0$, that is, an increase in real income increases the level of consumption. Thus, a weighted average of the income elasticities of demand must equal 1 and hence any one elasticity of demand “cannot be too far away” from 1.

While the income effect of a relative price change will be small, the substitution, or incentive, effect of a price change on consumption can be *arbitrarily large*. The size of this effect (the substitution elasticity of demand) for any good or service depends on whether or not there are close *substitutes* for that good or service. If there are other goods or services that are *very similar* in the eyes of the consumer – that is, have very similar impacts on utility – then the substitution elasticity will be very large. A small increase in the relative price of the good or service would cause a large substitution toward the similar good or service that has not changed in price. On the other hand, if the good or service whose price has risen is quite unique in the qualities it provides to consumers, the higher price will induce little substitution toward other goods or services.

In practice, there are very few goods and services that do not have a reasonable substitute. The key is to think of goods and services as “bundles of attributes” that are packaged in different proportions. Psychologists have argued that the fundamental demand is for sensory experiences of various sorts. These experiences can be obtained by consuming many different goods and services – there is very little that we cannot do without. Even the experiences themselves are not absolute requirements and there is a degree of substitution between them.

APPENDIX 2 – NATURAL MONOPOLIES AND GOVERNMENT OWNERSHIP

Natural monopoly

There are a number of problems associated with the argument that natural monopolies are best owned by governments. To begin with, it is difficult to know which industries might be *natural* monopolies when industries are monopolised by government edict. How can we know what the market structure would be when the market is not allowed to operate? Economists have argued that natural monopolies tend to be characterised by technologies that result in declining average costs of production as output expands.

Costs are, however, not a function of technology alone. While some technologies might display increasing returns to scale or scope, they need to be implemented within firms that also depend on other technologies that display *decreasing* returns to scale or scope. Administrative costs, for example, tend to increase more than proportionately with the number of layers of employees, the geographical dispersion of the firm’s operations or

the number of markets the firm is trying to serve. Large firms become vulnerable to competitive entry because large size tends to raise average costs.

Furthermore, competition is a spur to efficiency, since it imposes pressure to control costs and keep prices low. Monopolists therefore may tend to lose control of their costs over time as management sees less urgency in being vigilant, and employees unionise to obtain a share of the monopoly rents.

The disadvantages of large size and monopoly can even mean that two smaller firms competing for market share can have lower costs than a large monopolist would have. For example, Lubbock, Texas, still has two competing local electricity distributors and, as a result, arguably has a lower price of electricity than comparable cities served by a monopolist.

Firms also can face competition from producers of competing products, so it is difficult to determine the extent of a market on *a priori* grounds. For example, for many uses, natural gas and electricity are substitutes; for others natural gas and coal, diesel fuel or gasoline are. Thus, the ability to exploit natural monopoly in the natural gas market will be limited to some extent by competition with electricity and liquid fuels.

Furthermore, just as an unexploited niche in an ecosystem “invites” adaptation by organisms able to exploit it, monopoly profits in markets invite innovation and competition. Firms will scramble to invent new technologies that enable them to obtain a share of the monopoly profits. For example, the history of telecommunications in the United States is one of the application of new technologies – microwaves, satellites, optical fibres, cellular technologies, and use of existing cable television and electrical transmission networks – to enable new entrants (like MCI, United States Sprint and so on) to compete with the incumbent.

Entrants to a market can also often obtain a foothold by discovering new consumers, or new products, that have not been exploited by the incumbent. For example, following the expiration of the original telephone patents in the United States, new entrants flooded into the telephone market to supply services to the rural and suburban areas that had been largely ignored by the Bell companies. Similarly, Apple computer was able to gain a foothold in the computer market partly because IBM had dismissed personal computers as being nothing but a toy.

The argument that private monopoly will result in an *inefficient* use of resources is not necessarily valid – particularly when the efficiency is measured relative to the level attained by realistic alternatives rather than the theoretical “first best” that is probably not achievable in practice. While a

monopolist can raise profits by restricting output and charging a higher price, it can obtain even higher profits, while also producing a more efficient level of output, if it does not have to charge a uniform price for all its output. For example, in the lighthouse example discussed by Coase, annual charges *per voyage* varied as the number of voyages increased. If the monopolist could charge each consumer both a fixed price and a per unit price such that each of the consumers is barely indifferent between consuming the good or service and forgoing the pleasure altogether, and all consumers pay the same per unit price equal to the marginal cost of production, the output level would actually be efficient. The monopolist's profits would also be at their maximum feasible level.

In practice, the monopolist is unlikely to be able to price discriminate to this extent – practical schemes may involve bulk discounts or differentiated fixed charges, but not individual specific fixed charges. Nevertheless, the monopolist has an incentive to avoid the inefficiency associated with sub-optimal output whenever it can do so without reducing its revenue.

The costs of monopoly power may also be reduced in some cases by isolating the monopoly elements of some industries. In recent decades, many countries have restructured industries such as electricity or natural gas supply to isolate the natural monopoly elements from the more competitive elements. The competitive elements of the industry can then be allowed to operate as a normal market. In the case of electricity, for example, generation is split into many competing entities and separated from the high voltage transmission grid. A competitive wholesale electricity market is then put in place.

Another way of separating industries into competitive and monopoly elements is to use contracting out for supplying competitive services. So called BOT (build, operate and transfer) schemes, where the private sector constructs a facility (such as a water treatment plant or toll road), operates it for a number of years under contract and then transfers ownership to a government entity, are an example of this. In the water and waste water treatment industries, concessions or franchises have also been used to allow more extensive private sector involvement. Under these arrangements, the government retains ownership of the physical assets but contracts with the private sector to provide services using those assets for a fixed period of time. The right to provide services is periodically opened to competitive bidding.

Even where monopoly is unavoidable, government ownership is not the only alternative to unfettered operation of markets. Private monopolies can have their prices regulated, as has been done in the United States for decades

and has recently been done in the United Kingdom and many other countries. An impressive array of evidence has now been produced showing that regulated private monopolies are likely to produce a more efficient outcome than government-owned monopolies.⁶⁷

Efficiency of government enterprises and the New Zealand reform process

The general analysis of democratic political activity can explain why government ownership is unlikely to provide an efficient solution to the problems of providing public goods or correcting the deficiencies of monopoly supply. Management in government trading enterprises face weak incentives to minimise costs or produce the right mix of goods and services. Politicians do have an incentive to monitor the performance of managers in the public sector. However, as argued in the text, they are usually more concerned to ensure politically powerful interest groups are satisfied than that resources are not wasted. In particular, the link between inadequate returns on public sector investments and a politician's re-election chances is too weak to make cost minimisation or output value maximisation a prime target of political monitoring efforts.

Inefficient resource allocation in public enterprises takes a number of guises. The New Zealand reform of government departments and enterprises in the mid to late 1980s was aimed, with varying degrees of success, at eliminating or ameliorating many of these inefficiencies.

Over-staffing and work standards. Since the government has the legislative power to attenuate competition, there is an understandable tendency for government departments to seek, and obtain, a monopoly on service provision. A secure monopoly position is likely to diminish incentives to control costs.⁶⁸

The reduced incentives of managers, and their political masters, to control labour costs will show up not only in excessive staffing. Public enterprises

⁶⁷ This evidence has been surveyed in many books and journal articles, including many studies by the World Bank. See, for example, Bishop and Kay (1988), Boardman and Vining (1989), Shirley and Nellis (1991), Kikeri, Nellis and Shirley (1992), Galal *et al.* (1994) and Megginson *et al.* (1994).

⁶⁸ This problem is not restricted to government departments. Private firms with a relatively secure monopoly position, for example because they are protected by trade barriers, own patents on a crucial technology or have "natural monopoly" assets such as port facilities, also have reduced incentives to control costs and are vulnerable to employee pressure to increase wages and relax working standards.

are also notorious for harbouring inefficient work practices and hostility to labour-saving innovations in production techniques.

The New Zealand reform process attempted to reduce these problems by increasing competition between departments (through allowing overlap in responsibilities) and applying the same employment conditions (under the *Employment Contracts Act*) to the public and private sectors.

Sources of equipment and supplies. A directive (or “encouragement”) to favour local versus remote suppliers of equipment and supplies is also a likely outcome in an enterprise monitored by politicians. The beneficiaries of such a directive will be a concentrated local vested interest with political influence. The costs will again appear as a loss in “general revenue” or an increase in prices that it will be difficult to associate with the non-competitive tendering process.

Under the New Zealand reform process, departments were given more freedom to allocate budgets as they saw fit while political directives to departments had to be explicit and open.

Budgetary constraints on investment. Access to investment finance is a major problem for most public entities. Since the returns to capital are dissipated by transfers to consumers, employees or other suppliers, they usually are unavailable to finance additional investments.

Publicly-owned enterprises are often dependent on general government finances as a source of investment funds. The acceptability of publicly-owned enterprises incurring costs then often depends on the “macro” governmental budget conditions rather than the micro fundamentals of profits and markets. Urgent expenditures may be turned off for purely political or budgetary reasons.

In an attempt to promote more efficient use of capital and non-capital inputs, the New Zealand reform process gave government departments more freedom to reallocate funds between capital and recurrent expenditures. In addition, a capital charge was instituted to encourage departments to take account of the opportunity cost of capital.

Soft versus hard budget constraints. While government enterprises often are constrained in their investment decisions, they also can usually escape the discipline of covering at least their operating costs through earning sufficient revenue. Politicians are reluctant to have a business fail and can be relied upon to make up operating losses through transfers from general revenue. This in turn reduces pressures to keep costs to a minimum.

By contrast, privately owned businesses cannot engage in unprofitable activity for long. Impending bankruptcy usually forces a change in business

strategy. As we argue further below, even corporatisation has not provided a good solution to this problem.

Risk taking and risk avoiding behaviour. Managers in the private sector have an incentive to increase profits as well as avoid higher costs or decreased revenues. Their remuneration typically reflects both types of changes in company fortunes. While shareholders are averse to highly variable returns, they also have opportunities to greatly reduce their risks through portfolio diversification.

Public sector managers, by contrast, typically receive much less from making good decisions than they pay for decisions that, with hindsight, turn out to be mistakes. This particularly applies to bad decisions where the costs are immediate and easily connected with the originating decision. Public sector managers also fail to benefit to the same degree as their private sector counterparts in recovering a higher income from taking risks that pay off by lowering costs, or raising service quality. Often the benefits of good decisions are indirect, or delayed in time, and thus hidden from public scrutiny. Managers of government enterprises thus have an incentive to invest in system (and political) security by “gold plating” investments, and to behave conservatively and cautiously.

The New Zealand reform process attempted to cope with this problem by allowing government enterprise boards to determine the remuneration of chief executives, including an element for performance. Again, however, it is difficult to duplicate the functions of a private capital market in an organisation that has only one owner with a non-traded ownership claim. Furthermore, it is difficult to evaluate service quality, and therefore relate remuneration to output value, when outputs are not explicitly marketed.

Customer service. A significant part of the total value that customers obtain from a service depends on the quality of the service and their interactions with the firm. Consumers value billing accuracy, responsiveness to complaints, rapidity of response to system failure or, even better, anticipation and avoidance of failure, and of course the quality of the services supplied. Different consumers often value different characteristics in goods or services.

In a government enterprise, managers tend to become preoccupied with delivering services with a quality that is laid down in the statute. Inevitably, this results in reduced variety and a tendency to overlook dimensions of service that cannot be specified in a statute. By contrast, private competitive firms have an incentive to find and exploit any actions that can raise customer satisfaction or reduce the costs of service.

The desire to improve customer service was one reason the New Zealand reform process emphasised competition, user fees and market instruments in place of regulation. We argue that, in the conservation area, this process of introducing a more explicit market for the outputs from government enterprises could be taken much further.

Cross-subsidisation. Another consequence of political, as opposed to shareholder, monitoring is that government enterprises will need to attend to politically sensitive consumer groups. The “community view” or “political judgment” that some groups should receive services at subsidised rates leads to so-called *community service obligations*. Such subsidies will represent an inefficient allocation of resources, although they could be judged desirable on other grounds.

Using a competitive industry to supply output does not prevent a government from offering cross-subsidies. A difference between a government enterprise and a competitive industry, however, is that the cross-subsidies will need to be explicit in the competitive industry rather than “buried” in the enterprise’s internal accounts. Governments would need to make a case for *direct* support for groups deemed deserving by the political process, and fund the subsidies out of the relevant department budget (for example, the Ministry of Education would fund transport, water or electricity services for schools). This may make it more difficult for governments to implement cross-subsidies, but we believe there are benefits in a democratic political system from making political interventions explicit and matters of debate rather than keeping them hidden.

The New Zealand reform process attempted to limit cross subsidies by:

- making political directives more explicit;
- giving enterprises more transparent and explicit objectives;
- introducing greater competition in the supply of services; and
- relying more on user fees and market trades to fund departmental activity.

We argue in chapter 4 and elsewhere, however, that in the conservation area significant subsidies to powerful vested interest groups remain and these subsidies continue to adversely affect the efficiency of resource use.

Non-price rationing. A problem governments often face when they attempt to force public enterprises to cross-subsidise groups of consumers is that the enterprise may respond to the low prices by limiting the quantity or quality of services it supplies to the subsidised group. The resulting *non-price rationing* of demand (through queuing or first-come first-served policies, or

degradation in the *quality* of service) is likely to be less efficient than higher prices. When demand is reduced by increased prices, the least valuable uses of the good or service are eliminated first. All consumption that is valued at less than the price being charged is voluntarily forgone. With non-price rationing, however, there is no guarantee that the least valued demand is eliminated first. Some of the demand that is rationed could actually have a very high value to consumers.

We shall argue in chapter 4 that significant non-price rationing exists in the market for conservation services and that this rationing represents a continuing waste of resources.

Corporatisation versus privatisation

Many of the costs of public ownership identified above apply to the most extreme form where there is continual and extensive intervention and oversight by politicians. The results of such intervention include poorly specified objectives, a multiplicity of contradictory objectives and a weak relationship between managerial performance and managerial rewards or penalties.

One of the motivations behind many of the New Zealand reforms of the mid to late 1980s is that corporatisation can eliminate some of these defects. The firm is re-constituted along commercial lines with a board of directors who are responsible for achieving more transparent and focused objectives. Political directives have to be explicit and open to public scrutiny. Managerial rewards are closely related to achievement of the stated objectives.

There are nevertheless a number of differences between a corporatised publicly owned firm and a private business that often lead to reduced incentives to serve customers and minimise costs. The legislation rarely specifies as narrow a commercial objective for the public firm as exists for private firms. This may be partly a recognition of the potential efficiency losses from exploitation of monopoly power, but it does reduce incentives to maximise net benefits.

The legislation establishing a corporatised firm may also assign regulatory or oversight roles to the corporation in addition to a commercial role. The firm can then abuse its regulatory role by limiting competition for customers and employees and restricting the adoption of competing new technologies. Outcomes of both the regulatory and commercial processes are likely to be superior when the two roles are placed in separate organisations, as has typically been the case in New Zealand.

Governments also retain a financial interest in corporatised firms. They therefore also have an incentive to legislate to protect the firms from competition. In addition, management of a publicly owned corporation may believe they can rely on government to rescue them from financial distress. A private firm may also be judged to be vital to the economy. The ability to mark down the value of its assets and sell them to others means, however, that physical survival of the firm is not tied to the financial survival of its current owners. The new owners can continue to use the assets to supply output. In contrast, if the government wishes to retain ownership of a vital public corporation in financial distress there is no alternative to rescuing the firm. Knowing this, the managers have reduced incentives to control costs and avoid financial distress.

Corporatisation also may be favoured by politicians as a way of retaining cross-subsidies or community service obligations. Even if this is not formally the case, corporatised entities are usually required to report to the legislature, and cross-subsidies, along with employment and procurement practices, are a likely focus of legislative scrutiny. Managers of a corporatised firm will learn that their life is likely to be easier when they attend to such sensitivities.

Another set of differences between corporatised and privately owned firms arises because ownership shares in the latter are traded on share markets (or are otherwise available for sale to the highest bidder). Management of a private firm has an incentive to maximise the market value of the firm. Market value provides a continuous and easily observed measure of managerial performance. When assets are not being used efficiently, the market value of the firm declines. This makes it a target for the acquisition of a controlling interest. Often, managerial compensation is explicitly linked to the market value of the firm, for example, through stock options.

In a corporatised publicly owned firm, there are no ready sources of information on managerial performance. Management usually is judged by reference to various accounting measures of profits, costs, market expansion and so on. These accounting measures reflect arbitrary rules, for example on depreciation or what constitutes operating and capital expenses. They also focus on past performance rather than likely future performance as is reflected in share values.

Capital markets also provide other services that are absent for corporatised public firms. The market return on private ownership claims (or private debt instruments) reflects the costs of the risks associated with the income flow attached to those assets. There is no comparable source of information on the appropriate risk-adjusted return on investments made by

the corporatised firm. This makes it difficult to determine the efficient level of investment by the firm. Securitising the income flow to the government owners of the publicly owned firm may provide a partial solution to this problem. The government could float assets analogous to non-voting shares. The market return on those shares would reflect the risks of investing in the business – although there would also be a premium to compensate for the investor’s lack of control over management decisions.

Another consequence of the absence of marketed ownership claims in corporatised firms is that different individuals bear the risks of fluctuations in net returns. In private capital markets, individuals are paid to voluntarily bear risks. Those who are most willing to bear a risk will buy the corresponding asset when its expected return is very low. Thus, the market return on any asset reflects the compensation that has to be paid to the *least willing investor*.

In contrast to private firms, risks of fluctuations in net returns to public firms will not be borne by those most willing to do so. Fluctuations in the net returns of a public enterprise do not flow to investors. Taxpayers, recipients of other government spending, or consumers involuntarily bear the risks associated with publicly owned assets. Furthermore, many individuals bearing risks under public ownership may find it very costly to do so – they may be very risk averse, and if they have a low income a fluctuation in that income could have very undesirable consequences. The use of taxation to pay interest is also very expensive as a result of the losses from compliance and collection costs, and also the forgone economic activities due to taxes as discussed in the text.

APPENDIX 3 – A BRIEF ECONOMIC ANALYSIS OF “OVER-FISHING”

The problem of over-fishing occurs when the fish resource is unowned. It applies to other types of natural resources apart from fish and is the basic economic issue at the heart of much conservation policy. For the economists, the scientists, or the more mathematically inclined, amongst our readers, we outline the argument in this appendix.

We mentioned in the text that two types of externalities are associated with uncontrolled access to a population of fish. One is that an individual fisherman will not have an incentive to take account of the additional costs that his fishing activity imposes on others attempting to exploit the same resource. This is a “static problem” that has nothing to do with population growth or “sustainability” of the species, but since it is simpler to analyse we

look at it first. The second type of problem with uncontrolled access is that an individual fisherman does not have an incentive to take account of the effect additional fishing today will have on the available stock of fish in the future. This is a more difficult problem to analyse, since it involves examining the effects of different patterns of behaviour over many periods.

The classic exposition of the static problem is Cheung (1970). There are also many expositions of the dynamic, or intertemporal, problem. Our discussion later is based on Levhari *et al.* (1981).

Static model

Let the price of fish be p and assume that the supply of fish from a particular resource (one among many) has a negligible effect on the price.⁶⁹ Let the quantity of fish taken by i be q_i and the quantity taken by all *others* exploiting the same resource be $Q^* = Q - q_i$. The costs for i are assumed to depend on effort, but also to increase as the fish taken by the others increases – that is,

$$C_i = C(Q^*, q_i) \text{ with } \frac{\partial C}{\partial Q^*} > 0, \frac{\partial C}{\partial q_i} > 0 \text{ and } \frac{\partial^2 C}{\partial Q^* \partial q_i} > 0. \quad (\text{EQ 2.1})$$

Increases in own effort would increase the expenditure of energy, or time at sea, and would likely come at an increasing marginal cost. Increases in Q^* would increase the time taken to catch a given tonnage of fish and perhaps also the time taken to unload it (as a result of congestion in ports and so on). The i th firm will exert effort until the marginal *private* cost of fishing equals the price of fish $p = \partial C / \partial q_i$. The effects effort has on others will be ignored.

Since no-one can be excluded from fishing the area, new firms will enter until profits fall to zero. Thus, if we simplify by assuming all the firms are identical and the number of them m is a continuous variable, m and q will be determined by

⁶⁹ According to information provided on the New Zealand Treasury web site (<http://www.treasury.govt.nz>, September 1997), “more than 80% of production [of seafood in New Zealand] is exported”. Furthermore, New Zealand supplies would be a small part of most of the markets it exports to. According to the New Zealand Fishing Industry Board web site (<http://www.seafood.co.nz>, September 1997), New Zealand currently produces about 0.5% of the world’s catch. Japan takes 29% of New Zealand seafood exports, the United States takes 20%, Australia takes 11% and about 50 other countries take the remaining 40% of New Zealand seafood exports. It would appear to be safe to assume that changes in the supply of fish from the New Zealand fishing industry have an extremely minor effect on the price of the product.

$$p = \frac{\partial C}{\partial q} \quad (\text{EQ 2.2})$$

and

$$pq = C[(m-1)q, q]. \quad (\text{EQ 2.3})$$

If the firms could form a club and prevent others from fishing (at zero cost) they would maximise their *joint* profits $mpq - mC[(m-1)q, q]$, leading to choices of q and m that satisfy

$$p = \frac{\partial C}{\partial q} + (m-1) \frac{\partial C}{\partial Q^*} \quad (\text{EQ 2.4})$$

and

$$pq - C[(m-1)q, q] = mq \frac{\partial C}{\partial Q^*}. \quad (\text{EQ 2.5})$$

Equations (2.4) and (2.5) together imply

$$\frac{\partial C}{\partial Q^*} = \frac{\partial C}{\partial q} - \frac{C[(m-1)q, q]}{q}. \quad (\text{EQ 2.6})$$

From equation (2.4), each member should be charged a “fee” $(m-1)\partial C/\partial Q^*$ for each fish caught equal to the marginal costs imposed on other club members. The size of this fee *per other member*, $\partial C/\partial Q^*$, should, from equation (2.6), equal the difference between the marginal and the average cost of fishing for any one member. The revenue raised by the fees represents a return on the investment needed to prevent excessive fishing.

A numerical example

We can illustrate the difference between the cases where exclusion is, or is not, possible with a simple numerical example. Define units such that the price of, say, a hundred thousand metric tonnes of fish is $p = 1$. Assume that, with those units, the cost function can be approximated by a quadratic function in q and Q^* :

$$C(Q^*, q) = 0.2q + 10q^2 + 0.1qQ^* + 0.01Q^* + 0.1Q^{*2}. \quad (\text{EQ 2.7})$$

When firms cannot be excluded, and all of them are identical, q and m will solve:

$$1 = 0.2 + 20q + 0.1Q^* = 0.2 + 20q + 0.1(m-1)q \quad (\text{EQ 2.8})$$

and

$$q = 0.2q + 10q^2 + 0.1qQ^* + 0.01Q^* + 0.1Q^{*2}. \tag{EQ 2.9}$$

After substituting $Q^* = (m-1)q$, equation (2.9) can be simplified to:

$$1 = 0.01m + 0.19 + 0.1m^2q - 0.1mq + 10q. \tag{EQ 2.10}$$

Equations (2.8) and (2.10) can be solved for $q = 0.03832$ (that is 3,832 metric tonnes) and⁷⁰ $m = 9.7797$, and thus a total catch of 0.37474 (37,474 metric tonnes). By comparison, the *optimal* values of q and m would solve:

$$0.81 = 0.01m + 0.2qm^2 - 0.2mq + 20q \tag{EQ 2.11}$$

and

$$10q - 0.01m - 0.1qm^2 = 0 \tag{EQ 2.12}$$

leading to $q = 0.02321$, $m = 8.0748$ and thus $Q = 0.18738$ (that is 18,738 metric tonnes). The results are summarised in Table 2.1.

TABLE 2.1: Static model outcomes

	<i>Uncontrolled access</i>	<i>Optimal</i>
<i>Number of firms</i>	9.7797	8.0748
<i>Per firm catch</i>	3,832 metric tonnes	2,321 metric tonnes
<i>Total catch</i>	37,474 metric tonnes	18,738 metric tonnes

The free entry equilibrium thus results in too many firms each catching too many fish – so the total catch is roughly *double* the optimal level.

Dynamic model

Now extend the analysis to allow for many time periods. The assertion in the text is that there will be an additional effect in so far as none of the individual firms will have an incentive to take account of their current fishing activity on the likely future stock of fish.

We can again contrast the free access equilibrium with the choices made by a private club (able to exclude non-members at zero cost). The club is now

⁷⁰ Although in practice m has to be an integer, in reality the different fishing firms would also likely have different technologies – so we might interpret fractional values of m as representing different sized firms using different technologies. We might conclude in this case there would be *of the order of* 10 firms using different technologies and cost functions.

assumed to maximise the total market value of fishing licences held by its members – or, equivalently, the discounted present value of revenue from fish sales minus fishing costs.

Let N_t be the stock of fish in the fishery at the beginning of period t and p_t the price of fish (given to this part of the industry). Assume the individual cost of catching q_t fish from this resource given (m_t-1) others are taking Q^* can be written:

$$C(N_t, Q^*, q_t), \text{ with } \frac{\partial C}{\partial N} < 0, \frac{\partial C}{\partial Q^*} > 0, \frac{\partial C}{\partial q_t} > 0, \frac{\partial^2 C}{\partial Q^* \partial q_t} > 0 \text{ and } \frac{\partial^2 C}{\partial N \partial q_t} < 0. \quad (\text{EQ 2.13})$$

For example, costs could depend on the individual catch q_t and the *average fish stock* during period t , which, if fishing is uniform over the period, would be $N_t - (1/2)Q_t$.

Assume the stock N evolves according to the difference equation:

$$N_{t+1} = f(N_t - Q_t). \quad (\text{EQ 2.14})$$

Also, let r be the time discount rate – which also will be the required return on an investment in licences. Then (if we again assume for convenience that all m fishing firms are identical) it can be shown that a necessary condition for maximising the joint value of the licences is that, over each period,

$$(1+r) \left[p_t - \frac{\partial C_t}{\partial q_t} - (m_t-1) \frac{\partial C_t}{\partial Q^*_t} \right] = \quad (\text{EQ 2.15})$$

$$f'(N_t - Q_t) \left[p_{t+1} - \frac{\partial C_{t+1}}{\partial q_{t+1}} - (m_{t+1}-1) \frac{\partial C_{t+1}}{\partial Q^*_{t+1}} - m_{t+1} \frac{\partial C_{t+1}}{\partial N_{t+1}} \right]$$

and

$$\frac{\partial C}{\partial Q^*} = \frac{\partial C}{\partial q} - \frac{C[(m-1)q, q]}{q}. \quad (\text{EQ 2.16})$$

Equation (2.16) is the same as the condition (2.6) required to internalise the externality in the static model. This condition will now have to hold period by period.

Equation (2.15) gives the condition for intertemporal optimality. If we again think of $(m-1)\partial C/\partial Q^*$ as a “club fee” for each fish caught,

$$p_t - \frac{\partial C_t}{\partial q_t} - (m_t-1) \frac{\partial C_t}{\partial Q^*_t} \quad (\text{EQ 2.17})$$

will be the private “profit” from catching an additional fish this period *after* paying the fee. Similarly,

$$p_{t+1} - \frac{\partial C_{t+1}}{\partial q_{t+1}} - (m_{t+1} - 1) \frac{\partial C_{t+1}}{\partial Q_{t+1}^*} - m_{t+1} \frac{\partial C_{t+1}}{\partial N_{t+1}} \quad (\text{EQ 2.18})$$

will be the expected private “profit” from an extra fish next period when there is an additional “fee” $m_{t+1} \partial C_{t+1} / \partial N_{t+1}$ to account for the increase in marginal fishing costs for all club members next period as a result of the decline in the stock of fish. The *marginal* decline in fish next period from the loss of one fish this period will be f' . Thus, the club would allow fishing until the marginal value of leaving a fish to next year (taking account of its marginal effect on species population and next period’s expected price net of the marginal cost of fishing effort) just compensates for the forgone revenue (net of marginal cost of fishing effort) from not exploiting the fish this year *plus* an appropriate risk adjusted return on that marginal “investment” in extra fish. Since this will in general require:

$$p_t - \frac{\partial C_t}{\partial q_t} - (m_t - 1) \frac{\partial C_t}{\partial Q_t^*} > 0 \quad (\text{EQ 2.19})$$

the level of fishing enforced by the club would be *even lower* than when the dynamic effects were ignored. Similarly, equations (2.19) and (2.16) imply:

$$p_t q_t - C[(m_t - 1)q_t, q_t] - m_t q_t \frac{\partial C_t}{\partial Q_t^*} > 0. \quad (\text{EQ 2.20})$$

Comparing (2.20) with (2.5), we can also see that the profits earned by each club member would also be higher than in the static model. *Optimal* restrictions on the size of the catch aimed at increasing the future fish stock ought therefore to be supported by the club members. Profit and optimal conservation are compatible goals when firms reap all the rewards from preventing over-exploitation. Put differently, *if property rights to fish are secure*, any restrictions opposed by the licence owners because they reduce the total value of licences are *prima facie too severe*.

Firms without enforceable property rights would behave myopically and increase their catch each period until:

$$p_t = \frac{\partial C_t}{\partial q_t} \quad (\text{EQ 2.21})$$

and entry will again occur until:

$$p_t = \frac{C[N_t(m-1)q_t q_t]}{q_t} \quad (\text{EQ 2.22})$$

in each period t . Comparing (2.21) and (2.22) with (2.15) and (2.16) on the one hand and (2.4) and (2.6) on the other, we can see that over-fishing would occur both as a result of the lack of concern for the costs imposed on others today but also as a result of the dynamic distortion arising from the lack of concern for the effect of fishing today on the future stock of fish.

To solve the model for the *optimal* level of harvesting at t , we need to know the solution at $t+1$. Similarly, the solution at $t+1$ depends on what is best done at $t+2$ and so on. To “centrally plan” the optimal harvest at time t , therefore, we need to know the entire future path of expected prices of fish and costs of fishing. This is a very difficult problem to solve.

The club solution would instead involve issuance of enforceable licences to fish. The club of licence owners would then attempt to control fishing today, and signal future controls, so as to maximise the market value of the licences at time t and ensure that an investment in licences earned a competitive rate of return with other investments of comparable risk.

Of course, actual or prospective licensees also would have to forecast future prices, fishing costs and fish population levels in order to price licences. Market prices for licences would, however, reflect an *amalgam* of information from numerous individuals, many of whom would be very familiar with the current state of the fish stock, and each of whom has personal wealth at stake when acting on judgments. By comparison, a government official would make decisions based upon aggregated and much less complete information, and would be making decisions that have little or no effect on his or her personal income or wealth.

The efficient solution also can be contrasted with the *Maximum Sustainable Yield* (MSY) that is currently used to set TAC in the New Zealand QMS. The MSY is the maximum tonnage of fish that can be taken each year while leaving the surviving fish population unchanged. Mathematically, from equation (2.14), the population will be “sustainable” at a level N where the annual fixed harvest Q solves:

$$N = f(N - Q). \quad (\text{EQ 2.23})$$

In general, equation (2.23) will not have a unique solution for N as a function of Q . For any fixed level of harvesting Q there may be one or more corresponding constant population levels $N(Q)$. An implication is that there

are many “sustainable” population levels for the fish stock. The notion of “sustainability” is simply not sufficient to determine an “optimal” level of harvesting for the species. This is just one reason we prefer to emphasise the objective of efficient resource use rather than “sustainability”.

Of all the potentially sustainable population levels, the MSY one chooses N , and therefore the associated $Q(N)$, to maximise $Q(N)$. Differentiating (2.23) with respect to N , we find:

$$\frac{\partial Q}{\partial N} = 1 - \frac{1}{f'(N-Q)}. \tag{EQ 2.24}$$

The harvest level $Q(N)$ will then be maximised where Q and N solve:

$$f'(N-Q) = 1 \text{ and } N = f(N-Q). \tag{EQ 2.25}$$

Let the solutions to (2.25) be \bar{N} and \bar{Q} . The MSY policy then either taxes fishing, imposes fines for violations of fishing regulations, issues quota or uses some other method to ensure that the total harvest in period t is:

$$m_t q_t = \bar{Q}. \tag{EQ 2.26}$$

For concreteness, let us suppose the MSY harvesting level is achieved by issuing ITQ, and let the market price of quota per hundred thousand metric tonnes of fish be θ_t . The equilibrium number of fishing firms m_t , the catch per firm q_t and the quota price θ_t would then be determined from (2.26):

$$p_t - \theta_t = \frac{\partial C_t}{\partial q_t}, \tag{EQ 2.27}$$

and

$$p_t - \theta_t = \frac{C[N_t, (m-1)q_t, q_t]}{q_t}. \tag{EQ 2.28}$$

The actual fish population will change according to:

$$N_{t+1} = f(N_t - \bar{Q}). \tag{EQ 2.29}$$

Logistic population dynamics

It might be useful to illustrate the dynamics of the fish population under different cases using some simple diagrams. We shall only consider the logistic case for population growth (which is often used by biologists to model natural population growth):

$$f(z) = z[1 + a(z^* - z)]. \quad (\text{EQ 2.30})$$

Suppose units are defined (for example, hundreds of thousands of metric tonnes of biomass⁷¹ of the species) such that the logistic curve can be written:

$$f(z) = z[1.0 + 0.95(1.0 - z)] = z + 0.95(z - z^2). \quad (\text{EQ 2.31})$$

The population would then be unchanging (or “sustainable”) when:

$$N = N + 0.95(N - N^2) \quad (\text{EQ 2.32})$$

that is

$$N(1 - N) = 0 \quad (\text{EQ 2.33})$$

so that $N = 0$ or $N = 1$. When there is no fishing, the dynamic evolution of the natural population can be represented in Figure 2.6.

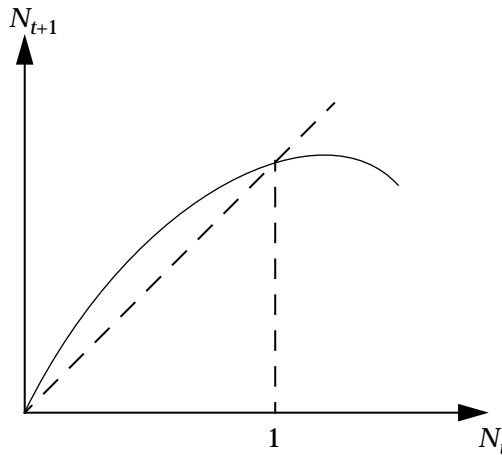


FIGURE 2.6: Natural dynamics of the fish population

A fixed amount of fishing each period would reduce the breeding stock available to recruit next period’s population. The result, illustrated in Figure 2.7, would be a lower steady state for the population:

$$N^* = (N^* - Q)[1.0 + 0.95(1.0 - N^* + Q)] < 1. \quad (\text{EQ 2.34})$$

⁷¹ In practice, we would also need to characterise the age composition of the fish population. Only fish beyond a certain age could breed, while fish weight and size, and therefore market value, would also depend on the age of the fish. Fishing would alter the age distribution of the population in addition to the total biomass.

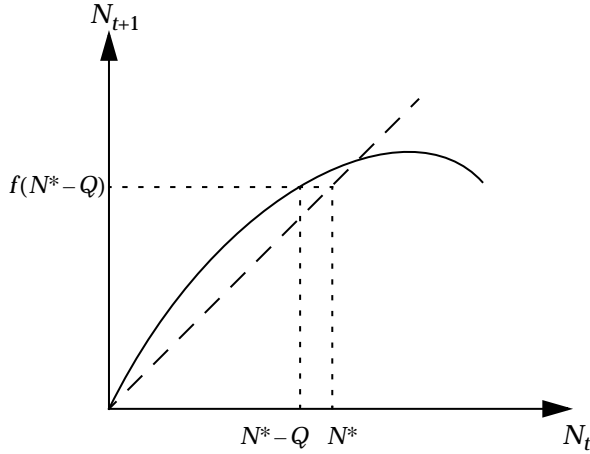


FIGURE 2.7: Fish population dynamics with a harvest of Q

From Figure 2.7, we can identify the harvest size $Q(N^*)$ corresponding to a sustainable population N^* as the horizontal difference between the population growth curve and the 45° line. This horizontal difference is at a maximum, yielding the sustainable population under the MSY policy, where the population growth curve is parallel to the 45° line. As noted in equation (2.25), the MSY policy chooses a fixed annual harvest to ensure both that the population is unchanging and also that the slope of the population growth equation is 1 at the sustainable level. The MSY level of harvesting in this case is illustrated in Figure 2.8.

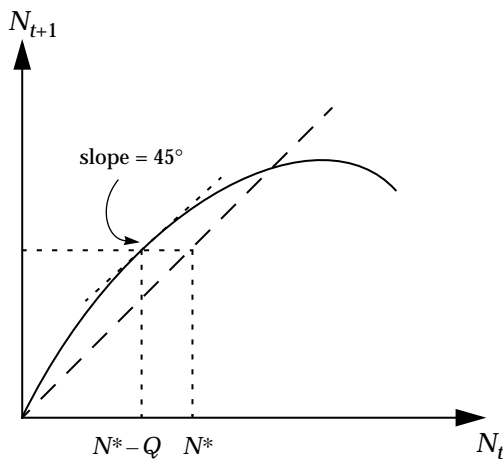


FIGURE 2.8: Fish population dynamics with MSY harvesting

If the harvest is larger than MSY there will be no sustainable population level that can support it. The population will continually decline until the harvesting necessarily diminishes or the species becomes extinct. Even under “modest harvesting”, the population becomes more vulnerable in the sense that a negative shock (for example, an epidemic) may result in extinction unless harvest size is reduced.

The possibility of extinction is, however, lower in a competitive market for fish than the analysis of a model with fixed harvesting would suggest. In a competitive market, the quantity of fish harvested each period will be determined from the marginal cost curve for an individual firm and the price of fish – as illustrated in Figure 2.9. As the total quantity of fish harvested increases (or the fish population decreases), the marginal cost curve for an individual firm will shift up and the fish catch each period will decline.

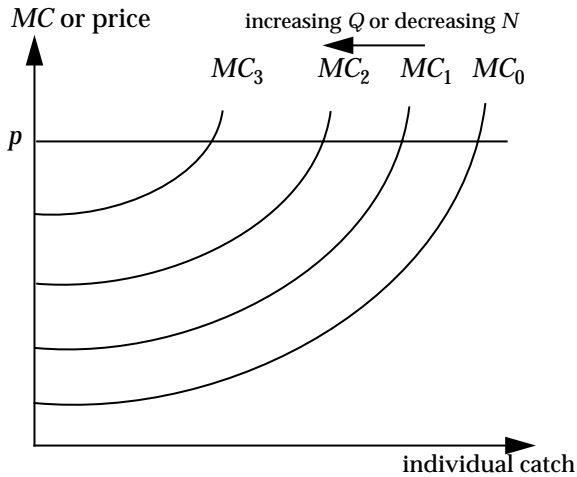


FIGURE 2.9: The effect of increasing costs on individual catch

Since the efficient solution effectively imposes fees on individual firms to reduce their level of fishing, the population dynamics under the efficient solution will lie “between” the dynamics associated with uncontrolled market harvesting and the natural population dynamics. In particular, extinction of the species is even less likely under the efficient harvesting regime than it is under uncontrolled market exploitation.

Numerical example extended to incorporate dynamics

We provide a numerical example for the dynamic model using the quadratic cost function and the logistic model of population growth for the fish stock:

$$N_{t+1} = (N_t - m_t q_t) [1.0 + 0.95(1.0 - N_t + m_t q_t)]. \quad (\text{EQ 2.35})$$

We first need to modify the cost function to allow changes in the population of fish to affect harvesting costs. We shall assume fishing costs are given by:

$$C(N_t, Q_t^*, q_t) = \frac{0.2q_t + 10q_t^2 + 0.1q_t Q_t^* + 0.01Q_t^{*2} + 0.1Q_t^{*2}}{N_t} \quad (\text{EQ 2.36})$$

so costs are as used above when the fish biomass is one hundred thousand metric tonnes ($N=1$) but fishing costs increase without bound (so fish become *impossible* to get) as N tends to zero.

We now take the price of fish to be 1 in the current *and all future* periods. We also assume that the relevant (real) discount rate is $r = 5\%$. Making all the substitutions into the necessary conditions for a maximising path of harvesting, equations (2.15) and (2.16), and the population dynamics equation (2.35), we obtain three sets of equations to solve for sequences $\{m_t, q_t, N_t\}$:

$$1.05 \left[1 - \frac{0.19 + 20q_t - 0.2m_t q_t + 0.01m_t + 0.2m_t^2 q_t}{N_t} \right] = \quad (\text{EQ 2.37})$$

$$\left[1.95 - 1.9(N_t - m_t q_t) \right] \left\{ 1 - \frac{0.19 + 20q_{t+1} - 0.2m_{t+1} q_{t+1} + 0.01m_{t+1} + 0.2m_{t+1}^2 q_{t+1}}{N_{t+1}} \right. \\ \left. + m_{t+1} q_{t+1} \frac{0.19 + 10q_{t+1} - 0.1m_{t+1} q_{t+1} + 0.01m_{t+1} + 0.1m_{t+1}^2 q_{t+1}}{N_{t+1}^2} \right\}$$

$$10q_t - 0.01m_t - 0.1m_t^2 q_t = 0 \quad (\text{EQ 2.38})$$

and

$$N_{t+1} = (N_t - m_t q_t) (1.95 - 0.95N_t + 0.95m_t q_t). \quad (\text{EQ 2.39})$$

A stationary solution to these equations – that is, a solution where $\{m, q, N\}$ are constant from one period to the next – can be found by dropping the time subscripts and solving for the three variables. In this particular case, we find just one solution $N \cong 0.9489$, $m \cong 7.8059$, $q \cong 0.0200$ and $Q \cong 0.1560$. A lower interest rate r increases the stationary N .

Equations (2.37), (2.38) and (2.39) can be used to numerically approximate the derivatives of the stationary solutions for N_{t+1} , m_t and q_t around the steady state. We find:

$$\frac{\partial N_{t+1}}{\partial N_t} \cong 0.32, \quad \frac{\partial m_t}{\partial N_t} \cong 2.67 \quad \text{and} \quad \frac{\partial q_t}{\partial N_t} \cong 0.028. \quad (\text{EQ 2.40})$$

In particular, since $\partial N_{t+1}/\partial N_t < 1$, the stationary state will be locally stable. That is, small perturbations of the population N away from that stationary value will tend to return the system to the stationary state. The signs of the other two derivatives imply that as the fish population decreases the optimal harvest also decreases. Changes in optimal harvesting decisions therefore contribute to fish population stability.

An uncontrolled market in this case would result in a set of equations

$$20q_t + 0.1(m_t - 1)q_t + 0.2 = N_t \quad (\text{EQ 2.41})$$

$$0.2q_t + 10q_t^2 + 0.1(m_t - 1)q_t^2 + 0.01(m_t - 1)q_t + 0.1[(m_t - 1)q_t]^2 = q_t N_t \quad (\text{EQ 2.42})$$

and

$$N_{t+1} = (N_t - m_t q_t)[1.0 + 0.95(1.0 - N_t + m_t q_t)] \quad (\text{EQ 2.43})$$

to be solved for m_t , q_t and N_{t+1} for a given value of N_t .

In a stationary equilibrium, we now obtain three equations to solve for m , q and N . In the current case, these three equations have a solution $m \cong 9.241835$, $q \cong 0.025698$ and $N \cong 0.735135$. Comparing the uncontrolled and the efficient policy we can see that the excessive fishing that takes place in the absence of controls mainly involves an excess of about 20% in the number of firms with each firm catching nearly 30% too many fish (comparing the steady states alone).

The maximum sustainable yield (MSY) policy would set the total fishing harvest to satisfy equations (2.25), which in this case become:

$$\bar{N} = (\bar{N} - \bar{Q})[1.0 + 0.95(1.0 - \bar{N} + \bar{Q})] \quad (\text{EQ 2.44})$$

and

$$f'(\bar{N} - \bar{Q}) = 1.95 - 1.90(\bar{N} - \bar{Q}) = 1. \quad (\text{EQ 2.45})$$

The solutions to (2.44) and (2.45) are $\bar{N} = 0.7375$ and $\bar{Q} = 0.2375$. Under the quota approach to ensuring the MSY level is attained, the equilibrium number of fishing firms m_t , the catch per firm q_t , the quota price θ_t and the population next period N_{t+1} would in this case be determined by:

$$m_t q_t = \bar{Q} = 0.2375 \quad (\text{EQ 2.46})$$

$$20q_t + 0.1(m_t - 1)q_t + 0.2 = (1 - \theta_t)N_t \tag{EQ 2.47}$$

$$\frac{0.2q_t + 10q_t^2 + 0.1(m_t - 1)q_t^2 + 0.01(m_t - 1)q_t + 0.1[(m_t - 1)q_t]^2}{(1 - \theta_t)q_t N_t} = 1 \tag{EQ 2.48}$$

and

$$N_{t+1} = (N_t - 0.2375)[1.0 + 0.95(1.2375 - N_t)]. \tag{EQ 2.49}$$

In a stationary state, of course, N will equal the MSY level $\bar{N} = 0.7375$ and we can solve (2.46), (2.48) and (2.48) for $m \cong 9.241865$, $q \cong 0.025698$ and $\theta \cong 0.003192$. For the particular parameter values we have chosen, the stationary state under an MSY policy is actually very close to the uncontrolled steady state (the total catch in the latter is slightly lower at 0.237494). There are slightly fewer firms in the uncontrolled market equilibrium than in the MSY equilibrium, but each of them catch more fish with the result that the total catch is almost identical in the two cases. Since the two steady states are close to each other, the price of quota in the stationary state under the MSY policy is quite small (about 0.3% of the price of fish).

Compared with the efficient stationary state where $N \cong 0.9489$, $m \cong 7.8059$, $q \cong 0.0200$ and $Q \cong 0.1560$, the MSY policy, like the uncontrolled equilibrium, involves too many firms each catching too many fish with a resulting fish population that is too small.

The outcomes under the three stationary states are summarised in Table 2.2.

TABLE 2.2: Dynamic model stationary states

	<i>Uncontrolled stationary state</i>	<i>MSY policy stationary state</i>	<i>Stable optimal stationary state</i>
<i>Number of firms</i>	9.241835	9.241865	7.805918
<i>Per firm catch</i>	2,570 m. tonnes	2,570 m. tonnes	1,998 m. tonnes
<i>Total catch</i>	23,749 m. tonnes	23,750 m. tonnes	15,597 m. tonnes
<i>Fish biomass</i>	73,514 m. tonnes	73, 750 m. tonnes	94,893 m. tonnes

3. GOALS OF CONSERVATION POLICY IN NEW ZEALAND

DEFINITION OF CONSERVATION IN THE ACT

The *Conservation Act* 1987 defines the functions of the Department of Conservation to be, among other things:

to manage for conservation purposes, all land, and all other natural and historic resources, for the time being held under this Act, and all other land and natural and historic resources whose owner agrees with the Minister that they should be managed by the Department

and it defines “conservation” to mean:

the preservation and protection of natural and historic resources for the purpose of maintaining their intrinsic values, providing for their appreciation and recreational enjoyment by the public, and safeguarding the options of future generations.

This raises the question as to what the “intrinsic value” of a natural resource is.¹ There is a related issue of the “intrinsic value” of historic resources, but the following discussion will focus on nature conservation.

WHAT IS INTRINSIC VALUE?

The word “intrinsic” generally refers to a property that is necessary for some thing to exist. For example, an intrinsic property of a square is that it have four sides. If we consider a shape that does not have four sides, that shape lacks an intrinsic or necessary property of being a square and cannot be one.

The word “value” generally refers to the appreciation, enjoyment or benefit accruing to some sentient being from some thing or event. For example, we value an ice cream because it gives us pleasure and provides nourishment. We value an inoculation because it prevents us catching diseases. We value a Ming vase because it is beautiful, provides cocktail party conversation and signifies our membership in an elite group.

A dog can value a long howl. A bird can value a worm for lunch. It seems inappropriate to say, however, that a mountain can value a sunny day, or a protozoan can value a warm pond. It order for the word “value” to have

¹ There is a burgeoning literature on this topic. A previous treatment by Tasman Institute can be found in Richardson (1993).

anything resembling its ordinary meaning, it must refer to a benefit accruing to a sentient being.

When we join these two words in the expression “intrinsic value”, a serious problem arises. First, if a property is intrinsic to a thing, then that property cannot depend upon anything external to the thing itself. For example, the intrinsic property of “four-sidedness” that attaches to squares does not depend upon anyone observing the four sides, liking the four sides or anything else. “Value”, on the other hand, is an observer-dependent term. Nothing has value which is not observed or connected to some sentient being. Thus, the term “intrinsic value” is internally contradictory, since the notion of “value” is itself “extrinsic” or dependent upon the existence of something outside any given object, namely, a beneficiary of the object. Thus, when examined closely, “intrinsic value” is about as useful an expression as “married bachelor” or “round square”.

Although the term “intrinsic value” appears of dubious merit, perhaps its meaning goes beyond the meaning of the two words of which it is composed. For the expression appears to refer to some ineffable quality inhering in all natural things, whether anyone perceives them or not. Perhaps what is meant is “intrinsic goodness” or “intrinsic beauty”. Certainly many philosophers such as Plato believed in the existence of intrinsic goodness which did not require, and indeed was beyond the reach of, human perceptions.

The phrase “intrinsic value” appears to be used by conservationists to mean that there is some value to conserving natural resources that is over and above any value attached to that act by any human or set of humans. Thus, even if we could take account of all the instrumental reasons for conserving nature (that is, all the ways that conservation is some means to some other human ends) and all the direct benefits natural environments provide to people (as an end in itself, analogous to sensations, pleasures, psychological states or the perceived benefits of religious practices), there are still other values that are unaccounted for.

Whether these other purported values would justify additional resources being devoted to conservation is an issue we shall return to below. First, however, we want to try to understand what these other values might be.

Animal rights and intrinsic value

A possible line of argument might go as follows. Just as a person values his or her own life beyond its instrumental value to other people, so might other

sentient beings value their lives beyond their instrumental value to other sentient beings.

Most decent people would say that just because a person has no instrumental value to anyone else that is no justification for ending his or her life. For example, an accident might eliminate all members of an individual's family and leave that person in a situation where he or she is of value or use to no other particular living person. Yet that is no reason to end his or her life.

It would also seem to be unreasonable to require the object of such moral standing to be able to reciprocate the sentiment or, more generally, to participate in moral discourse. For example, most people would say that the lives of children have value, and adults have obligations toward them, even though children cannot participate in moral discourse or reciprocate the obligations.

This seems to be the argument underlying the so-called "animal rights" movement. Other sentient beings that have preferences should be accorded some moral status. The efficiency criterion should be extended to other sentient beings. It is wrong, according to this thesis, not to take advantage of a situation where resources could be reallocated to make one sentient being better off without making any other sentient being worse off. The Pareto criterion need not be restricted to people alone.²

Most animal rights supporters would also be willing to rank the interests of sentient beings when pure Pareto improvements were not possible. In particular, when the interests of a human and another animal come into conflict, most animal rights supporters would agree that human interests ought in some sense to take precedence. They would, however, also reject the notion that human welfare, no matter how trivial, should take precedence over animal suffering no matter how great. Wanton destruction, or unnecessary torture, of other sentient beings is reprehensible.

There are, of course, objections to the animal rights position. For example, in correspondence with us, Brendan Moyle has pointed out that:

Individual animals do not always act as if the preservation of their life was the most important thing. The risks animals take during courtship and raising offspring are evidence of this. Many male spiders give up eating when they reach sexual maturation and for many other species, egg laying is a death sentence for a female spider.

² The Pareto criterion was discussed more extensively in chapter 2.

Also, a social contract theorist³ might argue that the basis of respect for human life is that we want others to respect our lives. There is an implicit contract between us. We could also include children within this contract on the grounds that we would have wanted to have been included in it when we were children.

For our present purposes, however, we need not debate the merits of the animal rights position. It will not do as a justification for the conservation of intrinsic value of nature in New Zealand.

To begin with, many of the conservation problems in New Zealand relate to introduced feral mammals – possums, rabbits, stoats, ferrets, weasels, rats, cats, deer, horses and so on. All these animals are sentient beings. The Department of Conservation wants to eliminate them, however, in order to preserve native plants in many cases, and in some cases native birds, lizards, frogs and insects which would rank lower down the “sentience scale” for most animal rights advocates.

There is a second, more general, problem with using animal rights as a justification for endowing non-human beings with intrinsic value. This approach would appear to endow *individual animals* with rights when in some cases, such as when populations are culled in order to promote population stability, conservation action appears to call for the sacrifice of individual animals for “the good of the species”.

Intrinsic value as enduring value

Another interpretation for the phrase “intrinsic value”, as it is used by environmentalists, is suggested by the following sentence in the entry on art museums in the Grolier encyclopedia:

In dealing with contemporary art, they [museum curators] must establish value judgments based upon a work’s intrinsic merit and interest, regardless of the promotional attention it may be attracting at the time.

The “intrinsic merit and interest” in an art work often may *not* be reflected in its current market price. It may be indicated, however, by the willingness of people to expend real resources in order to save it for a time when its true worth will be recognised. Thus, the successful curator needs to look beyond what people are currently willing to exchange for the work because current valuations can be misguided. There are, for example, many artists (perhaps Van Gogh being the most famous) whose works did not have a high sales

³ Social contract theory was also briefly discussed in chapter 2.

price soon after they were created but later came to have quite high market values.⁴

The successful curator needs to be like the successful speculator. A speculator may believe that inside knowledge or superior information indicates that the current price of a marketable asset or commodity is quite out of line with its likely future value. A speculator who considers the current market price is too low can buy the item and hold it in the expectation of making a capital gain. If the current price is thought to be too high, the object often can be sold short. The speculator enters into an agreement to supply the object at a future date for a price that reflects the current high market price and not the low market price the speculator expects to prevail when the object has to be purchased to fulfil the sale agreement. The speculator, like the curator, is representing the interests of future generations in today's markets. Unlike many curators, however, the speculator often gambles on future values using his or her own money and there is nothing like having one's own future welfare at stake to make one think seriously about the evidence.

Some environmentalists have argued that market speculation on future values of resources is unlikely to give a satisfactory outcome because markets will discount future values too heavily.⁵ Even if resources have no known "use value" at present, there will be an *option value* of preserving

⁴ Economists point out that after the artist has died the market can no longer be flooded with a supply of similar works, so it is not surprising value does not increase until then.

⁵ The Ministry for the Environment (1995a) claims that "Future generations are not 'traders' in the market, yet many consider that they should have fair access to resources". This argument completely ignores the role of speculators or other individuals who are motivated to save for their own private reasons. The statement by the Ministry for the Environment continues "The ability [of future generations] to meet their own needs should not be compromised by decisions taken today". Similarly, the Ministry of Fisheries (1996) claims that "intergenerational equity" requires that resource use should not "jeopardise the prospects of future generations". These statements are far too strong. Surely, the relevant criterion is the *welfare* of future generations relative to the *welfare* of the present generation. Using resources in an irreversible way today that nevertheless raises the welfare of present *and* future generations should surely be regarded as an unambiguous good. For example, using sand to make optical fibres "jeopardises the prospects of future generations" to use all the sand we and they otherwise would have had access to, but surely no-one would argue that forgoing the benefits of optical fibres is a sensible policy now or in the future.

natural resources for potential future uses that may be unforeseen. It is asserted that all such future values will be heavily discounted by the market. We need government intervention to ensure that the interests of future generations are adequately represented in today's resource allocation decisions.

This claim denies several empirical regularities in the outcomes of market and political processes. First, recent fiscal history makes one very sceptical that governments will be far-sighted and pay particular attention to the interests of future generations. Once they were relieved of the implicit rule that they should balance budgets except in time of war, most democratically elected governments ran budget deficits almost all the time. The consequent accumulation of government debt represents a burden on future generations who will be taxed to pay interest and retire debt.

Second, governments elected by majorities tend to ignore minority views and opinions. They tend toward a "one size fits all" mode of service. The much higher costs of monitoring employees in the public sector may also contribute to this tendency.⁶ Whatever its cause, however, markets always seem to give consumers more choice. Thus, in a market situation, a lone speculator with an extreme view about the future value of a resource can act on that view without requiring the consent of anyone else. The asset can be bought and conserved for the future in the hope of making a gain for one's heirs if not for oneself. In a majority voting system, a person with an extreme view is likely to be dismissed as irrelevant.

Third, we argued in chapter 2 that the high cost of information in the political arena systematically biases policies in certain directions. There is a tendency to focus on intentions rather than outcomes, on the short-term and immediate consequences of a policy rather than the longer-term and remote ones, and to pander to vested interests at the expense of wider community concerns. All of these tendencies work against politics being an ideal mechanism to look after the interests of future generations.

Fourth, decentralised market activity has been extraordinarily successful at saving massive amounts of art (and many other cultural artefacts) over very long periods of time. The examples of wildlife in Zimbabwe and the

⁶ Again the reader is referred to chapter 2, including appendix 2 to that chapter, for further discussion of the differences between public and private firms in relation to managerial costs and practices. Employees who are more costly to monitor can, other things equal, indulge their own preferences to a greater extent. One way of countering this problem is to reduce employee discretion by having them undertake only narrowly defined and clearly specified tasks.

New Zealand fishing industry presented in the previous chapter also show that *when property rights have been defined and allocated* markets will similarly preserve valued animals for future generations.

While we believe there is very little evidence that governments are more far-sighted than individuals, we admit that markets may nevertheless discount the future value of wildlife. The difficulty is not *discounting per se* but rather the undervaluation of wildlife *now as well as in the future*. The basic problem is the absence of property rights to wildlife. An unowned resource is without market value. Private individuals will therefore have an inadequate incentive to preserve it. Focusing on rates of time discounting is the wrong diagnosis of the problem.⁷

Most importantly, however, the outcome of this debate is not particularly germane to the issue of understanding what “intrinsic values” might be. Whether or not government action is needed to “safeguard the options of future generations”, this reason for conserving natural resources appears as additional to “maintaining their intrinsic values” in the *Conservation Act*. Anticipated future market values are still not intrinsic in the sense that they are a property of the resources themselves as opposed to something perceived from the outside. They are not over and above any value attached to resources by any human or set of humans now or in the future.

Intrinsic value in art

Again we might look to aesthetics for another possible interpretation of “intrinsic value”. The quote above also allows for the possibility that curators ought to be able to act even if they do not believe their “value judgments based upon a work’s intrinsic merit and interest” will ever be vindicated in the future. We could imagine a curator having a theory, for example, that certain symmetries, patterns of colour, arrangements of shapes, or patterns of brush strokes give a work “intrinsic merit or interest”. The curator exercises a value judgment and selects works representing these desired characteristics regardless of any judgment about the work’s likely future market value.

⁷ The intuition that discounting is part of the problem might be explained by the analysis of the “over-fishing” problem in appendix 3 to chapter 2. We showed there that the absence of property rights to a harvested species will tend to distort intertemporal resource allocation. An inappropriate attitude to future versus current use of resources may therefore appear to be the source of a problem that is in fact caused by a lack of property rights.

We leave to one side for the moment the question as to whether such a theory *should* underlie *public* expenditure on acquiring works of art when there is no expectation that the theory will accurately predict future market values. We first want to discuss whether there might be analogous criteria for judging “intrinsic value” in nature regardless of the current or anticipated future values for actual human beings.

The two examples of this type of criterion that we have seen in the conservation literature are *biodiversity* and *ecological end states*. For example, the *Resource Management Act 1991* defines “intrinsic values, in relation to ecosystems” as:

those aspects of ecosystems and their constituent parts which have value in their own right, including –

- (a) Their biological and genetic diversity; and
- (b) The essential characteristics that determine an ecosystem’s integrity, form, functioning, and resilience.

We shall first discuss what is meant by the terms “biodiversity” or “essential characteristics that determine an ecosystem’s integrity, form, functioning, and resilience” before we consider whether such characteristics might justify public expenditure on conservation activity.

Biodiversity and intrinsic value

Biodiversity is short for *biological diversity*. It is a multi-dimensional concept. Ian Atkinson (1996) argues that central to the concept is *species diversity* – the number of plants and animals that can be found in a given area. At a more disaggregated level, one can recognise *population diversity* where a given species might be composed of a number of geographically separated populations. Often these populations will have a distinct genetic make-up since the conditions favourable to their survival could have varied slightly from region to region and thus applied a different set of selective pressures. Regional differences in species might be *behavioural* as well as, or instead of, *genetic*. Thus, attempts to preserve diversity at this level might require behavioural characteristics as well as genetic characteristics to be measured.

At a more aggregated level than species, one can also recognise different *communities* of species that are adapted to surviving together. Each species will usually have a particular geographical range. These ranges for each species will not necessarily be coterminous. The factors that are critical for the survival of one species might differ from the critical factors for another species, and could even vary throughout a species’ range. As a result, the collections of species that tend to be found together will change as one moves

from one region to another. These varying communities are themselves part of the diversity of life forms that can be found on the face of the earth.

At a still more aggregated level, one could recognise groups of communities that tend to be associated with particular types of landforms – for example, climatic regions, elevations, soil types, geological formations and so on. These community groups are another aspect of the diversity of life forms.

When explaining why biodiversity may be an appropriate goal for conservation policy, many of the authors represented in McFadgen and Simpson (1996) simply cite the fact that the New Zealand government ratified the Convention on Biological Diversity that arose from the 1992 “Earth Summit” in Rio de Janeiro. This may be a good bureaucratic reason for focusing on biodiversity as a goal, and attempting to overcome the practical problems of using it as such, but it is of little help in suggesting why it is an *appropriate* goal in a deeper sense.

A DOC Fact Sheet (*A Biodiversity Strategy for New Zealand* in Department of Conservation, 1996a) attempts to answer the more basic question. Under the heading “why is biodiversity important” it states:

Biodiversity ... provides us with fresh air, clean water and fertile soil and is the basis of the interconnected web of life on earth. Biodiversity is essential for the survival of all species, including people. It is the source of our foods, medicines and industrial raw materials. Our economic prosperity is dependent on it, from agriculture to tourism ... Sustaining and protecting New Zealand’s biodiversity is an essential part of an overall global strategy for survival.

Some of these claims about the value of biodiversity are at least debateable – a point we shall take up later in this chapter. For the present purpose of trying to understand what might be meant by the phrase “intrinsic value of nature”, however, the claims are not relevant. They are all claims about the *instrumental* value of biodiversity. Biodiversity is important because it is a *means* of achieving other ends that are important to people.

The Fact Sheet also argues that biodiversity is important because “it will enable us to pass on the options we have to future generations”. This is the issue we discussed above. As we noted there, anticipated future values are still not intrinsic in the sense that they are a property of the resources themselves as opposed to something perceived from the outside. They are not over and above any value attached to resources by any human or set of humans.

Finally, the Fact Sheet claims that “biodiversity shapes our cultural identity and inspires our spirituality”. Some philosophers have likened the

psychological or emotional benefits people obtain from nature to religious experiences.⁸ Others have related them to the aesthetic pleasures obtained from art or music. People who have their “cultural identity” or “spirituality” shaped or inspired by biodiversity will value it. People value many other goods or services, including art, music and religious practices but also food, clothing, entertainment, sporting events and even gambling, for all sorts of psychological or other reasons. Most of the goods or services people buy in markets, or provide for themselves or others through non-market activity, provide utility, or individual well-being, for many reasons. For these goods and services to have an objectively measurable market value we do not have to know anything about the psychological or other subjective motivations of those who value them.

In terms of the goals of DOC as specified in its Act, valuing biodiversity because it “shapes our cultural identity and inspires our spirituality” can thus be seen as “protection of natural ... resources for the purpose of providing for their appreciation and recreational enjoyment by the public”. These are not “intrinsic values” that are properties of the goods or services themselves. Rather, they are values attached to these goods or services by humans.

The claim that biodiversity measures an intrinsic value of nature must amount to a claim that, in principle,⁹ biodiversity measures a value over and above any value attached to biological resources by any human or set of humans – that biodiversity has a value in its own right and not because it is useful to people or even because they enjoy it or are inspired by it.

⁸ It is quite interesting to think about religion in this context. The “products” that religious institutions are “selling” are more intangible than many of the services provided by conservation activity. Many of the benefits provided by religion – such as promoting concern for others and promulgating widely shared moral standards – along with many of the costs – such as sanctioning intolerance, violence and wars – are also diffuse and joint. Yet it would be hard to argue that religious organisations have not competed successfully for resources in the roughly 5,000 years of commercial civilization. People who value conservation might also contemplate why many of the deeply religious early English, Dutch and German immigrants to the United States believed in the separation of church and state.

⁹ In practice, measurement will not be easy, not least because we have a number of different notions of biodiversity – depending on whether one is concerned with genes, populations, species, or communities. These issues are further examined below in the context of discussing biodiversity as a measure of the non-instrumental value of nature for some people.

Particular ecological states and intrinsic value

The aim in “restoration ecology”, or “ecosystem management”, is to deliberately alter an ecosystem, or community of organisms, to resemble some prior or “ideal” condition as closely as is practically possible. For example, the goal in New Zealand might be to modify an ecosystem until it resembles as closely as possible an ecosystem that might have been present before the arrival of Europeans, or even before the arrival of any people.

The claim is that such an ecosystem has an intrinsic value. A particular mix of tree species, and distribution of tree ages, with an associated mix of bushes, birds and other animals and so on has value *in and of itself*. A particular condition of a forest, for example, becomes the primary objective of conservation management (Sedjo, 1995). Recreational opportunities, timber, species preservation, clean water and other products instrumentally valuable, or directly valuable as consumption goods, to humans are:

merely by-products of managing forests to achieve one of many possible forest conditions. Production of these other outputs is tolerable as long as it does not conflict with the primary objective of achieving one of these conditions ... the perspective of ecosystem management [or restoration ecology] is almost purely biological, with no serious attention given to social values and little real attempt made to relate forest outputs to human and social needs and desires. (Sedjo, 1995, pp 18–19).

Using the language of the *Conservation Act*, restoration ecology involves a use of natural resources “for the purpose of maintaining their intrinsic values”.

ATTEMPTING TO IMPLEMENT AN INTRINSIC VALUE CONSERVATION ETHIC

We thus have arrived at two interpretations of what might be meant by the phrase “intrinsic value of nature” akin to the properties of a work of art that might give it “intrinsic merit or interest”. It could be some composite measure of the biodiversity of genes, populations, species, or communities of species. Alternatively, it might be a set of specified states for designated ecological communities rather than any of the myriad of alternative possible states that these communities could be in. No doubt there are other possible interpretations of “the intrinsic value of nature”. In all cases, however, the distinctive feature of an “intrinsic value” is that it *cannot* be a value held by any human being for any purpose – otherwise it is simply a value and not an “intrinsic” value.

Thus, natural resources may be conserved in order to provide a number of *instrumental* services that are not valued in themselves, but rather as

means to other ends that do have direct value – the incidental services provided by naturally functioning ecosystems like the claimed services of “fresh air, clean water and fertile soil and ... foods, medicines and industrial raw materials” mentioned by DOC in the quote above. Next, conservation has a direct, or *non-instrumental*, value to people as a consumption good in its own right. People value the opportunity to wonder at, think about, be inspired by, walk in, look at, listen to, smell, touch and perhaps taste plants, forests, swamps, animals, streams, mountains, other geological features and so on. These direct consumption services are analogous to comparable services provided by other goods or services that people value as direct consumption items. Then it is claimed that *over and above* all these benefits *to people* there is an additional *intrinsic value* of natural resources.¹⁰ The assertion that such additional intrinsic values exist is used by conservationists to justify *forcing* people to allocate resources to conservation beyond what they would voluntarily contribute even if they were not “free riding” on joint benefits as discussed in chapter 2.

Suppose for argument’s sake that we agree that there are intrinsic values of nature such as biodiversity or particular ecological states. It does not follow, however, that such intrinsic values would justify allocating additional, or indeed any, resources to conservation. They cannot since resource allocations are decisions made *by people* and can *only* be based on *what people value*.

Intrinsic values cannot be part of the value of a resource to any individual, since if they were, the values would no longer be “intrinsic”. They would just be reasons why the individual concerned places whatever value he or she does on particular natural resources, or states of nature.

Also, any political decision-making mechanism can only be a way of expressing the preferences of individuals for alternative uses that can be made of the coercive power of the state. As we argued in chapter 2, there are ways of using the state’s monopoly on coercion to improve the welfare of the

¹⁰ It is interesting in this regard to contrast the *Conservation Act* in New Zealand with the *Endangered Species Act 1973* (ESA) in the United States. In Section One of the ESA, the Act states that:

The Congress finds and declares that various species of fish, wildlife, and plants in the United States have been rendered extinct ... other species of fish, wildlife, and plants ... are in danger of or threatened with extinction ... these species of fish, wildlife, and plants are of aesthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people ...

The values of fish, wildlife, and plants specified in this Act would all appear to be either instrumental or non-instrumental values *to people*.

citizens who (implicitly or explicitly) consent to be ruled by that state. There are also many ways a monopoly on coercion can be abused to make citizens worse off. Furthermore, democratic and legal institutions are only very imperfect brakes on such abuses and essentially operate by modifying the incentives of decision-makers entrusted with the exercise of coercive power. Whether legalised coercion is being used to make people better or worse off, however, the decisions can only represent the preferences of the officials taking the actions, although their choices will also be influenced by the incentives and constraints that operate within their decision-making environment.

Even if intrinsic values exist there is, *by definition*, no way of knowing whether “intrinsic” values are positive either for an individual or for society as a whole. For example, some individuals could equally assert there is intrinsic value in hydroelectric plants and artificial lakes that more than offsets the intrinsic value in natural rivers. There is no way to adjudicate such claims using a court of law, a political mechanism, a market or any other human decision-making mechanism.

By contrast, *non-instrumental value to people* can be measured objectively by the amount of other resources people are willing to forgo, or somewhat more imperfectly by what they say they are willing to forgo in, for example, a well-conducted contingent valuation survey, in order to obtain the benefits. Thus, if we replaced the requirement to manage resources for their “intrinsic value” by a requirement to take into account the “value placed on natural resources by people”,¹¹ the goals for the Department would be very different. The Department would then have a clear directive to establish *by objective means* how much people valued different habitats, species, scenic views and so on.

The requirement in the *Conservation Act 1987* that DOC manage “all land, and all other natural and historic resources, for the time being held under

¹¹ A referee suggested the alternative goal of “maintaining valuable intrinsic characteristics”. But what is an “intrinsic” characteristic of a rimu tree or a kiwi as opposed to a “non-intrinsic” one? And why specify that only “intrinsic” characteristics can have value? Furthermore, unless it is made clear that it is only value *to people* that can determine resource use through social decision-making mechanisms (such as markets, politics or the law) DOC is essentially left to do what it likes. The goal is inoperable and, like “maintaining intrinsic value”, cannot be used to guide management actions within the Department, to assess the performance of the Department in achieving its goal, or to allocate resources to conservation versus other valued uses. For a goal to be operable it needs to be measurable in an objective way.

this Act” for the purpose of “maintaining their intrinsic values” is a most unsatisfactory goal for a government department. People are being asked (perhaps indirectly through acquiescence in, if not explicit support for, government policy) to allocate resources for one among a number of alternative uses. As taxpayers, people are being forced to fund the activities of DOC rather than pursue their own desires or fund the myriad other activities that government could undertake. They have a right to demand accountability, to know what the funds are being used for, whether the objectives are being achieved, and whether more could be achieved at less cost.

How can the desirability of alternative actions be compared when one of them has a value that *cannot* be known to any person? How can the performance of DOC be assessed when there is no way of measuring the value of what it does, no way of comparing its achievements with what might have been achieved if the resources had instead been used differently? How can resources be allocated to different activities within the Department when there is no way of comparing the value achieved under different allocations? If the overall objectives of the organisation *cannot* be known to any person, how can managers make decisions? When there isn't a clear objective for the organisation, how can senior managers ensure that their local managers are properly performing their jobs? When local efforts or priorities cannot be directed toward achieving an overall measurable objective, local managers are able to pursue their personal agendas.

Not only is “maintaining the intrinsic value of nature” an unsatisfactory goal because there is no way of determining what it is: it is seen by DOC as its *primary* responsibility. For example, the Department of Conservation (1996c) notes that (pp 7–11):

The *Conservation Act* ... advanced three reasons for the ‘preservation and protection of natural and historic resources’ – maintaining their intrinsic values; providing for their appreciation and recreational enjoyment by the public; [and] safeguarding the options of future generations. The Act reiterated the validity of recreational use of most lands managed by the Department of Conservation, providing conservation values were safeguarded ...

The Department manages a substantial amount of the country's land area ... The protection of the intrinsic natural and historic values of these areas is the Department's first concern ...

The *Conservation Act* promotes the protection of New Zealand's intrinsic natural and historic values and sets up the Department of Conservation for that purpose ...

From this legislation, it is clear that the Department's first concern is the protection of the intrinsic natural and historic values of the areas it manages.

The requirement in the *Conservation Act 1987* that DOC "maintain the intrinsic value of nature" is a *fundamental obstacle* to the Department achieving successful outcomes for the people of New Zealand. A conservation scientist from the University of Auckland has made a related point (Craig, 1997, p 174):

Management will achieve greatest success if it targets actions towards people alive today ... Why do I suggest that conservation management is not for "the birds" or "their intrinsic values" or "for future generations"? People alive today have control of resources and unless their behaviour is modified, there will be fewer birds to look after and to hand on to future generations. Also without management targeted to stakeholders who can respond, managers can and will be unaccountable.

Similarly, Craig and Stewart (1994, p 164) assert that the Department needs clear objectives in order to devise consistent and effective long-term strategies and plans and enable it to move away from reacting to crises:

Every organisation has limited resources ... but what differentiates those that are successful (effective) from those that are not, is the way they use those resources. Confounding conservation more than the activities of most organisations is the urgency with which action must be taken - while action is focused in one area another species may slip to extinction. Conservation has been termed a crisis discipline ... which makes it more imperative that there is wide and rapid agreement between managers and researchers about direction and priorities ... All activities managed within the organisation and those sourced from outside ... must conform to these goals and priorities or the organisation will not achieve the major outcomes it requires. Instead, it will follow a reactionary mode, with too wide a focus, and it will always feel the constraint of its resources.

Similarly, Craig (1997) discusses the issue of deciding where to focus conservation efforts. Given limited resources, it is impossible to undertake the maximum conservation effort in all areas - choices have to be made. It might be argued that areas where diversity is already high are most important, since maximum diversity measured in terms of the number of surviving species might then be achieved at lowest cost. Such areas are usually found, however, where there are few people. They are expensive to get to (in terms of time, if not money) and the resulting conservation does not provide direct benefits to many people. If effort is focused on the areas that are most deteriorated, the conservation effort will be more expensive. In order to choose among the alternatives, DOC needs clear objectives that enable it to weigh the various pros and cons.

Lawless and Stephens (1996, p 151) note that:

The [conservation] manager's task is to set priorities for action amongst unlike things ... The conservation manager must decide whether to:

- lobby a local authority to make rules to protect riparian margins of spring fed streams;
- monitor forest ecosystems for condition and trend;
- trap stoats in a mohua (yellowhead) nesting area;
- pursue a marine reserve proposal; or
- any number of other actions about any other number of natural resources.

Most of our managers are also asked to pick and choose amongst other public good work as well, such as providing services for visitors or conserving historic resources. How then does the conservation manager choose amongst all these [actions] which cannot be compared? The manager uses the oldest decision-making instrument in the world – gut feeling.

The authors can see that clear and understandable objectives are needed in order to rank priorities for action. Since they ignore the common denominator of *value to the customer*, however, they have to throw their hands up and suggest nothing better than “gut feeling” as the appropriate way to proceed. It is also rather extraordinary that “providing services to visitors” and “conserving historic resources” are seen as “good work” rather than an integral part of the business of the Department.

One could ask a similar question with regard to any other economic (or resource allocating) activity that is attempted to be undertaken without the assistance of markets. If a central planner does not have prices to signal the value that consumers place on different uses of resources, there is no “common denominator” to guide decisions and ensure that resources are allocated to their most valued uses.

Lawless and Stephens nevertheless arrive at a similar conclusion to ours, namely that human values have to underlie the valuations of alternative courses of action, after they present “The Director-General's dilemma”:

It is impossible to get inside the manager's intuition to be sure that responses are consistent. Yet responses must be consistent if real and valid changes in direction are to be achieved. A way out of the Director-General's dilemma is to break the range of possible tasks into those that relate to particular human values. Relatively objective sets of rules for decision-making associated with that value can then be created. Value judgments will still be required, but their role can be explicit.

However, in the absence of price signals or other information about consumer preferences, Lawless and Stephens are still left with the problem

of determining valuations.¹² This is a fundamental problem for centralised resource allocation mechanisms, as we discussed in chapter 2.

Resource allocation decisions cannot be based on “intrinsic values”. The intrinsic value of a resource is not the value placed on (a particular use, or the continued existence, of) those resources by any individual or group of individuals. These are not intrinsic values. They are values *to people* that are, in principle at least, discoverable through market processes or survey techniques such as contingent valuation. Intrinsic values, on the other hand, are by definition incommensurable by any person, and since they cannot be measured, they cannot be used to guide resource allocation decisions.

MAXIMISING THE TOTAL VALUE OF RESOURCES

We conclude that the *Conservation Act* ought to be amended to remove all references to the notion of “intrinsic value”. The Act could simply define “conservation” to mean:

the use, development, and protection of natural and historic resources for the purpose of providing for their appreciation and recreational enjoyment by the public, and safeguarding the options of future generations.

In fact, we would argue that there is no good reason to exempt DOC from the *Resource Management Act* (RMA) 1991.¹³ Section 5 of the RMA states that the purpose of the Act “is to promote the sustainable management of natural and physical resources”. The section then defines “sustainable management” as:

¹² In correspondence with us, Brendan Moyle suggested that the Species Priority Ranking System is an example of how difficult it is for DOC to set priorities and allocate resources in the absence of explicit or market values. He comments:

In its incarnation from 1992–96 it worked by adding 17 ordinal numbers to produce a cardinal sum. Mathematical nonsense I am afraid and hence completely meaningless.

We agree with this assessment. Since the numbers are ordinal one could obtain *almost any result one wants* simply by re-scaling the components before summing them. Markets effectively overcome this problem by relating *relative* prices to *ratios* of marginal ordinal valuations. Thus, while the valuations themselves are not scale invariant, a re-scaling affects all marginal valuations by the same multiplicative term which cancels out when taking ratios.

¹³ While we argue that DOC should have a sustainable use goal, we do not wish to imply that “sustainability” is beyond criticism as a goal, or that the RMA is beyond criticism as a means of promoting such a goal. Extensive criticisms of the concept of sustainability or the RMA are simply beyond the scope of this report. We also note that the RMA would also need to be amended to remove references to “intrinsic value”.

managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while –

- (a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and
- (b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and
- (c) avoiding, remedying or mitigating any adverse effects of activities on the environment.

These provisions would appear to provide adequate goals for the Department of Conservation. By requiring “health and safety” to be provided for while also “safeguarding ... ecosystems”, they recognise the potential instrumental value of conservation of natural resources. They require that “the reasonably foreseeable needs of future generations” be taken into account. Finally, the requirement to provide for “social, economic and cultural well-being” surely encompasses providing for the non-instrumental direct consumption benefits of “appreciation and recreational enjoyment by the public”.

Removing the conflict between the *Conservation Act* and the *Resource Management Act* would have the added benefit that the taxpayers would no longer be called upon to pay for the Minister of Conservation to intervene on one side of a court case and the Minister of the Environment to intervene on the opposite side of the same case. The Environment Court could also be allowed to develop a set of principles that apply to *all* resource users alike, including DOC.

Defining the objectives of DOC to be “to promote the sustainable management of natural and physical resources” in the areas that it manages or otherwise uses legally would also make its aims consistent with the goal of maximising the *total* value of resources. By *total* value, we mean the value arising from uses of resources for “non-market” purposes as well as using them to supply marketed goods and services. Values derive from individual preferences. Many “non-market” activities, or uses of resources, provide a great deal of value to many individuals. In particular, environmental amenities contribute to individual living standards just as marketed goods and services do. Scarce natural resources need to be used wisely, therefore, to yield the greatest benefits to the community, including benefits that will accrue to future generations.

BIODIVERSITY AS A MEASURE OF WHAT PEOPLE VALUE

Biodiversity or other such biology-based concepts supposedly measuring an intrinsic value of nature divorced from any value to people cannot provide a basis for allocating resources in a society. Since only people make social decisions, resource allocation decisions can only be guided by measures of the way people value alternative uses of resources. For example, decisions made by DOC, the government of the day or an individual land holder for that matter, to preserve certain areas of land might be *claimed* to reflect the “intrinsic values” of the area but they can in fact only reflect the values placed upon those areas by the people making the decision to preserve them.

The *relevance* of biology-based measures for conservation action could be retained, however, if maximising (or minimising) such measures is an effective *means* for achieving other ultimate ends that are of interest. For example, biological measures such as biodiversity might serve as *proximate* goals or “rules of thumb” that represent the direct, or non-instrumental, value people place on experiencing or enjoying native plants and animals or natural ecosystems. We shall therefore examine the various direct and indirect benefits people obtain from natural environments and see to what extent those benefits amount to valuing the biodiversity of native species.

Why people might value biodiversity

One reason biodiversity might be a reasonable proximate goal is that people have a demand for variety. For example, a greater variety of plants, animals, environments, communities and so on is more stimulating and visually pleasing than seeing the same things over and over again. Most people display a decreasing marginal value of consumption for most goods or services. The more one has experienced a particular good or service, the less valuable additional consumption of that good or service is, other things being equal.

This argument for valuing biodiversity as a proximate goal would be less convincing if the demand for variety were not universal. Indeed, there are apparent exceptions to the generalisation that people display a decreasing marginal value of consumption for any one good or service. The most obvious ones are drugs of addiction. The more opium one has consumed the lower the euphoric effect of a given level of consumption. As a result, the individual wants to consume more in the future. While drugs of addiction appear to be a counter-example to the idea of diminishing marginal value of consumption, there is a type of “capital stock” associated with their

consumption.¹⁴ Diminishing marginal utility of additional consumption may still apply to the underlying “euphoric effect” itself relative to other desired experiences. It is just that the technology of achieving the desired effect requires increasing inputs of opiate over time to achieve the same desired effect.

Other apparent counter-examples to the notion of decreasing marginal utility of consumption may display similar “capital stock” effects. For example, the more classical music or fine art that people have experienced in the past, the more they may value additional consumption in the future. In this case, past investments a person has made to learn about a complicated and sophisticated subject enable them to obtain more value out of a similar experience in the future. A higher level of consumption will be needed before the same diminishing marginal utility of benefit is experienced. Again, however, it is likely that there will still be decreasing marginal utility for any fixed level of past investment in appreciation skills. There will still be a demand for variety of experience.

The same effect may also apply to the experience of nature. As people learn more about a particular flora or fauna, or the relationship between plants, animals and the associated climates, microclimates, soil types, landforms and so on, they can obtain greater benefits from experiencing nature. Their past investment will raise the marginal value of additional investment of a similar or closely related type. Nevertheless, they can still experience diminishing marginal utility of additional consumption for any given level of investment in past knowledge and understanding. Again, there will still be a demand for variety of experience.

While a demand for variety of experience implies that, other things equal, people would prefer more biodiversity to less, it also implies that the value of biodiversity relative to other categories of goods and services will tend to decline as more biodiversity is available. When people already have lots of different birds, trees, butterflies and so on to look at, marvel at, be inspired by and so forth they will tend to value an additional bird, butterfly or tree much less than, let us say, an additional trip to the beach, an additional game

¹⁴ The biochemistry of this effect appears to be that opiate consumption interferes with the natural production of neuro-transmitters in the brain. If the artificial substance is withdrawn when the individual is no longer producing a suitable level of the natural chemicals, the individual suffers greatly until production of natural transmitters returns to normal. In addition, the euphoric effect appears to be associated with an excess level of neuro-transmitter substances in the brain, so as the body produces less natural substance, more of the artificial substance is needed to achieve the same effect.

of rugby or another classical music concert.¹⁵ There can be “too much of a good thing” if the marginal value of an additional experience of a particular sort is not worth as much to people as the other experiences that have been forgone as a result. The implication is that the extent to which it is worth preserving biodiversity rather than providing other goods and services depends on the valuations people place on the relevant alternatives.

The optimal amount of biodiversity cannot be determined in the abstract but requires a balancing of costs and benefits. The latter in turn cannot be determined in the absence of market information about the amounts people are willing to pay for an additional experience, or at least say they are willing to pay in a well-conducted contingent valuation survey.

Accurate cost information also generally will be unavailable to central government agencies, as we argued in more detail in chapter 2. It is therefore inconceivable that a centralised government agency could achieve an efficient allocation of environmental resources, even if that were its goal. In addition, however, as we also argued in chapter 2, political mechanisms are likely to maximise goals other than the efficiency of resource use.

It could be argued that if we have appropriate measures of costs and benefits and a choice mechanism to balance them, we do not need to concern ourselves with proxy measures such as biodiversity. It is possible, however, that people might *indirectly* value “biodiversity” even if they think they value something else. Consumers in general do not know and do not care about all the production, technical and engineering decisions that have been made to produce a final product. They are interested in the final product and are willing to pay a price to have that product made, whatever is required to do so. Just as a demand for automobiles implies an *indirect* demand for steel, plastics, glass, rubber, the electronic components that go into cars, engineering and manufacturing skills, unskilled labour and so forth, so a demand to see rare birds in a natural setting could require other important inputs into the “production process” to be made available. For example, a demand to see rare birds in a “natural setting” might require that many other species and ecological processes be conserved. In short, a *private entrepreneur* providing conservation services *might* also discover that the value of the business can be maximised by preserving biodiversity.

¹⁵ Thus, part of the reason peoples in less developed tropical countries are not so excited about preserving rainforest is that, unlike environmentalists from the developed world, they do not see it as a particularly scarce good – certainly relative to the goods and services most residents in the developed world get to experience.

Is biodiversity a practical goal?

We conclude that biodiversity may be of interest either as a measure of the variety of experiences of nature that people desire or else as a proxy for the natural conditions that are required to provide people with the experiences they desire. However, conceptualising what is meant by biodiversity may be much easier than measuring it. Two seminars presented to the Science and Research Division of DOC in 1994 highlighted some of the problems:¹⁶

- There are different concepts that have been used to identify species with the result that species diversity can differ depending on the way it is measured.
- In New Zealand, as in many other countries, there is also much ignorance about whole categories of species. Atkinson (1996, p 11) suggests that “there are thousands, perhaps tens of thousands of invertebrates in New Zealand which have not been described, nor even recognised. Even with higher plants the species still not yet described run into hundreds”.
- Organisms that have been classified as a single species have later been found to be separate species. Sometimes, it is difficult to recognise species differences based on physical or behavioural characteristics alone.
- Simply counting numbers of species might not adequately measure *diversity*. Species can differ by greater or lesser amounts at the genetic level or in behavioural terms. A small number of species that are “more different” from each other could be a more diverse biota than a larger number of very similar species.
- Community diversity is even more difficult to measure than species diversity since we need to have a way of summarising the information on an assemblage of species into a simple index that can then be calculated for a range of communities.
- Many species or biological community monitoring programs rely on the enthusiasm of a single individual and are never carried through to completion because that person moves or becomes involved in other activities. Even in those that are completed, the results are not communicated to others in an accessible form through publication.

¹⁶ This discussion is based on Atkinson (1996) and Norton (1996).

- Different individuals use different methods to measure species numbers, community characteristics and so on. This reduces the value of the studies both because the data for one location cannot be compared over time and because the data from different locations is not comparable. The value of data series also can be seriously compromised when old data are lost or the basis on which they are collected is no longer available. The data collected at the local level also might not address the questions that are of interest. Furthermore, many researchers are not well trained in statistical matters and may collect data in forms that reduce the information content below what it could be.

Some of these criticisms illustrate the danger of using proxy measures for the underlying issue of interest. The key issue is not biodiversity *per se* but rather the effect diversity has on the *value of nature experiences*. Thus, for example, if it is very difficult for a trained biologist to identify different species, it is unlikely to be an important consideration for untrained observers.

This criticism can be taken too far, however. For example, the general “consuming public” are likely to be concerned if species become inbred – since that would affect characteristics that they care about. Professional biologists charged with the task of providing habitat people wish to experience may need to monitor the genetic characteristics of the population to ensure it can continue to provide the desired services.

Does biodiversity capture what people value?

There are other problems with using biodiversity as a proximate goal of conservation policy. Most individuals are not interested in biodiversity of any or all types of organisms. Rather, they are concerned about experiencing a variety of *particular types* of organisms.¹⁷

In New Zealand, for example, it is commonly believed that people are most passionate about rare birds – particularly the larger birds, the more colourful ones, or those with endearing behavioural traits. Many people do not seem to care much about, or even know about, the native invertebrates,

¹⁷ For example, the Ministry of Fisheries (1996) claims that “The utilisation of aquatic life should not compromise the existence of the full natural range of genetic material, species and ecosystems.” Are people really interested in preserving the “full natural range of genetic material” including viruses, bacteria and so on? Furthermore, might not people be interested in preserving some “unnatural” genetic material such as genetically-engineered species, or the plants and animals that people have bred and which modern agriculture is dependent upon?

or even the native frogs and fish present in New Zealand habitats.¹⁸ Similarly, while there is considerable interest in trees like the Pohutukawa, or even forest types dominated by particular tree species or the larger or more unusual plants, most people are not very interested in, or much concerned about grasses, sedges, prickly bushes, mosses, lichens, algae and so forth.

Atkinson (1996, pp 15–16) discusses the sorts of things people in New Zealand are interested in conserving:

With species, we probably haven't got a big problem, particularly if the species is warm and cuddly, fearsome or fascinating, or just plain cute. People identify with individual animals easily as well: "Old Blue", and "Grandma", the Royal Albatross from the Tairoa Head colony, are good examples. We may have a problem explaining effective breeders although the idea here is simple. Geographic populations will need explanation but we can use the analogy of dog breeds to explain that we do not want diversity of breeds reduced to rottweilers and dascshunds. Most gardeners will appreciate the importance of differences between geographic populations. Communities, landforms and landscapes all require more explanation. There should be no problem with habitat. The word ecosystem is overused and is certainly not understood. The difficulty here is that people do not get fired up by ecosystem processes, energy flow, nutrient cycles, hydrological regimes; these ideas do not grab them and we should not be surprised. Apart from species, what people do get fired up about is the attributes of place, special places in particular, and this is why I'm right behind DOC's efforts to identify special places and look after them.

Thus, there is not a great deal of *direct* interest in preserving a variety of many types of organisms. We have emphasised that it is the *direct* interest which may not be substantial because an interest in preserving birds, for example, might imply an indirect interest in preserving many other species that are critical to ensuring the birds can survive in a reasonably natural state. For example, Craig (1997, p 14) notes that some biologists have argued that:

programs based on the management of keystone species or flagship species will produce the necessary ecosystem benefits ... This has been the approach at places like Mapara in New Zealand where ongoing management has been directed at restoring kokako populations. The long-term result has been spectacularly

¹⁸ In correspondence, Brendan Moyle has disputed this claim. He reports an econometric study of donating behaviour at Otorohanga that could not identify a statistically significant preference for birds and which apparently shows that "recovery cost is by far the dominant variable" (we presume he means numerically dominant as well as statistically significantly different from zero). He continues, "My impression is that a small increase in recovery costs of birds compared to other species would be sufficient to produce a substitution away from birds".

successful and subsequent counts of other birds and plants has shown that most have benefited greatly from the program aimed at restoring kokako numbers.

The appropriate way to reflect indirect demands is to recognise that people are interested first and foremost in particular species (or “special places”). The indirect demands for other species then need to be justified by an appeal to the conditions required to produce the services of direct value of consumers.

It could even be argued that ecosystems are so complex that it is very difficult to know what else is required to produce the services of direct interest to people. This might provide an argument for attempting to maintain a diversity of species known to have been associated with the species of interest. The hope would be that since the species of interest survived in an environment “like that” in the recent past it may continue to survive in a roughly similar environment in the future.

It is most unlikely, however, that an indirect demand for biodiversity derived in this way would, in the words of Lawless and Stephens (1996), result in us “assign[ing] all naturally evolved genes equal value”. In this regard, we side with DOC in its apparent emphasis on preserving “charismatic” species and “special places” that people care about. In our view, conservation is about providing outputs that people value.

Some biologists are apt to point out that once a species has become extremely rare it has minimal impact on ecosystems. Whether it survives or not will make next to no difference for the remaining species – unless the rare species can be brought back from the brink of extinction and made a significant and fully functioning part of the ecosystems.

For example, Moyle (1995) argues that, because the political process does not place tight constraints on managerial actions:

Conservation work may be biased towards particular taxonomic groups ... For instance, birds are on average more likely to become a candidate for recovery work in New Zealand than other groups ... By 1992, birds made up about half of the recovery programs and a quarter of the endangered species. While the ratio of endangered birds to the total number of bird species is high, other groups also have high ratios. The endangered ratio for reptiles is in fact higher than for birds ... This preference for birds may reflect the history of the Department of Conservation. Many staff used to work in the old Wildlife Service which had an emphasis on saving birds. Not surprisingly the Wildlife Service had a high proportion of enthusiastic ornithologists. This enthusiasm has been perpetuated in the Department of Conservation.

Another hypothesis, however, is that the preference for conserving birds could reflect the concerns of voters rather than representing a deviation

reflecting staff preferences. Alternatively, while policy might have reflected above all else the preferences of wildlife officers, these preferences might nevertheless have corresponded closely with the preferences of many people in New Zealand.

The argument that resources should not be focused on conservation of birds because this does not adequately address the problem of conserving biodiversity amounts to focusing on means while ignoring ends. One of the main ends of conservation activity is preserving species that people care about.¹⁹ Ecosystem functioning may be an important means to this end, but it is not an end in itself – it is not, for the most part, something that people directly care about.

Undesirable biodiversity

The example of the prickly bushes suggests another defect with using biodiversity *per se* as a proximate goal. There may be some “naturally evolved genes” that most people are actually quite hostile to, and which therefore have a *negative* value. For example, a considerable amount of modern medicine can be viewed as a never-ending battle to greatly reduce the biodiversity of micro-organisms that adversely affect human health. Public health and food hygiene measures, and the sewerage and other waste treatment industries, have the same aim.

The idea that the biodiversity of all naturally evolved genes should be maintained regardless of the consequences for human welfare is inconsistent with the notion that only human preferences can determine human decisions about resource use. Certainly, within markets, the legal system, and areas of voluntary activity, genes that have net harmful consequences for people would have a negative implicit or actual value. Presumably the only reason such notions can be entertained within the political arena is that democratic political mechanisms place so few constraints on the behaviour of officials and their political overseers that public opinion can be ignored.

Genetic engineering and biodiversity

There is another respect in which the advocates of biodiversity as end in itself, rather than a means to an end, appear quite disingenuous. With modern advances in genetic engineering it will soon be possible to

¹⁹ We agree with Brendan Moyle, however, that costs are also relevant. Thus, if it costs much more to conserve rare birds than some other rare species that people care about just as much then it would not be efficient to focus on the birds.

deliberately produce all sorts of variations on naturally occurring organisms. All such feats of genetic engineering would, of course, increase biodiversity at the genetic level. Yet the advocates of biodiversity as a goal of policy devalue such advances by asserting, as do Lawless and Stephens (1996, p 154), that “value should ultimately only be ascribed to the continued existence of a genome in the environment within which it evolved”. If biodiversity is something people value, why should it matter whether that biodiversity is the result of evolutionary or scientific processes?

While the production of current agricultural crops or animals from their wild antecedents involved an extremely long process of selective breeding, modern science will enable a dramatic acceleration in this process. It may even be possible, for example, to alter native New Zealand trees to produce faster growing varieties that could be suitable as plantation species. As we mentioned in the previous chapter, nothing increases the probability of survival of a species more than making it economically valuable as a resource for humans. Thus, genetic engineering might enable a dramatic expansion in the amount of “near natural” habitat in New Zealand if plantations of exotic trees could be replaced by plantations of genetically modified native species.

Efforts are also already being made to collect genetic samples from endangered animals for future breeding. The Animal Gene Storage Resource Centre of Australia (AGSRCA) has been formed at Monash University in Melbourne as a collaborative venture between a number of universities and the Zoological Parks Board of NSW (Allen, 1997). It aims to preserve critically endangered wildlife:

AGSRCA's project manager, Dr. Ian Gunn ... says boosting reproductivity through captive artificial breeding programs will make it possible to reintroduce the endangered [species] into suitable new habitats, as well as supplementing existing wild populations. Techniques for preserving species through storage of frozen embryos and sperm will also act as insurance banks for future breeding ... The most revolutionary work so far has been attempts to create a pure-bred species from a chimera ... The sperm cells of an endangered species are micro-injected into the embryos from an abundant related species, and implanted into a surrogate mother. When mated, the chimera offspring produce some purebreds of the endangered species within a couple of generations. Japanese scientists are using this technique to resurrect the Japanese crested ibis with the preserved testicular cells of dead males and specially treated eggs of the female common ibis. (Allen, 1997, p 63).

Gene banks might, in the short run, be the most cost effective way of preserving many “charismatic species” until they can be bred once again to give people the pleasure of observing them.

Zoos and biodiversity

A similar remark applies to zoos and other captive breeding programs. Many radical ecologists express fierce opposition to zoos, even though such sentiments would appear to violate a belief that biodiversity *per se* is an appropriate goal of conservation policy. While there is little doubt that most people prefer to experience native plants and animals in their natural surroundings, for most people preservation of rare and endangered animals in zoos, or rare plants in parks or glasshouses, is preferable to extinction.

Modern zoos, such as Orana Park near Christchurch, are part of an extensive network of contacts on animal health and breeding expertise. A zoo may develop expertise in, for example, breeding parrots, or treating diseases specific to parrots, and zoos around the world contact that zoo if they have a problem with a parrot.

An entire private industry has also developed to support zoos and other captive breeding programs. For example, the firm Vetafarm in Wagga Wagga has specialised in manufacturing a range of products to assist with managing parrots (and related birds) including feed supplements, disinfectants, pharmaceuticals, parasite control products, anti-microbial drugs, vaccines and hand rearing equipment. Many of these industries have grown out of the veterinary products industries supporting modern agriculture.

Once a species becomes endangered, zoos and other captive breeding programs can probably ensure its survival at less cost than *in situ* conservation programs. For example, many *in situ* programs involve high costs of transporting staff and other resources to remote areas and high costs of monitoring populations. The remote locations of *in situ* programs may also make it less practical to have highly-trained experts involved in the recovery plans. Indeed, DOC itself acknowledges the value of captive breeding programs for aiding the recovery of some species. It operates such programs at Mt. Bruce and Te Anau. It also supports the *ex situ* conservation programs of many semi-government, local government, voluntary and private agencies. After suitable habitats have been restored, and the population has been increased to make it safe to lose a few individuals, individuals of the endangered species can be reintroduced into the wild.²⁰

²⁰ A potential problem with captive breeding programs that contributes to caution in their use is that individual animals raised in an artificial environment can alter their behaviour in ways that prevent successful reintroduction to a more natural environment.

Zoos also have considerable expertise that could be called on to assist with *in situ* intensive care programs, such as the kakapo recovery program in New Zealand. Wildlife officers often have to learn again the lessons that managers of captive breeding programs in zoos have already learned. For example, Moyle (1995) notes that, in the case of the kakapo recovery program:

In one conservancy the preferred course of action was to take less active management ... Rat predation was correspondingly higher. Further, the supplementary feeds were modified by the withdrawal of nuts. In consequence breeding success was lower in this conservancy. Nuts were a high fat food and as it turns out, important for weight gain in breeding adults. This less active management has produced a lag in the recovery program.

On the other hand, we have also been informed that the conservancy that took less active management did so on the grounds that without having two options to compare, there was no evidence that the proposed management action was helping the kakapo. Furthermore, a subsequent review of the management program cast doubt on the efficacy of feeding nuts to the birds.

Nevertheless, the general point is that the skills and information that are useful for *in situ* intensive care programs bear a closer relationship to the skills and information used in zoos and wildlife parks than to the skills and information used in managing conservation areas. This could show up in the costs of the two programs as well as, or instead of, the outcomes achieved.

DOC resistance to private sector initiatives to assist in the recovery of endangered species has also been the subject of comment to us during field trips. One example involves the South Island kaka. This is the southernmost nectar-feeding parrot in the world and is at the limit of its natural range in the South Island. As with many other New Zealand birds, predation by rats and stoats has significantly affected population sizes.

Orana Park voluntarily funded a population viability analysis for this species in order to develop a recovery plan. As with other conservation work undertaken at their Christchurch site, the Park management viewed the exercise as good advertising and a valuable voluntary contribution to the community. Similar motivations have resulted in corporate support for other endangered species recovery programs in New Zealand – for example, Comalco's support of the kakapo, ECNZ's support of the black stilt, and BNZ's support for the kiwi.

Orana Park's initiative was apparently met with some scepticism, however, on the grounds that the zoo was merely attempting to obtain preferential access to kaka for a captive breeding program. Even if that were

the case, it is debateable whether such a program could usefully supplement the *in situ* conservation effort and thus should not be rejected out of hand.

In any case, despite Orana Park offering to allow DOC staff to attend a seminar to discuss the kaka free of charge, it took about 2 years for DOC to agree. When the workshop was finally arranged, Orana Park flew in experts from the United States and elsewhere and produced a professional publication outlining a recovery plan for the species. The workshop revealed considerable information about the bird that was known to a large number of DOC field officers but which hadn't been communicated to others or compiled into a useable form.

As it turned out, a captive breeding program was part of the recommended recovery strategy. The motivation would be to study the breeding, feeding and behaviour of the bird. Since the workshop had revealed that up to 50% of nesting females were predated by stoats, one idea would be to see if behaviour could be modified to encourage the bird to nest in boxes. DOC opposed this plan. They would not allow eggs to be taken from nests in areas where chicks had not hatched in 10 years.

Two years after the workshop, DOC announced an intention to devise their own recovery plan for the species. They argued that the plan prepared by the workshop was out of date. DOC refused an offer to update the original study even though this would be much less costly than developing an entirely new plan.

Orana Park had a similar experience with the Fiordland crested penguin. These birds breed in a narrow area of coastline that is vulnerable to predation by introduced mammals. Orana Park offered to join with DOC and a university to raise funds and formulate a recovery plan for the species. A feature of the habits of these birds is that, as a rule, they lay two eggs but only raise one chick. Orana Park suggested that the surplus eggs could be raised in a captive breeding program alongside the colony and used to supplement the wild population, but DOC has to date refused to accept their offers of assistance.

Moyle (1997a) has discussed a related example. He remarks that:

most captive breeding of rare New Zealand birds and reptiles takes place in private facilities. The largest of these facilities is the Otorohanga Kiwi House and Native Bird Park ... run by the Otorohanga Zoological Society ... south of Hamilton ... The society does not ... receive a subsidy from local or central government. Instead, resources must either be earned by the society or donated to it. Ticket sales at the park followed by souvenir sales generate the majority of resources ... the Otorohanga Zoological Society has over thirty species of birds and reptiles in captive breeding programs.

The Otorohanga Zoological Society has played a significant role in conserving kiwi:

Up until recently it was presumed that the brown kiwi had a low vulnerability ... However a significant decline in species status has occurred and in 1992, the Department of Conservation launched its own recovery plan for the kiwi. While this undetected decline in species status was occurring the Otorohanga Zoological Society had already established a successful captive breeding program ... [developing] an artificial diet ... [and supporting] scientific research into ... the life history of the species and its reproductive strategies ... Another initiative ... is the release of North Island brown kiwi back into the wild ... The little spotted kiwi is also bred in captivity at Otorohanga ... The great spotted kiwi ... too is the subject of a successful captive breeding program. The Otorohanga Zoological Society is the only organisation that has all three kiwi species in captive breeding programs.

Moyle observes that:

One of the criticisms of captive breeding facilities is that they serve a limited conservation role. This argument is based on the fact that in many cases, captive-bred species are not introduced back into the wild. One of the goals of the Otorohanga Zoological Society is to augment natural populations.

He concludes that Otorohanga illustrates a number of key points:

- Private conservation is viable if it can be linked to an excludable economic service, such as tourism.
- The society does not own the animals at Otorohanga. Rather they are held under permits from the Department of Conservation that limit the transfer of animals to zoos overseas or to other facilities. This limits revenue that can be obtained by the society.
- Captive breeding of some species is illegal. For instance, the kaka and kea, which have commercial value in the world's avicultural market, cannot be bred in captivity.
- Otorohanga has, in some cases, demonstrated superiority over DOC in saving endangered species. It has correctly anticipated species that will need conservation work in the future while DOC has been relatively complacent. The society has also attempted to fill gaps in the current conservation effort by focusing on species neglected by DOC.
- The success of Otorohanga shows that the public sector does not have a monopoly on expertise in breeding threatened species.
- Despite these successes, or perhaps because of them, control by DOC makes it hard for the society to receive recognition for its work.

Right species, wrong place

Many environmentalists also oppose raising native species in environments considered to be out of their natural range. As with the artificial breeding programs, raising endangered species in suitable locations can contribute to preserving biodiversity of a kind that is valued by people even though it is “not natural”.

For example, the discussion in the previous chapter of the rehabilitation of Tiritiri Matangi Island noted that some environmentalists had opposed the release of rare birds that were not considered native to the island. As Craig *et al.* (1995b, p 538) observed:

The addition of a species known not to have been on the island for some critics meant turning the island into a zoo. That an island was being restored to represent a mainland area to give New Zealanders access to their lost natural heritage, and that this can not be done on the mainland, escapes these people.

The case of the takahe may be particularly revealing. As Craig *et al.* (1995b) note:

the idea of establishing a [takahe] population on an island was met with derision in the early years. Even after birds were successfully breeding on other islands, there was extreme resistance to allowing birds to be moved to Tiritiri Matangi because the weather was warmer, the island appeared too small and people had free access.

We have been informed that recent evidence suggests that the takahe was much more widespread in New Zealand before the arrival of humans (even being found in Tom Bowling’s Bay at the tip of the North Island). Flannery (1994) suggested that after the moa were extinguished the Maori people hunted other larger native birds. The takahe, which, at about 60 centimetres tall, is larger than a chook, would have been vulnerable and may have been relegated to Fiordland at the time of European settlement solely as a result of previous hunting pressure. As we concluded in the previous chapter, the existing range, or habitat, occupied by a rare species is given inordinate status in deciding where the species might be able to survive and prosper.

The experience on Tiritiri Matangi also showed that it is much easier to provide suitable habitat in which rare birds can survive and prosper than many radical environmentalists would like to suggest. The key requirement seems to be the elimination of introduced feral animals.

The strong opposition to the reforestation aspects of the original Tiritiri Matangi plan is further evidence of an irrational “natural is best” attitude. The bias amongst more radical environmentalists is to allow areas to revegetate “naturally” rather than engage in an explicit planting program.

Another example of opposition to raising rare species out of their natural range was reported in a letter to the editor of *The Evening Post* on 20 June 1996, written by a Mr. Malcolm Thorpe of Te Marua:

The saga of the Antipodes parakeet is totally unbelievable. This endangered species occurs only on the Antipodes Islands. Some years ago competent DOC (then Internal Affairs) staff decided it would be a good idea to set up stocks of these birds inland, as a backup in case the Antipodes birds were ever wiped out by predators. Many private individuals gave time, money and property, and breeding populations of parakeets were soon doing well in their care. No further input from DOC was required. Everything went fine so in moved the bureaucrats. Separate them, they demanded. Smash their eggs. We don't want you people breeding parakeets because we haven't the resources ... we want to police you and we can't because we're under-funded. It was made clear to the volunteers that the birds would be confiscated if they resisted.

It is conceivable that accidental or deliberate release of these birds in an area out of their natural range might introduce new diseases to local populations, or hybridise with them. The result could be a net change in biodiversity, although biodiversity could increase as a result instead of decreasing!²¹ Perhaps some policing to avoid accidental release might be warranted, and if so would require additional resources. On the other hand, using enthusiastic volunteers to assist with the species recovery program would save the Department considerable money. Investigating whether the Antipodes birds would actually be a threat to any species endemic to the area may have been relatively inexpensive, and the knowledge so gained may have had other conservation benefits. The net balance of benefits and costs of the different courses of action are at least debateable.

A similar example was reported by Beattie (1994):

A couple of years ago I visited the government-run Mt. Bruce Endangered Species Unit. An official from the unit took me on a tour of the complex and described each endangered species and its management. When we came to a species of kakariki my escort explained that there were males in one aviary and females in the next. I asked why they were separated:

Official: We do not want them to breed any more.

Me: Do you mean to say that you have birds in an endangered species unit that you are deliberately not breeding?

²¹ Australian visitors to New Zealand would surely be struck, for example, by the similarity between the New Zealand fantail and the Australian grey fantail. More than likely, the fantail is a relatively recent immigrant (perhaps brought to New Zealand by a severe storm) that has adapted and contributed to New Zealand biodiversity.

Official: Yes.

Me: Why?

Official: We do not know what to do with the extra young birds.

Me: Have you thought of selling any?

Official: Oh no! You couldn't do that!²²

In all of these cases, the prejudice in favour of “natural regimes” appears to be at odds with a desire to increase biodiversity.

Introduced animals and plants

Of course, the proposal of Lawless and Stephens (1996, p 154) that “value should ultimately only be ascribed to the continued existence of a genome in the environment within which it evolved” relegates all introduced species (including humans) to having zero value.²³ This is notwithstanding the fact that, as Atkinson (1996) said in the passage quoted above, that people like “warm and cuddly... or just plain cute” animals and, in New Zealand, most of these are introduced species (exceptions include marine mammals and “warm and fluffy” birds).

The dilemma this poses for DOC has been highlighted by the controversy over the Kaimanawa wild horses. It was announced on 14 May 1996, that DOC had been given permission to shoot up to 1,000 wild horses on the Kaimanawa ranges in the centre of the North Island. The destruction of the horses was permitted “to protect some of the world’s rarest grasslands, and some nearly extinct plants”.

On 27 July 1996, the Kaimanawa Horse Action Network announced that direct action would be used to stop the cull. A spokesman for the group said he “was prepared to get arrested for his beliefs in the horses’ right to go on existing in the area where they had been for more than 100 years”. He

²² The kakariki is commonly traded overseas where there is a large and legal market for the species.

²³ The “natural is best” argument of course runs into the problem that people too are “natural”. Further, if bird nests are natural because they are built by a natural organism, then surely everything people do, including building nuclear power plants and taking actions to preserve other species, also is “natural”. Alternatively, if only actions of people are to be condemned on the grounds that they are “unnatural” then how can preservation of other species through establishing reserves, eradicating feral animals, controlling fires and so on be regarded as a “good thing”? The “natural is best” argument clearly suffers from some serious logical difficulties let alone from the other criticisms one can make of it.

claimed the horses had a right to be left alone and that “the army was doing more damage to the land than the horses”. In response DOC banned news media and the public from the site “for safety reasons” and announced that demonstrators would be charged with trespassing.

In an article in *The Press* on 10 August 1996, Jeremy Kirk commented on the government decision to overturn its previous policy to allow the cull:

The past week will be remembered as the one in which National bit the bullet and did a backward somersault over its plans to gun down up to 300 wild and ecology-threatening Kaimanawa horses. It will also be remembered as an example of pragmatic politics at its best – and its worst. It showed that politicians do listen to vocal lobby groups ... Unfortunately, it also showed that decisions that have been years in the making can be overturned in a moment for all the wrong reasons and just how easily principle, scientific evidence, and logic can be jettisoned if it is a matter of staying in power ...

The Kaimanawa horse management plan was the result of five years of extensive public consultation with groups as diverse as the New Zealand Veterinary Association, the RNZSPCA, Forest and Bird, the local iwi, and the Kaimanawa Wild Horse Preservation Society.

There was, and still is, agreement that introduced wild horse numbers in the North Island’s central plateau have to come down to protect the ecology of the native tussock. How many horses need to go is still a moot point ...

In the past few days many have been quick to turn on the Department of Conservation and blame it for forcing the government to retreat. DOC was full of zealots, they said, with an irrational hatred of introduced species who had not adequately explored the option of a muster as an alternative to shooting ...

These groups [arguing for preserving the horses] ... have argued the horses are genetically important, but this has been dismissed this week by Massey scientists. They have argued that a muster and sale of the horses is viable and that the horses will not be more traumatised than if they were efficiently shot where they grazed. This will be complicated by the likelihood that by next autumn there will be 700 not just 300 surplus horses to deal with, according to DOC briefing papers. Immuno-contraceptives being researched at Massey University may provide an answer, but it is likely to be years before they are available ...

It is a foible of human nature that humble, rare, and endangered native tussocks do not tug at the heartstrings as much as unkempt wild horses, symbolising freedom, nobility, and pride. However, it is another thing to allow the heart and superficiality to rule the head.

The major difficulty with this rebuttal of the case for conserving the horses is that the argument for preserving natural biodiversity also largely rests on emotional “tugs at the heartstrings” – although admittedly from a different direction. The fact that the source of both attitudes is largely emotional does

not make either of them illegitimate. Emotions are relevant factors determining the allocation of resources. They are one reason why people value one use of resources more than another. For example, the world-wide market for red roses, and the substantial resources devoted to growing and marketing them, is based on very emotional factors.

The real problem in this case is that the issue is being decided through the political mechanism. It is interesting to speculate how markets might handle the same resource allocation conflict. A clue might be found by looking at the Wilderness Lodge in Arthur's Pass on the South Island. This is a 20-room, \$2 million lodge set among 300 ha (3 square km) of mountain beech and tussock. The lodge is run by noted conservationist Gerry McSweeney and his wife Anne Saunders – who is the chef and assists in creating a welcoming and homely atmosphere at the Lodge. Wilderness Lodge Arthur's Pass is the second venture in their eco-tourism business. They built their first lodge at Lake Moeraki in Westland in 1990 which, according to Marchant (1996), earned a million dollars in revenue in 1995.

The Arthur's Pass lodge, which “has been designed to make the most of grand alpine views, to combine quality accommodation with high country nature discovery”, is located on the 2400 ha (24 square km) Cora Lynn sheep station adjacent to the Arthur's Pass National Park, 130 km from Christchurch. Many of the sheep have been taken off the former property. The remaining 4500 or so sheep, with higher quality wool and grazing on improved pastures, have been kept to supplement the income from the tourist venture.

The sheep are a popular attraction in their own right. Tourists are told about farm management issues and the history of the wool industry in New Zealand. They are also given demonstrations of hand-shearing, wool classing, using dogs to muster the sheep and so on.

The smaller number of sheep, and the pasture improvement program, have allowed 500 ha (5 square km) to be kept completely free of grazing. Native vegetation is now regenerating in these areas. Rare shrub species have been planted and a major weed and possum control program undertaken. Rare red and yellow mistletoe plants have been one target of the conservation efforts.

The Lodge provides canoeing opportunities and several organised walks to suit different interests. Some cater to people more interested in strenuous climbing. On another walk, Gerry treats his guests to an extended botany lesson based on close observation of the native alpine vegetation. He has a PhD in high country botany from Lincoln University and he helps his guests

get much more out of their visit by explaining lots of fascinating details about the plants and the environment in which they live.

If Gerry McSweeney owned the Kaimanawa ranges, we might speculate that he would eliminate many, but not all of the horses. An annual mustering to cull the herd (with the product being sent to abattoirs) could be an attraction to some tourists in itself. There could be tours to explain the native plant and animal life, but also how the horses got there, what effect they have on the different vegetation types and so on. This would involve fencing off some areas and leaving them to regenerate while the horses are left to roam over other parts of the property. The owner would have an incentive to experiment to discover where to place the horses so they do least damage to the other resources of value on the property (such as the native plants).

Some of the horses could be broken in to provide a unique horse trekking experience for other tourists. If the horses do have some unique genetic characteristics, specimens could be sold to breeders interested in injecting those traits into their stock.

The point is that markets provide incentives to maximise the value that can be obtained from the available resources. The owner therefore has an incentive to *trade off* alternative uses and cater to many customers. While the Kaimanawa Wild Horse Plan allowed the retention of a herd of 500 horses in the southern area of the Kaimanawas, this decision represented a balancing of the vested political interests and not an attempt to obtain maximum value from all the resources available in the region, including the wild horses. In particular, the plan does not involve utilising the horses to provide goods or services of value to people. Rather, it involves tolerating their continued existence in part of the area since to do otherwise would create too strong a political backlash from individuals such as the passionate supporters of the Kaimanawa Horse Action Network.

Tocker (1997) recently joined a tour of the Kaimanawa region led by DOC. The tour included some information on the horses that was of obvious interest to the tourists, although the prime motivation of DOC was apparently to make the case for culling the herd. The tone of Alison Tocker's article is that there is value in conserving the rare native plants of concern to DOC, but there is also value in preserving the horses in their current wild state:

DOC Wanganui conservancy advisory scientist Colin Ogle says that the horses' territory has at least 560 recorded native plant species, with more found on each DOC expedition. Sixteen are on the national threatened species list ...

Just as I start to wonder if horses will ever be mentioned, DOC Wanganui conservancy field officer Bill Fleury tells us that the area has one of the highest

densities of horses in the country. He reminds us that the horses were first recorded in the Kaimanawas in the 1870s, brought by Maoris and colonial settlers for transport. Some were released and others escaped. Later, other breeds, including Ex-moor ponies and Arabs, were mixed with the local stock creating a herd variously described as “genetically unique”, “not of great scientific interest” and “a bunch of mongrels”.

After an hour ... there’s been no sign of the horses, but ... at last, 25 horses, some with foals ... We’re herded off to see an army conservation initiative – small plots of land fenced off to measure the effects of grazing by horses, hares, rabbits and other animals. Mr. Ogle shows us rare plants, including special types of forget-me-not and sedge. “Horses would chew the tops off this sedge, and the seeds”, he says.

By this stage, several people are bored with plant talk and wander off to get a closer look at the horses ... Back in the bus, Mr. Ogle describes the area’s bird life ... We pass another herd of horses; altogether we have seen about 100 dotted about the landscape in small groups. On reaching a picturesque green setting, surrounded by beech trees, we get out for lunch. There’s not a horse in sight. We are taken to see a rare mistletoe in a nearby tree.

Then we head for the remote northern region where, through the bus windows, we can see ever-lasting daisies, bristle tussock, sub-alpine plants. The vegetation, as promised by DOC, is diverse and unique. Of the horses, nothing is to be seen.

We’re led to a wetland surrounded by spongy vegetation ... we bend to see minuscule tadpoles and watch a pair of dragonflies at play. From being over-awed at the land’s vastness, there’s now an equal sense of awe at the tiny and delicate. Maybe the DOC public relations exercise is working? Not for all. “There’s enough land here for the plants and the horses”, one member of the group says grumpily ... Forest and Bird Protection Society member Vic Vercoe, who has been closely examining the flora, is ... unchanged in his view, concluding: “They have to cull”.

The author ends the article by quoting a Palmerston North man who says “A managed herd is the practical compromise”. That seems to be the view of Alison Tocker too.

DOC performed a head count in Easter 1997 and reported that numbers had risen to “at least 1700”. An article in *The Press* on 9 April 1997, reported Kevin Smith, conservation director of the Forest and Bird Protection Society, as calling for an apology from horse protection groups, who, he said, had repeatedly disputed DOC estimates of horse numbers and delayed culling by calling for more counts. Mr. Smith called on the government to implement its 1995 wild horse plan. However, Minister of Conservation Nick Smith said his preference was for a muster, but that “decisions would be made after

consultation with interested groups, and advice on the logistics of a muster". Alison Tocker (1997) reported that "the government has decided on a muster in April or May" of 1997.

At the time of writing, the latest development in the Kaimanawa horse saga was that the proposed muster went ahead in May, accompanied by considerable protest action. An updated Kaimanawa wild horse strategy plan was released in April 1997. According to a DOC Fact Sheet (at <http://www.doc.govt.nz/biodiver/kaimanaw/>, October 1997), the plan proposed:

to retain a herd of 500 horses in as wild a state as possible in the southern area of their current range, with no horses in the more fragile northern area. As a result, surplus horses are to be mustered from the area this autumn and made available for sale to the public ...

The Department will negotiate with neighbouring property owners to seek compatible management of horses on private lands. Some of these horses on adjoining properties may be mustered, if agreement is reached with the land owners ...

Horses will be sold in a series of auctions, the first likely to be held in late July ... A reserve price of \$100 per horse will be set ...

The Department of Conservation will continue to manage the horses while research continues over the next three years. Ultimately if the horses remain on army land the army will manage them with advice from the Department, in consultation with the Kaimanawa Wild Horse Trust. The army already has a land management plan and aims to protect the special plant areas. It does not allow activities which could damage the particularly fragile areas in the northern zone.

The effect of introduced species on biological diversity is a complicated issue. While a host of new species would initially increase biodiversity as a straight arithmetical fact, many of the new migrants will be poorly adapted to the existing ecosystems. Often this means the species could not survive "in the wild" or without continued human interference. In some cases, however, the new species survive too well. Without many native predators, and with capabilities or characteristics that the local species are not well adapted to withstand, the population of the new invaders can grow extremely quickly. Eventually, their numbers may be brought under control by a loss of suitable food or habitat, but in the meantime they can wreak havoc on the native plants or animals – and in the process eliminate a great deal of desirable biodiversity.

A DOC Fact Sheet ('Threats to Biodiversity – Weeds and Pests', in Department of Conservation, 1996a) states that New Zealand has about 2,700 native plant species, approximately 80% of them found nowhere else in the world. It also states that over 2,000 species of plants have been introduced by

humans.²⁴ Of these 2,000 introductions, over 200 have become pests (weeds) by crowding out native plants (which have to contend with native insects, diseases and so on that have not adapted to attack the invaders), clogging rivers and estuaries, spoiling water quality with rotting vegetation, eliminating wetlands, preventing native trees from growing by eliminating light and so on.

There are also a number of introduced mammals that have had a significant effect on native vegetation. Possums, goats, deer and rabbits eat substantial quantities of native vegetation. Some of the native plants were vulnerable because they had adapted to withstand grazing by large birds but not mammals.²⁵ The damage done by these mammals has threatened the survival of many trees and other plants. Of course, native animals can also be adversely affected by indirect effects as grazing animals destroy their food sources, nesting areas, protection against predators and so on.

Introduced rats have had a large impact on native plants and animals. The seeds and fruits they eat affect the survival of plants, while their consumption of lizards, eggs and chicks directly affects the survival of native animals.

Mustelids – stoats, ferrets and weasels – were introduced to control rabbits. Research has shown that rabbits do indeed form part of their diet, as do rats and possums. However, they also wreak havoc on many native bird

²⁴ The DOC Fact Sheet actually states that over 20,000 species have been introduced but a referee and the Ministry for the Environment (1997b, p 9.20) both suggest this is a typographical error and the correct number is 2,000.

²⁵ The New Zealand experience with possums may have implications for past, and potential counter-factual, evolutionary developments. The current accepted scientific opinion is that Australia, New Zealand and South America shared similar plant and animal communities when they were connected to Antarctica about 80 million years ago. New Zealand separated first. Marsupials evolved in South America and then apparently invaded Australia (as possum-like creatures) via Antarctica. Upon arriving in Australia, they probably spread rather rapidly, devouring many of the native trees as they are now doing in New Zealand. Some of these trees were probably eliminated by possums – leaving species with more toxic leaves, such as the eucalypts, to dominate the forests. Eventually, the possum-like creatures evolved into koalas, wombats and the vast array of kangaroos and other marsupials that now occupy Australia. Left undisturbed for long enough, there might also be an eventual accommodation of environments in New Zealand to many of the new invaders brought by humans. The result might be a more biologically diverse set of ecosystems than the ones found by humans upon their first arrival in the country.

species (particularly those nesting in holes in trees or on the ground) by eating eggs, chicks and even adult females incubating eggs.

Other introduced animals affecting native insects, lizards and birds include wild and domestic cats and dogs, wild pigs, hedgehogs and Australian magpies, Asian mynas, blackbirds, song thrushes and owls. Again, some of these, such as cats, also prey on other introduced pests such as rats and mice, rabbits and possums, but their net effect on native species is harmful.

Even where the introduced biodiversity has no direct value to anyone (unlike the case of the horses discussed above), it is impractical to eliminate all the introduced weeds and pests. The cost would be staggering. The most feasible approach seems to be to heavily control them in selected locations, and then rely on less intense control over a larger area.

The clearest examples of areas where intensive controls are justified are the various islands that have been developed as conservation reserves. Mortimer *et al.* (1996) observe that:

New Zealand has over 500 offshore islands, with more than 273 larger than 5 ha. Nearly 50% of these islands are designated sanctuaries and/or nature reserves with restricted public access. Many islands exhibit little recent modification by humans and, compared to the mainland, remain relatively pristine. As well as being wilderness areas, offshore islands contain a disproportionately large amount of New Zealand's biological wealth. About 6% of New Zealand's indigenous vascular plant species are confined to islands, as are about 25% of native frogs and reptiles and 50% of the species or subspecies of breeding birds and some groups of invertebrates.

The greatest advantage of islands as sites for intensive eradication of pests is that it is much easier to prevent re-invasion. In a recent paper, former Director-General of DOC, Mansfield (1996) notes:

Successful removals of cats from islands have been achieved since early this century. Progressively, the more technically difficult problems were attacked. In the last 15 years Department of Conservation staff have successfully cleared many islands of rodents ... about 20 island restoration projects [are] now in progress.

These island rehabilitation programs were discussed in the previous chapter in the case study on Tiritiri Matangi Island.

More recently, DOC has turned its attention to eradicating pests from selected areas of mainland habitat. Again quoting from Mansfield:

Until very recently our attitude to mainland sites resembled that for islands three decades ago: the pervasive effects of pests and weeds could not be overcome, we

were faced by the imminent collapse of millions of hectares of forest browsed by possums, goats, pigs and deer, and species sensitive to these effects on the mainland had a dubious future – unless they could be translocated to islands. The Mapara experience turned that perception on its head.

Mapara is a 1400 ha (14 square km) Crown reserve, situated in the centre of the North Island between Te Kuiti and Taumarunui. It comprises previously logged podocarp/hardwood forest surrounded by farmland and exotic pine plantations. As Skinner (1997) notes, the Mapara project originally started as a plan to save the reserve's kokako population:

Mapara's population [of kokako] had dwindled to a meagre 52 birds, only five of which were female. Because they are inadequate fliers, preferring instead to run through the upper branches of trees like squirrels, the kokako were unable to fly over surrounding farmland to other bush areas and were marooned at Mapara. Although the forest area was ample for the remaining birds to live in, the population was in need of help if it was going to survive.

Enter conservation officer Phil Bradfield and the staff of the Te Kuiti DOC Field Centre who took over management of the bush area in 1989 ... it was decided to go ahead with the bold and costly experiment that called for the almost complete eradication of introduced predators and browsers at Mapara ... In the first year alone, 4,000 feral goats were shot, possums and other introduced predators were controlled with vigour, and fences were erected and upgraded to control wandering stock. Bradfield explains that the DOC team tried to control everything, "because we didn't really know what the main problems were for the kokako". By the 1991-92 breeding season, kokako numbers had dropped to 47 ... It had been discovered that many pairs weren't breeding because both birds were male ... video cameras at Rotoehu forest in the Bay of Plenty [revealed] that many nest attempts were failing because of predation at nests by rats, possums and harriers. This explained the low breeding success rate and ... male-male pairings ... video recordings also showed that supposed herbivores [possums] were devouring kokako eggs and chicks. Initially, successful predatory control was achieved with annual applications of 1080 poison.

However, the control program encountered some difficulties. Baits laid against possums also reduced rats, which had been the main food for mustelids. When rat numbers declined, mustelids ate more birds. A comprehensive control regime of trapping, poison baits dropped from the air and bait stations on the ground was instituted.

The response of the forest to the removal of the feral animals has been spectacular. As Mansfield (1996) records

The 1996 census identified 86, and possibly 100, kokako, of which females comprised over 40%. Other monitoring indicated increased numbers of insects,

long-tailed bats, and forest birds such as tui, bellbird, kerereu, whiteheads and fernbirds.

Skinner (1997) also comments on the effect of the program on plants:

Plant regrowth is now occurring rapidly throughout the reserve. In drier areas hangehange, mahoe, kanono, karamu and fuchsia are the most common species and in the wetter areas pate is the most common. Also seen again are native passionfruit vines ... pigeonwood berries and the uncommon kiekie flower.

Although the original aim of the program was to save the kokako population, it has now developed into an exercise to restore the whole forest ecosystem of Mapara. Skinner reports Bradfield as saying that the project is now beginning a new experiment:

DOC will turn off much of the pest control for a few years in a move known as 'pulsing.' The pulsed management strategy will give the Mapara forest a rest from the poison use of the last six years and it will ease the high cost of annual pest control, which appears unnecessary to maintain the kokako population.

Following the success at Mapara, a number of other mainland restoration projects have been started on both the North and South Islands.

The type of intensive rehabilitation work undertaken at Mapara is quite expensive. The November 1996 issue of the *Forest & Bird* magazine noted that:

From the early days, the kokako work has been relatively well funded, due to high public interest and support from the top levels of DOC and generous corporate sponsors. Tasman Forestry funded pest management and monitoring at Kaharoa during 1990-1994 and, now, State Insurance and Norwich Union Ltd actively funds many aspects of kokako management through the DOC/Forest and Bird Threatened Species Trust. The sponsorship provides funding for the recovery program including video surveillance at nests, the reintroduction of kokako to Trounson Kauri Park and monitoring of Kapiti Island kokako.

Apart from the concentrated, and expensive, attacks on pests on islands and selected mainland sites, DOC also has authority under the *Wild Animal Control Act 1977* to prepare wild animal control plans that are wider ranging. DOC has prepared and implemented control plans for possums and thar (Himalayan wild goats) – it now carries out possum control over 1.4 million hectares and goats over almost 1 million hectares.

The Animal Health Board, regional councils, community groups and individual farmers also control possums and feral deer to limit the spread of TB to cattle. Farmers thus have a different goal for controlling possums and deer than does DOC. Not all possums or deer have TB, and the impression among many farmers is that ferals on the DOC estate are more likely to be

infected.²⁶ The problem this creates for the farmer is that pest control on the boundary between agricultural and DOC land encourages the migration of diseased ferals from deep within the DOC estate into the newly vacated area. Similarly, the possibility of re-infestation from neighbouring properties suggests that pest control programs should be coordinated on a regional basis.

The widespread use of poison, particularly 1080, to control pests in New Zealand has been controversial. It was the subject of a thorough report by the Office of the Parliamentary Commissioner for the Environment (1994). Some of the key findings of the report relevant to the controversy over poisoning are summarised in an appendix to this chapter.

From our current perspective, this debate on the efficacy and desirability of pest control through poisoning emphasises the inadequacy of “biodiversity of native species” as even a proximate goal that can be used to guide decision-making. For example, pest control policy needs to take account of the fact that many people are concerned that animals are killed in as humane a way as possible. Believing that animals suffer a prolonged and painful death causes these people a considerable loss in welfare. Furthermore, there is obviously a necessity that the desired eradication goal be achieved as effectively as possible, and with the lowest possible cost. Paying attention to any of these alternative goals will inevitably involve sacrificing to some degree the goal of achieving maximum diversity of indigenous species. On the other hand, a humane and efficient pest eradication policy that also recognises the benefits people obtain from increased diversity of native species is quite consistent with a goal of maximising the *total* value of resources as defined above.

Biodiversity and endangered foreign species

Most people value introducing foreign species to New Zealand (or retaining species already introduced) for any of a number of reasons. It is simply not a valid representation of most people’s preferences to say that all native species are valued above all introduced species, let alone that all introduced species should be assigned a negative, or best zero, value.

Some people value New Zealand hosting exotic species in zoos and elsewhere because of the contributions those actions can make to enhancing

²⁶ Gavin Forrest, Federated Farmers of New Zealand Inc., personal communication. A similar issue arises in the case of “weeds” – plants that are weeds to farmers could be very different from plants that are regarded as weeds by DOC.

global biodiversity. One of the factors that can make exotic species a threat to native biota is that they do not have natural parasites, diseases, predators and so on in New Zealand. Yet that very fact also can make New Zealand an ideal host for some of these species that are threatened in their home environment. Since the native biodiversity could be greatly compromised, however, if the exotics escaped into the wild, the exotics would need to be confined in zoos or elsewhere if the actions are to make a net contribution to global biodiversity.

Another reason that New Zealand zoos can assist in preserving rare and endangered foreign species is that there are considerable economic and scientific resources available in New Zealand that may not be available in the home country. Many of these species are endangered in their natural environment because they do not have a high value²⁷ and the low material standard of living of the local population makes them less willing to set aside resources for conservation purposes. In addition, the highly developed agricultural industries in New Zealand often have veterinary or other knowledge that can be used to assist the survival of, for example, African grazing animals.

A related example recently came to light in Melbourne – and there are no doubt similar examples in New Zealand. It was revealed in *The Age* on 24 March 1997, that Victoria apparently has one of the best collections of elm trees in the world – more than 6,000 trees in the City of Melbourne, more than 33,000 under local government control elsewhere in the state, and at least that many again on private land, representing about 12 varieties from Europe and North America. The Dutch elm disease has decimated elms throughout their native ranges in Europe and North America, but it has not yet arrived in Melbourne – although it is present in Auckland, and the beetle that spreads the fungus has been in Melbourne since at least 1974. Special measures are being taken to protect Melbourne's elms as they represent a very valuable contribution to preserving *global* biodiversity.

Apart from a concern for global as opposed to local biodiversity, however, many people also value exotic species as pets or inhabitants of zoos, parks or gardens for reasons that are probably similar to the reasons people value native biodiversity. They like to look at, study, marvel at and experience these species of plants or animals. They like to show them to their children, so that the kids learn that zebras, deciduous trees and so on are not just found

²⁷ We would argue that this is primarily because they are an unowned resource – an issue discussed more extensively in chapter 2.

in books but really exist. It undoubtedly is not exactly the same type of experience people have with native species, but that doesn't make it any less worthy of recognition as a source of value. And while elitist environmentalists might want to argue that it is of no value to experience an African animal except as a wild beast on the plains of Africa, that does not give them licence to deny others the opportunity to see such species at relatively low cost.

There is also an instrumental reason – that is, a means to an end, rather than an end in itself – for valuing conservation of foreign species in domestic locations. Experience gained in captive breeding, treating diseases, altering diets or behaviour and so on can often be useful in intensive captive breeding programs undertaken to save endangered native species.

Biodiversity and the “lock it up” approach to conservation

It often seems to be taken for granted that maximising the biodiversity of native plants and animals is equivalent to maximising the area of land that is “locked up” and left as free from human interference as possible. While this might seem to be a plausible hypothesis, it is something that is not self-evidently true. For example, the provision of permanent stock watering points in outback Australia has permanently raised the range of niches available to be occupied by native wildlife and has no doubt increased local biodiversity in some locations. Similarly, the basic premise of species recovery programs is that active intervention can increase desirable biodiversity.

Another reason the “lock it up” approach does not necessarily raise native biodiversity is the presence of ferals. Usually, “lock it up” does not involve building a fence that is able to keep out the exotic predators doing so much damage to plants and animals in New Zealand. Massive invasion of “protected” areas by weeds and animal pests could result in a large decline in native biodiversity. This point was made in a seminar presented at Tasman Institute on 14 March 1995, by Dr. John Wamsley, founder of the private Warrawong Sanctuary in South Australia (discussed further in chapter 5):

A colony of rare or endangered mammals is discovered somewhere. The colony is surviving because it is receiving a management regime that allows it to survive. The land holder may not be doing it for the benefit of the colony. He may be shooting foxes because they kill his lambs. He may be shooting goats because they eat his grass. Nevertheless, the colony survives because of that regime. Pressure is put on by the greens. The land is made a National Park. All

management ceases. The ferals take over. The colony disappears. That scenario is happening again and again across Australia.

A similar point was made by Beattie (1994):

When threats to native plants and animals are publicised, people are keen to see something done. Environmentalists and conservation scientists argue that endangered native plants and animals must be protected. Protection means placing native plants and animals under government control and leaving them in their so-called pristine state. Unfortunately this sort of protection doesn't work. Native plants and animals are now being protected to death.

Like Dr. Wamsley, Mr. Beattie has started a private sanctuary at Banks Peninsula near Christchurch (also discussed in chapter 5).

The principal reason that the "lock it up" approach may not increase native biodiversity is that before an area is "locked up", the environment usually has already been affected by human activity. Removing the human activity then represents a change to the system, and any such change is likely to impact on the survival of the remaining plants and animals.

Species that were adversely impacted by the previous human activity may have already disappeared. If so, the ecosystem cannot return to its pre-intervention state if the human activity is removed. The species that are left may no longer be well-adapted to coexist with each other in the absence of the human activity. When the human activity is eliminated, the system goes through another series of changes that may produce more extinctions.

Even if few critical species have been lost, so there is some hope that the system might return to some approximation of its state before the human activity began, the convergence may take a long time. In the meantime, the evolution of the ecosystem will pass through a series of states that are different from anything that was experienced before and thus may still lead to extinctions.

In a seminar presented at Tasman Institute on 13 November 1996, Dr. Mick Tanton, Senior Lecturer in the Department of Forestry, School of Resource Management and Environmental Science at the ANU, stated:

It is difficult to predict the effect on conservation outcomes of changes in management regimes. The change in seral succession in the forest will lead some populations to be reduced, others to be increased. The overall effect on biodiversity is uncertain. P. Christensen [in an unpublished report to State Forests of NSW] has argued that it would be "foolhardy" and "reckless" to bar practices from state forests without first setting up moratorium areas to assess the extent to which present populations of animals are there because of 100 years or more of such impacts. I would add "irresponsible and mischievous". To set aside such areas in reserves and to forgo any management may be ideologically sound, but

ecologically disastrous for many species that currently are present in the harvested and burnt forests.

Dr. Tanton suggested that narrow perspectives are resulting in the pursuit of simple answers to complex problems:

The value of past forestry operations in maintaining many species associated with successional stages is known. Locking up areas is disastrous for a range of rare species which require seral stage forests. We need to take a broader, holistic view. The precautionary principle,²⁸ properly understood, requires continued management. If maintaining diversity is the goal, continued grazing, logging, and so on is required in native forests. This benefit may even require judicious use of logging and burning in national parks. It will be regrettable if some species were to disappear because political expediency and restricted views of some pressure groups took precedence over fundamental ecological principles.

A related issue that is more of a problem in Australia than New Zealand is fire. Leaving a national park unattended in Australia can lead to a massive build-up of fuel (fallen logs, long grass and so on). When the inevitable fire happens, it can do enormous damage to native plants and animals. A regime

²⁸ For further discussion of the precautionary principle, the reader is referred to Wills (1997). The Intergovernmental Agreement on the Environment (IGAE), signed in Australia (by representatives of the different levels of Australian governments) in 1992, states the principle as follows:

Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:

- (i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and
- (ii) an assessment of the risk-weighted consequences of various options.

Ian Wills comments:

Who is to decide what constitutes "serious environmental damage", what is "irreversible", and on what evidence? How are "risk-weighted consequences" to be assessed? The implied degree of discretion on the part of decision-makers would not seem to make for certain or stable environmental management rules. Nor is it clear why the IGAE specified "serious or irreversible environmental damage" ... Precautionary principle advocates give no reasons why we should worry about "serious" environmental damage which can be reversed, or irreversible damage that is not "serious". In its non-absolute form, the essence of the precautionary approach is not a rejection of scientific and economic analyses, but the reversal of the burden of proof...

However, the precautionary principle represents a very risk averse decision rule. More generally, decision-makers would be willing to trade-off the costs of delay against the potential benefits. The rule also focuses all attention on avoiding potential degradation rather than seizing opportunities to promote beneficial outcomes.

of many smaller managed fires can achieve better outcomes in terms of preserving native biodiversity.

Attitudes to fire can be used to illustrate another important point. Some radical environmentalists have suggested that only fires starting from a natural cause (such as a lightning strike) should be allowed to burn. Any and all fires started by humans should be extinguished. This assertion represents a clear confusion of means and ends. Surely, the relevant issues are what damage (or benefit) will the fire bring and how costly will it be to extinguish. The answers to these questions are unlikely to be related to the cause of the fire – and in any case could be assessed directly without any reference to the originating cause.

Dr. Alston Chase²⁹ discussed some similar examples from the United States at a recent seminar in Canberra organised by the Australian APEC Studies Centre (Chase, 1997):

Yellowstone. In 1967, National Park Service authorities introduced a management scheme called “Natural Regeneration”. The intention ... was not to “Play God” but to practice “benign neglect”. Nature, it was assumed, “knows best”. We don’t know enough to justify intervention in biotic processes. And if we let nature take its course, the ecosystem will take care of itself.

This decision ignored the fact that aboriginal Americans had been evicted from the park in 1876, and that these peoples had played a critical role in keeping ungulate populations in check and in modifying the landscape, through burning. So natural regulation was historically unprecedented ...

Protected from predation, elk and bison multiplied ten-fold in twenty years. Bison overgrazing destroyed natural grasses. Browsing elk virtually eliminated aspen, willow and alder – plant species critical to the survival of mammals that use riparian areas, such as beaver, otter, white-tail and mule deer and grizzly bear. As streams became denuded of the cottonwood trees whose roots had provided structural strength to banks, these shores collapsed, and soil erosion became pandemic.

Thanks to the absence of aboriginal burning, the build-up of combustibles in the forests continued, until, in 1988, a giant conflagration erupted. A million acres burned. Crown fires, burning too hot, sterilised soils and further accelerated soil erosion.

Old-growth forests in the Pacific Northwest. For decades, the United States Forest Service, following various so-called “sustainable yield” policies, practised forest conversion in this region, clear-cutting old-growth to stimulate regeneration of shade intolerant Douglas fir. Its goal was sustainable

²⁹ See also Chase (1986, 1995).

development – to increase growth rates in order to ensure a steady supply of timber in the future.

And by the late 1970s, this strategy was succeeding. But then the goal posts were suddenly moved. What under an earlier set of values (maximising timber production and upland game species) had been considered “sustainable” was then judged by a new value, namely the desire to preserve old-growth. And by this yardstick, service policies were not “sustainable” at all.

The change occurred when a graduate student at Oregon State University, Eric Forsman, began studying a little bird known as the Northern spotted owl, which, he concluded was an “old growth” species. And therefore, Forest Service harvests jeopardised its survival. On the basis of Forsman’s study, environmentalists went to court, demanding the bird be listed as threatened under the *Endangered Species Act* and that logging be halted to save the creature.

Eventually, environmentalists won. Timber harvests on federal lands dropped from 5.4 billion board feet in 1989 to less than 800 million in 1994, and continued to drop ... As public harvests declined, timber prices rose, encouraging private land owners to log their own stands without attention to ecological consequences. As forests were left unthinned, wildfires spread. Thousands of acres of supposed spotted owl habitat went up in smoke ... It [Forsman’s study] had tracked a mere six pair of owls. No one knew how many such birds there were, nor whether old growth was a source or sink for these creatures. Later studies would find over 12,000 owls. And evidence would mount that the preferred habitat of these birds were cut-over lands, not virgin forest. But unfortunately, *Endangered Species Act* provisions against disturbing the owl’s officially designated “critical habitat” will not permit the kinds of research needed to disconfirm this possibility.

In summary, it is at least debateable whether the goal of preserving native biodiversity always leads to the policy prescription of “locking up” land into reserves. Even if it did, however, there is another criticism of this approach. We have argued that biodiversity conservation is at best a *proximate* goal representing what people value in New Zealand ecosystems.

Some of the value that people obtain from conservation activity might come from people simply knowing the resources exist. For example, many people in New Zealand support the kakapo recovery program although they probably never will be able to see a kakapo in the wild.³⁰

A considerable amount of the value from conservation, however, will surely come from people seeing, hearing and experiencing the wildlife on visits to the reserves. A mentality that the resources need to be “locked away” and protected from negative impacts of people as much as possible

³⁰ The ability to see them on television no doubt helps greatly with maintaining such support.

will not lead to people being encouraged or helped to visit the “protected” areas. Only an anointed few who can hike the necessary distance, camp out overnight or spare the time to queue for scarce boat tickets will ever see the areas. This is unlikely to ensure that the resources provide the maximum possible value to the people of New Zealand.

Auckland conservation scientist John Craig recently made a related point (Craig, 1997):

We need to address underlying societal and economic values and ensure that by managing bird populations we are providing a product to an increasing range of customers. When there is increasing demand for enhanced bird populations and people are keen to pay to see this happen we will have been successful.

Craig argues in his paper that “people alive today have control of resources” and if resources are not allocated in a way that provides value to those people, pressure will be brought to bear one way or another to have the resources reallocated. In the conclusion to his paper, he states:

For those of us who believe so strongly in the importance of birds (or other species) we need to look carefully at what we are managing and the societal context in which we are managing. As long as natural systems are seen as separate from people and outside of our economic measures, gains will be small, slow and difficult.

In the end, biodiversity of natural species is only valued by society because people value it.

Biodiversity as a means to an end

In addition to valuing biodiversity of native species in its own right, many people could value biodiversity for *instrumental reasons* – because it is a means to various ends. A recent paper by Costanza *et al.* (1997) evaluates 15 categories of *indirect* services provided by ecosystems. Their table 1 is summarised as Table 3.1.

The valuation method used by Costanza *et al.* (1997) is, of course, open to a number of criticisms but the paper represents an interesting attempt to value the indirect services provided by ecosystems. It will no doubt be improved upon in years to come. The relative magnitude of the estimated values might be more robust than the actual numbers. The authors estimate that nutrient cycling provides almost 60% of the total indirect value of ecosystem services. Other highly valued services include waste treatment (8%), disturbance regulation (7%), water supply (6%), food production (5%), water regulation (5%) and gas regulation (5%). They also estimate that about

60% of the indirect value is contributed by marine systems, with forests and wetlands contributing about 17% each.

TABLE 3.1: Indirect or instrumental ecosystem service categories valued by Costanza *et al.* (1997)

<i>Ecosystem service</i>	<i>Ecosystem functions</i>	<i>Examples</i>
Gas regulation	Regulation of atmospheric chemical composition	CO ₂ /O ₂ balance, O ₃ for UVB protection, SO ₂ levels
Climate regulation	Regulation of global temperature, precipitation	Greenhouse gas regulation, effects on cloud formation
Disturbance regulation	Modified response to environmental fluctuations	Storm protection, flood control, drought recovery
Water regulation	Regulation of hydrological flows	Providing water for agriculture, industry, transport
Water supply	Storage, purification, retention of water	Water provided by watersheds, reservoirs, aquifers
Erosion control, sediment retention	Retention of soil within an ecosystem	Preventing loss through wind, runoff, silt in lakes
Soil formation	Soil formation processes	Weathering of rock, organic material accumulation
Nutrient cycling	Nutrient storage, cycling, processing and acquisition	Nitrogen fixation, other elemental cycles
Waste treatment	Recover mobile nutrients, breakdown compounds	Waste treatment, pollution control, detoxification
Pollination	Movement of floral gametes	Facilitating plant reproduction, including crops
Biological control	Dynamic regulation of populations	Predator control of prey species, herbivores
Refuges	Habitat for resident and transient populations	Nurseries, habitat for harvested species
Food production	Gross primary production extractable as food	Production of fish, game, crops, fruits, nuts
Raw materials	Gross primary production extractable as raw materials	Production of lumber, fuel, fodder, fibre
Genetic resources	Sources of unique biological materials and products	Medicine, genes to resist diseases, horticulture

In a similar vein, the DOC Fact Sheet, *A Biodiversity Strategy for New Zealand* (in Department of Conservation, 1996a), argued that biodiversity was important:

- for providing “fresh air, clean water and fertile soil”;
- because it was “the basis of the interconnected web of life on earth” and is “essential for the survival of all species, including people”;
- as “the source of our foods, medicines and industrial raw materials”; and
- since New Zealand’s “economic prosperity is dependent on it, from agriculture to tourism... Sustaining and protecting New Zealand’s biodiversity is an essential part of an overall global strategy for survival”.

It is questionable, however, whether *native* biodiversity is *necessary* for providing fresh air and fertile soil in New Zealand, as a source of food or other raw materials, or as an important element in the prosperity of New Zealand agriculture. Surely, plantations of exotic trees (not to mention other vegetation) can also provide fresh air, while the quality of the soil that New Zealand agriculture depends upon is probably governed much more by an ecosystem of introduced plant and animal species. Similarly, while the biological world is undoubtedly the source for many foods, medicines and industrial raw materials, in New Zealand few of these species are natives. In addition, while the *total* value of the indirect services provided by ecosystems is undoubtedly large³¹ for many resource allocation decisions we are interested in the value of *marginal changes* in resource use and these typically will be much smaller.

It is quite likely that the stability or productivity of the ecosystems underpinning New Zealand agriculture, and the prosperity of the agricultural industries, could be improved upon by agricultural scientists and farmers paying more attention to ecological factors. Despite the fact that there is a large amount of agricultural research, and New Zealand is at the forefront of some of this, advances in the biological sciences have also been very rapid in recent decades. Greater use of biotechnology in agriculture is undoubtedly a potential growth industry.

For example, greater reliance on natural processes might be preferable to chemical fertilisers and insecticides as means of maintaining soil fertility and combating insect pests. There could also be reasonable returns to

³¹ Costanza *et al.* (1997) estimate it at about 1.8 times GNP for the world as a whole.

investments in understanding interactions between New Zealand native species and the exotic species that so much farming and forestry relies upon.

Genetic engineering might also enable native species to be adapted to increase their economic value – for example, by making native trees grow faster or increasing the value of native plants for gardening purposes. Some New Zealand native species might also prove to be a valuable source of medicines – as has been the case with natives from many other countries. Some drug companies have invested in preserving rainforests, for example, because they have been granted property rights to new drugs based on the native species they find there. This might be an argument for allowing patents to be registered for drugs based on New Zealand species.

Native plants and animals that are good sources of foodstuffs might also be allowed to be farmed. In Australia, there is a growing demand for “bush tucker”, including kangaroos and emus. There has also been a strong movement to encourage the planting of native shrubs and trees in gardens – thus providing additional habitat for native insects, birds and other animals, even if the cultivated species are hybrids or otherwise genetically altered varieties.

Nothing will ensure the survival of native species better than turning them into marketable plants or animals. An important proviso in this regard, however, is that effective enforcement is needed to ensure harvesting of wild populations does not destroy both the market value of the farmed or cultivated species and the chances of survival of the wild populations themselves.³²

Maintaining the productivity and prosperity of the agricultural industries in New Zealand is also a good argument for maintaining a genetically diverse stock of the plants and animals upon which those industries depend. If farmers could be charged for access to new genetic material, however, the market ought to provide incentives for at least some people to maintain diverse stocks of economically important species such as sheep, cattle, deer, horses, pigs, chickens, wheat, rice, maize and so on. A potential issue here is that while artificially engineered genes can be patented, naturally evolved ones cannot. The lack of property rights to such genetic materials may have reduced incentives to invest in them. If property rights in natural genetic material are not contemplated then there might be an argument for subsidising the hoarding of such material by, for example, placing levies on the affected industries to pay for gene banks or special breeding stock.

³² Essentially the same issue was discussed in chapter 2 in the context of fisheries.

None of this is very relevant, however, to conservation of New Zealand *native* biodiversity – particularly in separate areas of land managed by DOC. If anything, it argues for closer integration between conservation and the rest of the economy so that preservation of native species becomes an integral part of the normal functioning of the economic system.

Of all the instrumental reasons for preserving biodiversity mentioned above, perhaps the one that has most force as a reason for preserving marginal tracts of *native* biodiversity is the need to provide clean water. This need may often be provided at lowest cost by retaining native vegetation in functioning ecosystems within the relevant catchment areas or in riparian zones. This is not to say, however, that all existing native biodiversity is crucial even for providing this resource. In urban areas in particular, better management and operation of water distribution and sewage treatment systems, for example by:

- preventing the discharge of raw or partly treated sewage into the ocean;
- extending and better maintaining water distribution networks to reduce contamination and waste;
- using modern water treatment technologies to purify water to a very high standard; and
- replacing ground water by surface collection and storage

could achieve far more for urban water quality standards at lower cost than maintenance or extension of native habitats in water catchment areas. More generally, reforming institutions to encourage greater private sector involvement in water supply and sewage treatment, for example by using concessions or contracting out, could be the single most effective action governments could take to ensure quality supply of this important resource at minimum cost.

In summary, native biodiversity could assist with providing a number of environmental goods and services. However, for the marginal adjustments of resource use normally under consideration, native biodiversity is almost surely a minor factor in ensuring an adequate supply of any of these goods or services. The *marginal* instrumental value of *native* biodiversity is therefore not likely to be very large. The major motivation for conserving marginal or additional tracts of native biodiversity has to come from its direct value to people rather than its indirect or instrumental value.

ECOLOGICAL STATES AS THE VALUED ITEMS

Another notion of “intrinsic value” that we entertained was that particular ecosystems as a *whole* had value. Again, while we reject the notion of “intrinsic value” as a justification for allocating resources in society, individuals could personally value “particular ecosystems” rather than the individual species, or the diversity of species, that make them up. This is perhaps analogous to Ian Atkinson’s (1996, pp 15–16) claim that “apart from species, what people do get fired up about is the attributes of place, special places in particular, and this is why I’m right behind DOC’s efforts to identify special places and look after them”.

In its most radical form, “restoration ecology” attempts to return natural ecosystems to some state they were presumed to be in prior to a time when extensive human influence was experienced. This idea makes little sense in a place like Africa, where people or their relatives have been a part of the ecosystems for a long time, or a place like Europe where people have been a part of the ecosystems since the end of the last ice age and the land mass was re-colonised by plants and animals as the ice receded. It is only imaginable in a country like New Zealand, where human influences are relatively recent.

Even in New Zealand, however, it is not possible to return ecosystems to conditions they may have been in before the arrival of humans. Key species, such as the moa, have already been lost. Introduced exotic species are continuing to do substantial damage to native species and probably will never be able to be exterminated on the mainlands. Even places like Mapara (discussed above) will need continued management and vigilance to control feral animals and weeds.

More fundamentally, the idea of returning an ecosystem to a particular state is suspect on the grounds that it treats ecosystems as static. Ecosystems are continually evolving and reacting to changes and were doing so even before the arrival of humans in New Zealand. Which of these potential past ecosystems are we going to try to restore? There would seem to be no rational basis within the “restoration ecology” paradigm for favouring any one stage in a dynamic path of succession of plant and animal communities as environments continually react to various exogenous shocks.

On the other hand, if we recognise that only human values can determine how humans manage environments, we need to confront the fact that humans may prefer environments that do not resemble any previous pre-human state. For example, many conservation areas also contain significant cultural resources for both Maori and Europeans. Attempting to restore the

natural ecosystems would involve obliterating the historical and cultural resources that also have value to people.

A recent example in the United States involves a conflict between recreational (and other) use of an area and demands that it be “restored” to something resembling a prior state (Brooke, 1997). The Sierra Club has proposed draining Lake Powell, the second largest artificial lake in the United States. Lake Powell was formed about forty years ago when the Colorado River was dammed by the Glen Canyon dam about 50 miles upstream from the Grand Canyon National Park. Brooke (1997) reports that:

Lake Powell has ... become a runaway recreational success story. Last year 2.5 million people visited this remote lake five hours north of Phoenix ... almost 1.8 million camped overnight, just under the 2.1 million who stayed at Yosemite National Park, the nation’s most popular camping area. The lake fuels an annual local tourist economy of half a billion dollars.

Brooke (1997) also reports that the dam provides other valuable services:

Lake Powell has served for the last 20 years as a massive water bank for flood control, for hydroelectric power and for guaranteeing steady water supplies to Phoenix, Las Vegas, Nev., and Los Angeles ... Another group that fears the Sierra Club’s proposal is the Navajo, the largest American Indian tribe. About 1,200 Navajos work at a coal-fired electricity plant and at a coal mine that feeds the plant, both of which might have to close if the lake were drained ... Designed to use a constant supply of clear lake water for steam and for cooling, the plant could not run on erratic supplies of muddy Colorado River water ... With the dam and the plant, Page [the local town] supplies power to about 4 million people.

The environmentalist opposition to the lake essentially amounts to saying that it should be removed because it is “unnatural”:

The Glen Canyon dam, one of the last to be built on the Colorado River, has long been anathema to hard-line environmentalists. In the novel “The Monkey Wrench Gang”, Edward Abbey discussed blowing it up. In 1981, Earth First, a confrontational group, made its political debut by unfurling a 300-foot long piece of plastic down the dam’s wall to simulate a massive crack ...

“The primary reason is recovering Glen Canyon,” said Adam Werbach, who is Sierra Club’s president ... “I don’t want to be known as part of the generation that killed the Grand Canyon,” said Mr. Werbach ... “There is the destruction of the beaches, and the die-off of the fish from the cold water coming out of the dam.” This water, which flows out of the middle of the 500-foot deep lake at 47 degrees, has pushed to the edge of extinction several warm-water species of fish that are unique to the Grand Canyon.

Leaving aside the value of other benefits that would be lost, it is doubtful whether removing the dam even would produce net environmental benefits:

But people here say that the canyon is lost forever. Draining the lake, they say, would create a massive environmental mess – the odour of millions of rotting fish, a white “bathtub ring” of dried salt stretching for 2,000 miles around the red rock shoreline, an air pollution problem from fine sand blowing off the old lake bottom.

In addition:

the new lake has become a popular wintering ground for bald eagles, a threatened species, and home to the largest population in the lower 48 states of peregrine falcons, an endangered species. The endangered species argument cuts both ways, people here say. Referring to one of the endangered fish species, Mrs. Stoddard [who runs the Lake Powell Yacht Club] said, “Why choose a humpback chub over an eagle?”

Yet the major loss would be the destruction of the “nation’s second most popular camping area”:

With 400,000 boats launched on Lake Powell every year, local people also argue that draining the lake would destroy the recreational economy.

Mr. Werbach says river rafting, hiking and mountain biking could take the place of flat water boating.

But the old landscape and ecosystem were not big tourist draws. Before the lake was formed, Rainbow Bridge National Monument was visited by only several hundred people a year, who arrived on foot or on mule. With a boat dock now only a few [yards] away, 325,000 people visited the 290-foot high natural arch last year.

To see that the environmentalist opposition is not based on measuring the values of alternative uses of resources, one only has to imagine how opinions would change if the dam were “natural” rather than “artificial”. Suppose, for example, that a lava flow had blocked the canyon to create a dam and a lake that was, as with the present Lake Powell, the second most popular camping area in the nation. Suppose a mining firm then discovers valuable minerals in the lake floor and proposes draining the lake to facilitate mining. Can anyone believe for a moment that the Sierra Club would not vigorously fight the proposal?

There is also an alternative strategy for managing conservation areas that is represented by the case of Tiritiri Matangi Island discussed in the previous chapter. Islands out of the swimming range of introduced mammals have great value as conservation areas for native animals and plants. Using these islands to preserve native species *including species that were never present on the island at any time in the past* could make them more valuable as *conservation areas* than would any attempt to “restore” some past historical state.

An interesting example of this problem in the New Zealand context is Motutapu Island in the Hauraki Gulf. Challis (1996, p 50) describes the situation quite well:

Mid-nineteenth century records indicate that the island was then largely deforested as a consequence of centuries of Maori occupation, and remained so because of European farming. About 600 years ago, Motutapu was covered in ash from eruptions of adjacent Rangitoto. Any forest surviving this event is likely to have been soon cleared. There has been no general natural succession since the eruptions, although remnants of old coastal pohutukawa forest, and mixed lowland forest regenerated in the European period, exist. Should the island remain as it is now, or should it appear as it might have been in AD 1840, 1640 or 1000, or should it be allowed to revert without intervention, or should a more varied strategy be adopted? Whatever the outcome, the vegetation will be a human construct. Conservation managers are operating within the ancient tradition of environmental modification in accordance with human preferences. Any rehabilitation project requires integrated cultural, historical and ecological research if the landscape is to be clothed appropriately and if development in the name of conservation is not to be destructive of significant humanly-induced habitats and landscapes.

Miller, Craig and Mitchell (1994) propose that the most valuable use of Motutapu and the connected Rangitoto islands would involve:

- pest eradication;
- revegetation of large areas;
- the reintroduction or translocation of rare or endangered species that may *or may not* ever have been on the islands;
- restoration, maintenance and full interpretation of representative cultural, archaeological and historical sites; and
- continued open public access.

They propose a planting strategy that includes the creation of wetlands by raising water levels in “swampy, silted up areas, pugged by stock”. They also comment (pp 76–78):

We have no plan to re-create a forest on Motutapu. The composition, distribution and relative abundance of species in the original forest³³ are unknown. Instead we suggest an ecologically directed revegetation project, using native species that are known to have been on the island in the past ... We suggest planting wind and salt-tolerant shrubs around the cliffs ... and ... a buffer zone of ... shrubs along

³³ One could ask whether it is even reasonable to speak about a “single” original forest – perhaps “any pre-historic forests” would have been a better choice of words.

the cliff tops, so that birds will then disperse the seeds into inaccessible places ... In existing forest fragments ... a buffer of shrubs could be established around the trees and natural processes allowed to proceed. We do not advocate planting within the forest remnants. Exotic trees should gradually be replaced with natives, although at first exotics can provide shelter for establishing native plants.

They observe (pp 77–78):

There are some people who will object to an “unnatural” revegetation program ... Given that native habitats and species are being lost at an alarming rate, we feel that there is no time to wait for regeneration to start “naturally” on the bare land. Native plants and animals need those habitats now.

The strategy they propose for translocating endangered and rare species would no doubt excite similar opposition from radical restoration ecologists (p 79):

Kiwi are unlikely ever to have been on Motutapu, but we recommend they be included as a way of providing additional refuge for this national symbol. Rock wren and Snares, or Chatham Island, snipe will be needed to replace equivalent species long since extinct; they also allow for a more complete trophic structure [or food chain] within the community than would otherwise be possible. We recommend that omnivorous and often predatory species, such as the weka, should not be released to ensure protection for reptiles, frogs and large insects.

Reflecting their interest in providing opportunities valued by people, the authors note (p 79):

Because we advocate that the conservation development of Rangitoto and Motutapu be for the public as well as for ecological reasons, planting should stop within 20m of selected high areas and viewpoints, and walking and vehicle access tracks should be bulldozed before planting begins, and subsequently kept clear.

Rather than saying “for the public as well as for ecological reasons” we would, however, have preferred to say “for the public, including their desire for ecological restorations among other values”. Also, the authors are perhaps inclined to belittle the interest in translocating “charismatic bird species” even though the emphasis on such species appears to accord with the public interest, while the reasons they give for an alternative focus are less centred in human values than we would prefer (p 79):

There has been a tendency to focus on particularly charismatic bird species when considering animals for translocation. However there are many lizards, such as Whitaker’s skink, and frogs whose existence is under threat, that were once on these islands, and which would be needed to complete a total ecosystem restoration. Perhaps one of the most neglected categories in the management of island releases has been the invertebrates. Invertebrates are a significant

component of ecosystems, as they contribute to pollination, decomposition and nutrient cycling, and also provide food for birds and reptiles. For this reason we suggest that invertebrates are also considered for species translocations, once mammals have been eradicated. Our suggestions of invertebrates are purely speculative as there is no record of past species. Moreover we lack the expertise to devise a full invertebrate plan and therefore suggest only those that will have a high public profile.

On the other hand, we are in considerable agreement with their discussion of the need for full interpretative facilities (pp 80–81):

Without interpretation, New Zealand's heritage is like a full bottle without a label, valuable only to those who already know what it is. The value of the resources presently on Rangitoto and Motutapu, and of any future restoration there, will be appreciated by the general public only if there is full interpretation. The educational opportunities are boundless; it is a chance to capitalise not only on the fascination of people in general for interacting with animals and plants, but also their desire to identify with the young, but rich, human history of New Zealand ... Interpretation of aspects of all these historic features will add to the rewards for visitors, even during the early years of the program, when revegetation is in its infancy.

The authors also emphasise that conservation needs to recognise what people value (p 81):

People in New Zealand have a growing awareness of and conscience for environmental issues, and increasing numbers of them want to experience conservation at first hand. Opportunities to take part in activities such as planting or watching rare species being released are eagerly seized upon. Many other people simply want to experience the pleasure of seeing native species in a natural environment.

Sedjo (1995, pp 19–20) provides a similar critique to ours of ecological restoration, or “ecosystem management”, in the public forest lands of the United States:

Public forests were established to generate benefits for all citizens, and in the past the objectives of forest management reflected a degree of political consensus. In recent decades, these objectives have been codified in congressional legislation: the *Multiple-Use Sustained Yield Act* of 1960, as well as the *Resources Planning Act* of 1974 and the *National Forest Management Act* of 1976. By contrast, forest management as practised by the Forest Service in the mid-1990s has no clear political or social mandate. Indeed ecosystem management marks a sharp shift away from legislatively supported multiple-use forestry – which recognises many biological, social, and economic values – focusing instead on an arbitrary forest-condition objective that, in essence, is defined by biological considerations only

... ecosystem management could ... constantly alter the goods that forests provide and do so without reference to public opinion ... And if there appears to be some public support for returning forests to a specified condition of fewer human impacts, this condition could be added to the list of existing management objectives, such as producing timber and providing recreational opportunities. The advantage of multiple use management is that it tries to accommodate additional objectives and make trade-offs among them in order to increase social values. Such an approach, although sometimes flawed, is much more likely to benefit all members of society than ecosystem management, which makes one objective dominant and essentially impervious to trade-offs ... ecosystem management is rigid in identifying objectives and essentially arbitrary.

Farms and other exotic environments

Another problem with “ecological restoration” is that, as with the biodiversity objective discussed above, it only recognises natural ecosystems as having value. Yet there are many environments constructed by humans in New Zealand that also have great value to many people. Most people value resources such as parks in the major cities, botanical gardens, beaches, sport and recreation facilities and venues, and cultural, historical and archaeological landmarks for other than instrumental reasons, and for reasons somewhat akin to the reasons they value natural environments. Obliterating these changes and returning the areas to a prior natural state would undoubtedly represent a net destruction of social value.

There is even a great deal of interest in heavily modified farm environments in New Zealand. Most people find bucolic country scenes – with livestock dotting green fields and occasional clumps of trees, perhaps with a tree-lined river and majestic mountains in the background – as a beautiful sight that is worth preserving every much as a native forest or swamp is worth preserving. In fact, native vegetation in some of these locations could do more to obscure the view, or reduce visual variety or impact, than the existing modified vegetative cover. Restoration to something approximating conditions prior to human intervention could *reduce* net social value. Similarly, many people enjoy the variety provided by the autumn colours of introduced deciduous trees in both urban and rural environments.

Of course, the benefits provided by these ecosystems of introduced species need to be balanced against their possible threats to native biodiversity (which people also value), but the benefits should nevertheless not be denied. The appropriate response is to balance out competing uses of resources to obtain the maximum social value. It is simply not true that an

objective such as total value to the people of New Zealand could be maximised by assigning a positive value exclusively to natural ecosystems.

ALTERNATIVE RESOURCE USE IN CONSERVATION AREAS

While people value native plants and animals, native ecosystems and “special places”, they also value many other things, including many other uses of resources. In order to provide maximum value to the people of New Zealand from the resources available to them, the various alternative possible uses of resources have to be weighed against each other.

Optimal resource use often involves multiple use of the same resources. Just as the demand for variety fundamentally follows from the decreasing marginal value of consumption of any one good or service, the optimality of joint resource use follows from the decreasing marginal productivity of using any one resource in any one activity. As more of a resource is used for any one purpose, additional use of the same resource produces less of an increment in desired output.

Consider, for example, the use of islands for conserving native New Zealand wildlife. The most suitable islands will tend to be used first, giving large increases in conserved species for a given area of land devoted to that purpose. As more islands are devoted to that purpose, however, adding another one will result in less of a gain in the number of species, or variety of habitats, preserved in return for a given sacrifice of alternative outputs.

Another example would involve the use of labour and other resources to eradicate feral animals. With few resources allocated to controlling pests, a small increase in resources devoted to the activity may give a large gain in reduced pest densities. As more pests have been eradicated, however, larger amounts of resources will be needed to achieve a given further reduction in pest densities.

A consequence of decreasing marginal productivity of resources devoted to a particular activity is that the marginal costs of producing additional output of any given good or service increase as the output increases. As the level of biodiversity already preserved is greater, for example, the costs of further increasing the amount of biodiversity preservation also increase.

The cost of conservation

What are some of the costs of conservation? An obvious cost, of course, is the direct cost to the agency (like DOC) undertaking the conservation activity. As more areas are preserved, the number of staff and other resources needed to

manage them increases – and probably at an increasing rate. The earliest areas to be set aside will tend to be ones that require less management per unit of conservation output produced. In addition, as the number of employees increases, the layers of bureaucracy increase and the ratio of head-office to field staff rises.

Another element of the cost of conservation is the denial of alternative preferred uses for resources. This is known as the “opportunity cost” of an activity and may not be reflected in the accounts of DOC. In a normal market situation, a user of resources has to bid them away from alternative potential users. The price paid for a resource will reflect the value of those resources in their next best alternative use. If total social value is to be maximised, the actual use of a resource has to deliver greater value than its next best alternative use. This will be the outcome when benefits to consumers are no less than revenues, and revenues in turn are required to at least cover all costs including opportunity costs.

Sometimes, however, the costs of using a resource are not reflected in market prices. For example, markets do not direct the allocation of resources within firms. A manager allocating time to one activity could instead be doing something else. The value of the opportunities forgone represent the opportunity cost of the activity that is undertaken. They are a “shadow price” that ought to be counted in the cost of undertaking a particular activity if resources are always to be allocated to their most preferred use.

Similarly, when resources can be commandeered by government without having to be bid away from alternative users, the accounting costs will not reflect the opportunity costs. Alternative uses of the resources will be denied and there will be no measure of the value of those alternative uses. The budgetary cost of the policy will not represent its full cost to society. Resources can easily be allocated to uses that are less valuable than the alternatives.

Sometimes it is possible to measure the likely value of the forgone opportunities – and thus the opportunity cost of the policy. In many cases, however, there will be insufficient information to ascertain the costs. Often government takes action to preclude society from ever discovering what those costs are likely to be. For example, mining exploration on certain land may be banned, so that the society will never discover how valuable the land might be if it were used differently. The implicit assumption appears to be that no matter how valuable an alternative use might be, it will never be valuable enough to change policy – so we don’t want to know about it!

Other opportunity costs that are difficult to measure include the costs of delay in commencing activities. Firms may have to engage in expensive and time consuming litigation in order to obtain permits or consents to undertake projects. Even if the final value of the project is not much affected, delaying receipt of those benefits represents a real cost to society since current benefits are always preferred over future benefits. The expectation that there will be delays or obstacles to undertaking projects is also likely to discourage some entrepreneurs from even contemplating the project in the first place. These lost opportunities also represent a real social cost that may be difficult to measure.

Joint production and costs

One way that the costs of conservation activity can be greatly reduced is by limiting the range of alternative uses of resources that are forgone. For example, conservation of native species can be combined to a greater or lesser extent with tourism, protection of catchment areas for urban water supplies, customary use of native wildlife, hunting and fishing, forestry, some farming activities (for example, as with the “land care” program discussed in chapter 4), gardening, the discovery of new types of drugs, and mining that leaves surface features largely intact or is accompanied by extensive rehabilitation of mined areas.

Most of these alternative uses will compromise the “conservation output” from the resource – that is, they will provide less suitable habitat for native species or they will make the experience of nature less valuable for existing users. If conservation were to be pursued at the expense of everything else, however, the denial of such activities would represent an additional cost, or “opportunity cost”, of the conservation output. A small reduction in “conservation output” to allow some of these alternative activities to proceed would then be likely to deliver large benefits to society as a whole while imposing only small conservation costs. Completely eliminating these alternative activities imposes high opportunity costs on society and is unlikely to result in an optimal use of resources.

Subsequent chapters in this report examine trade-offs between conservation and some of these alternative resource uses in much more detail. The main point we want to make here, however, is that using resources for a single purpose is often an extremely expensive way of catering to individual desires. Rarely is it optimal to allocate “all or nothing” of a particular resource to one use. That is why efficient resource use in

markets typically involves “compromise” between competing uses and joint production.

There are, of course, also exceptions to the generalisation that markets do not produce specialised uses of resources. In particular, many activities tend to be concentrated geographically. We find many manufacturing, transport and retailing activities concentrated into cities because there are gains from locating these activities near each other rather than spreading them out uniformly over the entire available land area. Similarly, in conservation there is a trade-off, for example, from concentrating a large amount of pest eradication on a particular area versus undertaking a less intensive effort over a wider geographical area. Similarly, for a given resource “expenditure” (including opportunity costs), more conservation output might be obtained in New Zealand from an intensive program focused on the offshore and mainland “islands” than from a less intensive program thinly spread over a very large area.

In order to answer questions such as these, conservation needs to be treated like a business activity. The value of the conservation outputs obtained, and the costs incurred, under different modes of organising and operating the business need to be measured. The business can then be reorganised to produce better outcomes at less cost.

Minimising production costs

As we argued in the previous chapter, minimising the costs of production is not one of the strengths of government enterprises. Although public sector managers are asked to meet customer demands at a satisfactory cost, their incentive to do so is diluted in comparison with that of commercial managers facing profit goals as bottom line performance requirements. The reasons public sector managers have weaker incentives typically include poorly specified enterprise objectives, a multiplicity of contradictory objectives, external parties’ involvement in management, inadequate monitoring of managerial performance and lack of a clear relationship between performance and rewards or penalties for managers.

The superior performance of privately owned businesses in terms of minimising production costs is not just a theoretical proposition based on an understanding of the differences in incentives and information that face private and public sector managers. As we also noted in the previous chapter, there is now a considerable body of empirical evidence showing that the potential cost differences are realised in practice. The typical result seems to be that, following privatisation, the private firm can save from 20% to 30%

on the costs of a publicly owned firm – although the gains are greater when the change in ownership is associated with a move from a monopolistic to a competitive market structure.

These arguments apply in conservation no less than in other business activities. Contracting out pest and weed eradication, the construction, maintenance and operation of tourist facilities, transport services and many other activities where the resulting markets are likely to be tolerably competitive is likely to produce substantial cost savings. Indeed, in New Zealand DOC already contracts out many of these services to private firms; and where it does not it may often be the case that the local service market is not sufficiently competitive to ensure cost savings.

Achieving cost savings is important since it enables more conservation output to be achieved for the same expenditure of resources. The waste of resources that occurs when costs are not minimised can be seen as a conservation issue almost as much as an economic one. In fact, it has been argued that the greatest “environmental problem” in the formerly centrally-planned economies of Eastern Europe was their inefficient, and therefore wasteful, use of resources.

We also argued in the previous chapter that public sector managers are likely to have much inferior information to their private sector counterparts. While decentralised markets give individuals an incentive to reveal relevant information on costs and benefits, in centralised decision-making contexts it is often in the interests of individuals to conceal information, or even provide misleading information.

In conservation, as in many other businesses, it can be very important to exploit local knowledge to achieve the best outcomes at the lowest cost. Field officers are likely to have considerable information about local habitats, the factors affecting the breeding and survival of particular species and so on. Often, this information may not be communicated to managers further up the chain of command, since there are no incentives to do so.³⁴ If passing on the information results in the local staff being asked to do more with no increase in budgetary outlays, there will be incentives to withhold information.

Another type of local knowledge about environmental matters has been referred to as “traditional environmental knowledge” (TEK) by Moller (1996). This is the understanding obtained by indigenous peoples over many centuries of interacting with the local animals and plants (pp 105–106):

³⁴ This was the case, for example, with the South Island kaka discussed above.

TEK includes systems of classification and gathering of continual empirical observations that are validated against daily, lunar and annual cycles ... Protagonists of TEK see it as the ideal mechanism for self-management of resource use that has sustainability at its core. They point to instances where TEK has been ignored and environmental damage has resulted, or where western science has validated (by its own knowledge constructs) the environmental protection outcomes that ensue from traditional methods ... Discounters of the value of TEK point out that extinctions have occurred overseas where it has been used to guide harvests.

Moller suggests that a compromise between western science and TEK might yield more satisfactory outcomes for customary use of wildlife by iwi. He proposes the “Kia Mau Te Titi Mo Ake Tonu Atu (Keep the Titi Forever) Research Program”, a joint program between the Rakiura Titi Islands Committee and the University of Otago, as a model of the type of cooperative venture that may enable the insights of both TEK and western science to be used to guide sustainable use of native wildlife.

Cost-benefit analysis

In balancing out the use of native wildlife and ecosystems for either conservation or alternative purposes, costs and benefits need to be compared. As noted in the previous chapter, this happens automatically in markets if all inputs and outputs are priced. When some inputs or outputs are not priced, however, or resources are allocated other than through market mechanisms, formal cost-benefit analyses are often used as a substitute mechanism to determine whether social benefits are at least as high as social costs. Such analyses are, however, usually a poor substitute for using genuine market mechanisms to allocate resources since they are typically based on substantially less accurate and less relevant information. They are nevertheless better than making judgments without any attempt whatsoever to compare costs with benefits or to justify resource allocation decisions on a rational basis.

The effectiveness of cost-benefit analysis in the environmental arena in particular is severely restricted by the lack of suitable measures of benefits and usually incomplete measures of costs. The cost measures often omit information about the opportunity cost of forgone resource uses. Benefit information is also difficult to obtain in the absence of willingness to pay measures as reflected in responses to real user charges.

Requiring cost-benefit analyses for conservation action would at least provide an incentive to collect data on costs and the values that people place on conservation. The latter could be done using contingent valuation studies,

for example, as in Craig *et al.* (1995a). Such surveys are not without their limitations, however, and cannot be relied upon to yield as accurate information about marginal benefits as would be revealed by real demand decisions made in a market context.

Undertaking cost-benefit analyses has an added advantage that it would enable DOC and other organisations involved in conservation activities to compare the use of resources for different purposes on a consistent basis and devise more effective internal management strategies and plans. For example, Craig (1997, p 20) notes:

Australia and New Zealand approaches to bird species recovery planning processes differ fundamentally in their approach to finance. New Zealand plans include no estimates or comments on cost. Instead, the best course of action determined without the benefit of costings is proposed. Whether any action follows depends on whether conservancies or the national office can find adequate finances. Typical business decisions on stakeholder satisfaction or even whether more of the rare bird could be conserved for fewer dollars if the actions were undertaken in a different way or at a different place are conspicuously absent ... In contrast, Australian bird recovery plans contain full projected costs (including salaries) alongside estimates of the feasibility of proposed action.

CONSERVATION IN AREAS OF ALTERNATIVE RESOURCE USE

Just as a small amount of some alternative resource uses can be combined with conservation at little cost in terms of forgone conservation output, so also can some conservation often be combined with alternative economic activities at little cost in terms of adverse effects on desired outputs from those activities. Use of native as opposed to exotic species for windbreaks or control of soil erosion on farms can provide additional habitat for native species – or corridors for moving between otherwise isolated patches of native vegetation – with little sacrifice in terms of lost farm output. Hybridised or genetically engineered native species could be used for forestry, or gardens, or as food sources in place of exotic substitutes and so on.

The obvious question is why many of these industries use exotic species when native ones would yield additional conservation benefits. While native species might be less productive in the conventional economic sense, they could be made more competitive with some additional scientific input.

One answer to this question is that the exotic species at the foundation of New Zealand agriculture and other industries based on using biological resources have been adapted for the purpose over hundreds, even

thousands, of years. By contrast, potential productive uses of native species have not had long to be developed.

In addition, we would argue that the costs and benefits of greater use of native species have been distorted by government policies. The benefits of producing conservation outcomes as a by-product of farming, forestry and related activities have been compromised by the policy of providing access to public conservation areas at minimal or zero charge to the user. Giving away the public product for free makes it difficult for a competing private supplier to make sufficient revenue to cover costs, even if the private product is preferred by consumers.

The threat that the government might interfere with the use of significant native ecosystems might also raise the cost of leaving them on private land. Outright nationalisation of private property requires compensating payments to the land holder. However, there are also many ways that governments can effectively “partially nationalise” private property without having to pay compensation. They can impose restrictions on land use, land clearance, farming practices and so on without having to pay compensation – even if the resulting restrictions reduce property values. The expectation that such restrictions might be imposed reduces incentives to maintain native species, wildlife corridors and so on. It sends a signal to land holders that the way to avoid government controls is to rely solely on exotic species.

CONCLUDING REMARKS

DOC sees its current primary objective to be the maintenance of “intrinsic values”. This is a meaningless concept, or at best something that is inherently incommensurable. An organisation with an incommensurate goal has no basis on which to judge the quality of the job it is doing, and no basis on which to set priorities or allocate resources internally. Under these circumstances, it is not surprising that DOC appears to lack focus and effectiveness in providing some key services. Specifying that DOC achieve an incommensurate goal also does not provide any rational basis on which to justify allocating resources to conservation versus alternative activities.

Conservation is a use of resources that delivers benefits to the people of New Zealand. These benefits need to be quantified so that they can be compared with alternative uses and conservation can be shown to be delivering value in the form of benefits in excess of its costs. Making it clear that conservation is a resource use on a par with other uses of resources would encourage a wider appreciation of the importance of conservation and remove it from its almost “ghetto” status. A measurable goal will also

provide DOC with a basis on which to allocate resources internally to competing ends.

To form an adequate basis for allocating resources within society, however, the goal needs to reflect the values held by the people who make up that society. Purely biologically-based measures such as biodiversity, or particular ecological end-states or habitats, are not adequate. Such measures might serve as a *proxy* for *some* of the environmental amenities that people value, but they need to be related back to the underlying values to make them useful. This can be achieved most effectively by asking people to pay for the services they want to be provided with. Any substitute mechanism, such as cost-benefit analyses based on contingent valuation surveys to measure benefits, will surely use less accurate information and will produce less satisfactory outcomes.

Conservation also needs to be better integrated with the rest of the economy. Other economic activities can often be altered slightly to deliver significant conservation benefits. Decision-makers need to be given the incentives to take these additional benefits into account and balance out conservation against other values. Similarly, resources now devoted solely to conservation can often deliver other benefits at little cost in terms of forgone conservation value.

Finally, there is a fundamental conflict between the objectives of the RMA and the objectives of DOC. This conflict has even resulted in the Minister of Conservation and the Minister for the Environment appearing on opposite sides of the same court case. The objectives outlined in the RMA make more sense. The *Conservation Act* should be amended to make it clear that conservation is a use of resources enabling people and communities “to provide for their social, economic, and cultural well-being and for their health and safety while sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations; and safeguarding the life-supporting capacity of air, water, soil, and ecosystems”. Conservation provides these benefits by retaining or enhancing “natural and historic resources for ... appreciation and recreational enjoyment by the public” among other goals.

APPENDIX – PEST CONTROL PROGRAMS

This appendix presents some of the key findings of the report on possum control in New Zealand prepared by the Parliamentary Commissioner for the Environment (Office of the Parliamentary Commissioner for the Environment, 1994, hereafter referred to as the PCE Report, 1994). The focus

is on the controversy over the widespread use of poisons to control mainly possums, but also rabbits, rats and mustelids. The reader is referred to the original, very thorough and well-documented report for further details. We also discuss some issues related to designing an efficient method of possum control.

The PCE Report (1994) showed that New Zealand was the largest user of 1080 poison in the world – perhaps using more than the rest of the world combined. Other poisons used included a number of cyanide compounds, phosphorus and brodifacoum (trade name “Talon”).

Dangers to humans, pets and livestock

- Toxic compounds related to 1080 occur naturally in about 40 species of plants from Australia, Africa, South America and India.³⁵ In these environments, there have been substantial losses of livestock, but native animals are often highly tolerant of the poisons. There are also many naturally occurring micro-organisms capable of detoxifying these chemicals. (PCE Report, 1994, pp 63–64).
- There is no documented evidence of indirect effects on human health from water supplies contaminated with 1080. The chemicals are very toxic to humans if directly consumed, however, and they should be handled with care and precautions should be taken to keep them away from children. (PCE Report, 1994, pp 58–59).
- The number of documented human fatalities in New Zealand is much greater for cyanide than it is for other control methods. (PCE Report, 1994, p 60).
- Dogs are extremely sensitive to 1080 and have been poisoned by baits or by eating dead animals. Livestock (cattle, sheep and deer) find carrot and cereal baits attractive and there have been “numerous incidents of livestock poisoning over the 40 years aerial-1080 has been used for control of rabbits and possums” (PCE Report, 1994, p 57). In addition, there is evidence of long-term damage to livestock from sub-lethal doses

³⁵ Since plant survival can be advantaged by poisons that protect them from browsing animals, it is not surprising that many plants have chemical compounds that are toxic to animals. For example, only a relatively small percentage of all the plants on earth can be used by humans as a source of food. In addition, plants are the source of a large number of toxic chemicals used in the pharmaceutical and pesticide industries. This situation is hardly consistent with a naive “natural is best” or “nature is benign” view of the world.

of 1080. Bees have been killed after being attracted to 1080 paste (jam) baits and contaminated honey has been found. (PCE Report, 1994, Appendix D).

- Data on non-target effects of phosphorus is extremely limited, although dogs, cats, livestock and birds have been killed. (PCE Report, 1994, p 61).
- Cyanide and phosphorus compounds are highly unstable in the presence of air and water and are unlikely to persist for long in the environment. There is considerable uncertainty about the persistence of Talon in the environment. (PCE Report, 1994, p 67).

Net effect on biodiversity of native species

- Individuals from a wide range of native species have been found dead after possum control operations from 1080, although less so in more recent times when methods have been changed. This does not prove, however, that populations of native species were adversely affected since the control program itself should have beneficial effects on native populations in the longer term. (PCE Report, 1994, pp 50–51).
- Kaka, kokako, kakariki, saddleback and weka have been observed consuming cereal and carrots in sufficient quantity to cause death had the food contained poison in the usual quantities. Kiwi and other ground-feeding birds have been observed feeding on maggots on possum carcasses, but it is not known whether this delivers a significant dose of poison to the birds. Overseas studies suggest reptiles, amphibians and fish are relatively tolerant of 1080. Effects of 1080 on invertebrates are largely unknown – as is any possible effect on bats from eating poisoned insects. (PCE Report, 1994, p 56).
- Native and non-target introduced animals have been killed by cyanide, with kiwis and weka particularly at risk. (PCE Report, 1994, p 61).
- Talon was used by DOC for rat eradication from islands (including Tiritiri Matangi, discussed in a case study in the previous chapter) and birds were killed by it. The evidence on its effects is, however, scanty. (PCE Report, 1994, pp 61–62).
- The evidence for the island rehabilitations, and mainland restorations such as at Mapara, suggests that the net effect on native species of animals and plants of pest eradication through poisoning is strongly positive after a reasonably short period of time.

Other costs of the poisoning programs

- Reflecting perhaps a concern for “animal welfare” above “biodiversity” as a basic issue of concern, some people have questioned whether the pain suffered by poisoned animals is too great.
- Cyanide at lethal doses causes a very rapid death. Many animals apparently display “convulsions and signs of distress” when poisoned by 1080, but it is not known whether they feel pain, it being suggested that the state could approximate “epileptic seizure”. Talon results in internal bleeding and probably involves some pain and stress for perhaps 24 hours before death. Finally, “phosphorus causes death after a prolonged period involving intense gastric pain”. The report notes that “the DOC Ethics Committee prohibits the use of phosphorus to poison possums, except where it is approved by the Director of the Estate Protection Policy Division”. Phosphorus is favoured by land holders as “cyanide has bait-shyness problems and [Talon] is relatively expensive”. (PCE Report, 1994, pp 67–68).
- Some traps can cause a rapid death but are costly to deploy. The cheaper traps can cause considerable pain and are required by law to be checked every 24 hours. Traps believed to cause less pain are less effective at holding animals, while escapees could suffer for a long time with painful and debilitating injuries. (PCE Report, 1994, p 68).
- There is some evidence that the effectiveness of 1080 as a control for possums and rabbits could be compromised in the longer term by animals receiving sub-lethal doses learning to avoid it. Laboratory rats have also been shown capable of developing genetic resistance to 1080 following only four generations of selective pressure applied through single doses. The strong odour and taste of cyanide is well-known to result in “bait shyness”. Possums appear less capable of learning how to avoid traps. (PCE Report, 1994, pp 69–70).
- Data on the monetary costs of the different control programs is incomplete and in need of further analysis to determine the effects of different factors such as terrain, height of tree canopy, nature of undergrowth, tree density and so on. Nevertheless, it appears that “aerial and ground operations can both achieve 70–80% reductions in possum populations over considerable areas and the cost and effectiveness of aerial and ground operations can be similar”. Also, it should be borne in mind that while “aerial-1080 poisoning over large areas may be more cost efficient in a comparison of direct costs ... there

are increased indirect costs ... such as consent procedures, consultation ... liability for operator error ... and the requirement to pay the majority of costs regardless of ... success.”³⁶ (PCE Report, 1994, pp 70–72).

Commercial hunting as an alternative

- Commercial hunting of possums is often suggested as an alternative to poisoning. After all, if fish populations can be decimated by over-fishing,³⁷ it stands to reason that possum, rabbit and other pest populations could be similarly decimated by hunting.
- A bounty scheme “tried in 1951–61 was abandoned when it proved ineffective in controlling possums in high risk areas. Over 8.2 million bounties were collected at a cost of more than \$2 million (\$24 million in 1993 dollars), with the scheme having little impact on the size of the possum population or the rate of migration”. (PCE Report, 1994, p 75).
- A DOC Fact Sheet (‘Bounties’ in Department of Conservation, 1996a) claims that “most skins came from ‘nuisance’ possums in prosperous farming and semi-urban areas, or from possums killed on country roads, rather than from areas where possums were critically affecting agricultural production, watershed protection or natural landscape or wildlife values”. The Fact Sheet adds that “possums now threaten pohutukawa in the Coromandel and Northland because hunters deliberately introduced the pest to those areas when the bounty was in force in order to have a local population to ‘farm’”. Unfortunately, the sources for these claims are not documented. (We hasten to add that this is not a criticism of the Fact Sheets – they are brief overviews rather than definitive treatments of various topics. It would have been useful, however, to have known where the claims have been documented.)
- The DOC Fact Sheet also estimates that it would cost “at least \$150 million a year” for a take of about 10 million possums, which it estimates is “the minimum required to reduce possum populations by 40% and hold them there”. By contrast, it estimates current annual government spending on possum control at \$40 million, with \$10 million spent on long-term research and \$30 million on targeted control programs. It argues that with a bounty system “there is no way to differentiate between a possum caught from a pine plantation near an urban area,

³⁶ Ground operations are easier to stop in progress.

³⁷ See the discussion of fishing in chapter 2.

where there is no TB threat or risk to natural values, and a possum caught in a national park or at the boundaries of a TB control area. The possum in the easily accessible area is that most likely to be harvested”.

- The PCE Report (1994, p 72) claims that “commercial hunting for skins in the late 1970s to early 1980s in many cases targeted easily accessible and high density possum areas ... often only reducing the population by 30–50% before moving on to more easily attainable possum populations. However, in other areas commercial hunting also lowered possum densities and reduced forest damage compared to non-hunted areas”. The Report cites a number of papers from the *NZ Journal of Ecology* in support of its claims.
- While payment of bounties is one thing, encouraging a market in furs is another. The PCE Report (1994, p 76) notes that there has been no funding for marketing or promotion of possum products. Investment in the industry would be discouraged by the fact that the prices of furs fluctuate substantially (partly because of opposition to trapping of animals for furs), while the possum control programs themselves might create uncertainty about continued access to the raw material at low cost.
- An alternative method of harnessing the incentives of the market to control costs, while avoiding incentives to ‘farm’ possums or only take the easiest targets and then move on, is to contract out possum control to the private sector using performance-based contracts. The PCE Report (1994) examines a number of different types of contracts. These need not be *alternatives* to poisoning – the method of control is a separate issue.
- If there are sufficient competing firms, putting eradication contracts out to tender should give the buyer of the eradication services a competitive price. By paying a price up front, the eradication firm is given an incentive to complete the job at minimum cost, since it can keep 100% of any savings in costs relative to what it had anticipated. Given the difficulties of arriving at preferred methods of control in different environments, there is a strong argument for encouraging a competitive control industry. The normal marketplace incentives to minimise costs by experimenting and investing in specialised skills and information would then lead firms to seek out new and better ways of getting the job done.
- Under a tendering system, the contractor bears uncertainties associated with the cost of eradication – for example, because the possums in a particular location are more resistant to taking baits than “on average”. The PCE Report (1994, p 73) suggests that these risks would “reduce the

incentive for people to pursue hunting as a full-time occupation ... and ... develop skills and experience". A scheme that makes the payment conditional on the percentage of pests taken can reduce the risks to the hunter, but at the cost of making the total payments for the service uncertain. We would argue that any risk premium required by the market under an up-front tender system would be bid into the contract price for the job and suggest that, when the purchaser is a government agency, markets are better able to handle such risks than are taxpayers.

- Of course, the purchaser of the eradication services has to monitor performance, since the firm also has an incentive to eradicate a smaller percentage of possums than specified in the contract. Most DOC contracts apparently specify between 70% and 95% kill rates (PCE Report, 1994, pp 72–73). Monitoring methods currently used are discussed in Chapter 6 of the PCE Report (1994), which notes that “most commonly, a relative estimate of possum numbers killed or surviving is obtained, by comparing indices of pre-operation and post-operation population levels. This results in a percentage kill or percentage survival rate”. DOC apparently uses measures of the “number of possums caught in traps over successive nights [to] provide an index of abundance before and after control”. Potential problems with this approach are that it has a high equipment requirement, considerable effort is needed to carry, place and shift traps, non-target species can be caught and there can be various inaccuracies of measurement. (PCE Report, 1994, p 88).
- It might be feasible to supplement, and partially replace, the current monitoring strategy with an alternative scheme based on required accounting standards accompanied by occasional audits. While the furs do not have sufficient market value to pay for the required percentage elimination of pests, they may nevertheless have sufficient value to pay for a tracking system. Contractors could be given a number which is used by purchasers of furs to record skins as is done with fish catches under the ITQ fishing system in New Zealand.³⁸ Contractors would need to specify the location that the possums were removed from when the skins are sold, and keep a record of numbers caught per day from that area. Eradication efforts would continue until the number caught per day falls below the required percentage of the numbers caught per day over the first few, say 10, days of operations. A fraction of these records could be selected for audit (either randomly or in response to previous

³⁸ The reader is again referred to the discussion of fishing in chapter 2.

“suspicious outcomes” from a particular contractor). DOC could trap for 10 days at the completion of the contract and, if it found a daily catch rate more than a specified percentage at variance with the rate recorded in the books, the contractor would have to pay a heavy fine.³⁹ These procedures could all be specified in the contract and the contract price for undertaking the service would reflect the risks and expected costs associated with the fine system. The various parameters in the system (number of days in initial period or a checking trap catch, size of fines, percentage of contracts audited and so on) could be fine-tuned in the light of experience.

³⁹ As argued in a more general context by Buchanan and Hartley (1996), to deter cheating, the fines would need to be higher if the probability of detection were lower.

4. ACHIEVING CONSERVATION GOALS

We argued in chapter 3 that conservation is one among many competing uses for the natural resources of New Zealand. Like other uses for resources, it has to deliver benefits in excess of costs if it is to make a net contribution to community welfare. Both benefits and costs need, however, to be interpreted to include *all* relevant effects on individual welfare. Thus, benefits perceived by individuals because fascinating rare species, delightful historical buildings or significant cultural assets have been preserved are to be counted along with material benefits that satisfy more basic needs for food, water and shelter. So too are the benefits of greater or more satisfying recreational opportunities, and the benefits of cleaner air to breathe or cleaner water to drink, swim in or fish from.

The critical economic issue, then, is how can we ensure that *all* resource allocation decisions take relevant “environmental” costs and benefits into account. Conservation is not just an issue that pertains to “reserved areas”. Effective conservation strategies will integrate conservation into the economic system so that resource users face prices that reflect total costs and benefits and not just subsets of those costs or benefits. Equally, however, to ensure the community is obtaining maximum value from its scarce natural resources, managers of the current “reserved areas” need to face incentives to consider the value of multiple or alternative uses for those assets.

While most conservation activities provide a number of different types of benefits, it is useful to consider a number of “polar cases”.

To begin with, we consider the many direct benefits that conservation assets can provide to individuals – for example as tourists, hikers, bird watchers, hunters or fishermen or breeders of valued rare plants and animals. From the discussion in chapter 2, a critical issue is whether a price *can* be charged for these uses, and, if so, whether it is efficient to do so. Further, even if it is efficient to charge a positive price, there is an additional issue of whether the revenue raised would be sufficient to cover the costs of supply and, if not, how the revenue shortfall should best be covered. Finally, even if it is not feasible to operate these activities as normal business enterprises, there is the question of whether voluntary activity or public ownership might achieve a preferable outcome.

Later in the chapter we consider the indirect benefits provided by conservation areas. These are in general much harder to charge for. Yet it is

by no means obvious that private and voluntary activity could not also better provide these services than a monopoly government agency – particularly if new property rights and market mechanisms are recognised and enforced.

TOURISM AND RECREATION

The most significant direct use of the 32% of New Zealand currently under DOC management is for tourism and recreation. This includes not only hiking and observation and enjoyment of nature, but also activities such as skiing, canoeing, rafting, horse riding, bike riding, driving recreational vehicles, bungee jumping, sightseeing by plane or helicopter, hunting and fishing.

Attitude toward visitors to areas managed by DOC

The Department outlined its “vision and direction” for strategies towards visitors to areas it manages in Department of Conservation (1996c). DOC states at the outset that (p 12):

The Department’s over-riding protection goal is to ensure that the intrinsic natural and historic values of areas managed by the Department are not compromised by the impacts of visitor activities, and related facilities and services.

Since (as we argued in chapter 3) intrinsic values are *by definition* impossible to measure, it is unclear how *any* actions could ensure these values are not compromised. The Department then has no basis on which to judge the most desirable type or level of use of any given area. For example, DOC asserts (p 13) that:

some sites and ecosystems (e.g. those strictly protected as nature reserves and some scientific reserves) are so important because of their natural and/or historic values that visitor access should be controlled or even denied.

This amounts to asserting that some sites that *are* strictly protected are so important that they *should be* strictly protected. This is not a very helpful test for deciding which sites, if any, should be strictly protected and which sites should be opened to greater public access. DOC continues:

in all other Department-managed areas, the protection of intrinsic natural and/or historic values will take precedence over visitor activities, and the provision of visitor facilities and services.

Again this is not a very helpful test for deciding what visitors will or will not be permitted to do. Since no-one knows what “intrinsic values” are, how can anyone tell when they have been compromised, and what does “taking

precedence” mean? Does it mean that visitor activities or the provision of visitor facilities or services can be denied merely by asserting, without the need to provide any evidence, that they reduce some incommensurable characteristic of the area? This would seem to place an extraordinary degree of discretion into the hands of the decision-maker. It would also be extremely difficult for any responsible party (such as the Minister or the Parliament) to review the decisions on an objective basis and determine whether DOC is adequately fulfilling its goals.

The Department interprets the principle to mean that “most areas will be kept in their natural state without facilities development”. This statement of course avoids the issue of what the “natural state” of an area is. More importantly, however, taking no measures to develop facilities in most areas managed by DOC is unlikely to lead to the best use of resources for the people of New Zealand. Many of the areas managed by DOC have extraordinary value as tourist destinations, but cannot be developed as such without facilities. A similar remark applies to the assertion that “the qualities of solitude, peace and natural quiet will be safeguarded *as far as possible* in *all* areas managed by the Department” (emphasis added).

DOC says that “visitor activities, facilities and services that are in keeping with and promote understanding of intrinsic natural and historic values will be preferred”. They give us no indication, however, as to the criteria that could be used to select such activities, facilities or services. Again, is it to be nothing more than an arbitrary judgment by a DOC official? While “visitors will be encouraged to minimise their impacts on natural and historic values” this would seem to be difficult to do when visitors cannot be informed as to what those “values” are.

Under the heading “Deciding a Suitable Management Regime for Visitors”, DOC states:

If it is considered appropriate for visitors to use and enjoy a particular site, then the next step is to:

- decide what is an appropriate number of visitors and set limits where necessary to avoid or reduce impacts on intrinsic natural and historic values
- decide what are appropriate visitor facilities and services and the appropriate management practices and standards for these so that the impacts on intrinsic natural and historic values are avoided or reduced
- promote good conservation practices for managing visitor facilities such as energy efficiency, recycling and waste reduction
- encourage appropriate visitor behaviour, for example, through promotion of the environmental and water care codes.

Using the Paraparaumu Scenic Reserve again as an example, it can provide walking opportunities for visitors with scenic views and the conservation values of coastal forest can be interpreted for visitors. *For this reason* it will be managed for a moderate number of visitors with a standard loop track and high quality interpretation material. (emphasis added).

It is a complete mystery to us how the conclusion in this quote follows from what was stated in the previous sentences! In particular, where are the considerations that underlay the conclusion that a “moderate number of visitors” to the site was “appropriate”?

In order to decide the “appropriate” number of visitors, one first needs a goal or objective that can be affected both positively and negatively by increasing visitor numbers. The appropriate number of visitors can then be chosen to balance out these positive and negative effects.

“Avoid[ing] or reduc[ing] impacts on intrinsic natural and historic values” sounds like an attempt at specifying harm caused by additional visitors. However, if the “intrinsic” values of the site cannot be measured there is no way of relating visitor numbers to the harm done. Resource allocation decisions are made by people and can only reflect costs and benefits as perceived by people. Why should public policy decisions depend on changes in some measure, such as “biodiversity”, that is at best vaguely related to individual values?

We suggested in chapter 3 that the *net benefits* accruing to people from managing a site in different ways (including, as one possibility, not allowing any visitors at all) is a more reasonable objective for conservation policy. Maximising this objective would require an evaluation of the likely beneficial and harmful effects *for people* of changing the number of visitors.

For example, the scenic value of the Paraparaumu Scenic Reserve would be one of the important benefits people obtain from visiting it. Our objective for conservation policy would thus explain the relevance of the first sentence after the dot points in the quote above. That sentence mentions “scenic views” but it is not clear to us why the scenic views are relevant to any of the previous dot points. The dot points do not even mention benefits to individuals from visiting sites.

More generally, people will be concerned about the *quality* of their experience when visiting nature reserves, national parks and so on. One element of that quality will be the joy they obtain from observing the native plants and animals at the site. The quality of visits can therefore be compromised if too many visitors, for example, reduce the number of native species able to be seen, or alter their behaviour so visitors can no longer experience “natural conditions”.

Total net benefits will also, however, depend on the *number* of visitors to a given site. *Other things equal*, the more people who are able to enjoy the site, the higher the benefits. Other things will not be equal, however. For example, more tourism to most sites is likely to:

- result in more vegetation being cleared to provide facilities, or more vegetation being trampled or destroyed by visitors who do not stay on prepared tracks, thus reducing the benefit for visitors who want to experience native vegetation;
- damage tracks, making them less pleasant to use or adding to soil erosion and compaction, making it more difficult for native vegetation to survive;
- disturb wildlife and perhaps interfere with animal behaviour, which is one of the features visitors value about the site;
- increase water pollution through increased effluent and rubbish, which makes visits less enjoyable and perhaps hazardous to one's health;
- increase the risk of fire, or the risk of introducing unwanted species – particularly weeds, which will reduce the benefit for visitors who want to experience native plants and animals;
- increase litter, vandalism and taking of souvenirs at historic sites, which again reduces the pleasure or value of each visit;
- reduce the “wilderness” experience for existing tourists by increasing noise and reducing their solitude;
- bias conservation more toward species and activities that are valued by the “average” person rather than the “devotee”, thus reducing the value of visits for the devotees; or
- increase pressure to cater to interests such as bike riders, four wheel drive owners, horse riders and people with a high cost of time who want to view the scenery from the air – the consequent noise and crowding will also reduce the enjoyment of “wilderness seekers”.

The number of visitors should be increased so long as the beneficial effects outweigh the harmful effects. At the “appropriate” level, any further increase in visitor numbers would do more harm than good, while any further restrictions on visitor numbers would cost more in lost benefits than is delivered in reduced harm.

It is important to note that since we are talking about net benefits to people these values are all *in principle* measurable. For example, we could look at the amounts of money and time people were willing to pay to visit

the site. As the quality of the site changed, the willingness to pay would also change. Even when we consider benefits provided to non-visitors (for example, some people might value just knowing that the site helps preserve some rare species that they care about) we could use contingent valuation or other survey-based techniques to discover a value people place on the site.¹ Requiring DOC to undertake such surveys would be a useful additional measure of “outputs” for the Department. Quantifying the benefits that conservation activities provide to the people of New Zealand might even assist DOC in its competition for budgetary allocations.

Maximising the net benefits provided by the available resources leads to a balancing of the costs and benefits associated with additional access. By contrast, DOC’s emphasis on “protecting intrinsic values” leads it to see visitors only as a threat to be managed. A “monitoring system” is needed to “indicate the steps that need to be taken to prevent further impacts occurring”. When the “monitoring program identifies ... an unacceptable impact” DOC will first respond by “restricting the number of visitors, imposing a limit on the length of stay, discouraging potential visitors or improving access, facilities and promotion in alternative areas”.

The Department includes among its guiding principles for action that (p 22):

- the qualities of solitude, peace and natural quiet will be safeguarded as far as possible in order to enhance visitors’ enjoyment of areas managed by the Department; and
- visitor activities, facilities and services should be actively managed to avoid compromising the experience of other visitors.

These principles will not generally result in an efficient allocation of resources. More generally, greater net benefit will be obtained if there is some compromise of the benefits delivered to those users who are most demanding of “solitude, peace and natural quiet” in return for delivering more moderate joy to a much greater number.

¹ Such a survey would need to be done very carefully to ensure that it avoided the well-known defects of contingent valuation techniques and gave meaningful results. A major issue is that people taking part in the survey need to appreciate that they are being asked about the *marginal valuation* they place on this particular site, or *changes* in management actions at this particular site, taking land use decisions elsewhere in New Zealand as *given*. Thus, for example, if this site is only one among many that are important for the survival of a valued rare species, people answering the survey would need to be appraised of the relative importance of this one site.

The Department notes (p 21) that, “Some visitor groups resent the intrusion of increasing numbers of visitors and an expanding range of commercial activities”. Of course existing users will decry a reduction in the value of their recreational experience if there is no offsetting benefit to them. They will be forced to “pay” a price for no benefit. Their desire, however, ought not necessarily prevail. If the gains to the additional users exceed the losses to the existing users, it will be efficient to allow increased use.

One of the underlying issues in this example is that the existing users are not paying a price that represents the true opportunity cost of their use. Suppose the value of the existing use to each visitor was extremely high. The price existing users would be willing to pay may then produce a total value for the resource that exceeds the value it would have if many more visitors were to be allowed, but with each of them paying a much lower price. The alternative patterns of resource use could compete with each other. The final allocation would be decided by the pattern of resource use that yields the highest total value. The total price the “winning” users would have to pay would be the value placed on the resource by the next best *alternative* use. The eventual users would still in general be left with positive net benefits.

Alternatively, in a market situation, existing users may willingly accept a diminution in the value of their experience if there is a compensating reduction in the price they have to pay. Consider, for example, international air travel. There is no doubt that international travellers would, other things being equal, prefer to fly on planes with beds. If they had been flying in that style and new passengers were added to the plane (so that the original passengers now had to sit rather than lie down), the original passengers would no doubt “resent the intrusion” of the additional passengers if there were no offsetting benefit for them. If the addition of passengers dramatically lowers fares, however, the original passengers can be more than compensated for the loss in benefits they suffer so they willingly accept the new arrangement.

Allocating visitors

DOC has identified seven visitor groups:

- short stop travellers;
- day visitors;
- overnight visitors;
- backcountry comfort seekers;
- backcountry adventurers;

- remoteness seekers; and
- thrill seekers.

This categorisation of visitors appears to emphasise the length of time the visitors will stay in areas managed by DOC. Similarly, DOC categorises the areas it manages into:

- urban;
- urban fringe;
- backcountry drive-in;
- backcountry 4 wheel drive;
- backcountry walk-in;
- remote; and
- wilderness.

The categorisation of areas emphasises the accessibility of the area rather than the resources of value to visitors that it provides. The categorisation of visitor types and areas inevitably leads DOC to allocate the more remote and wild areas only to the visitors who are able and willing to invest sufficient resources, particularly time, to get there – typically healthy young people with an independent income source and plenty of time on their hands (such as youths receiving intra-family transfers or unemployment benefits). For example, on p 33, DOC observes that its main responsibility for overnight visitors is to “provide basic short-term camping opportunities ... in the frontcountry”.

An approach aimed at maximising net benefits would instead focus on the resources or activities visitors are interested in experiencing. It would then seek to allocate visitors to areas taking account of both the desire of some to experience “solitude, peace and natural quiet” but also the desire of many to experience as much of the spectacular scenery and other natural assets that New Zealand has to offer. The Department’s procedure runs the real risk of limiting the value of those resources by restricting their availability to a privileged minority.

Another defect of the Department’s categorisation procedure is that it lumps different types of users together. For example, on p 29, the Department notes that the category “backcountry adventurers” includes people interested in tramping, hunting, fishing, mountaineering, cross-country skiing, rafting, kayaking and mountain bike riding. Each of these types of visitors is in fact interested in a very different set of resources. Rather than being lumped together on the basis of the “degree of self-reliance” that

they exhibit, they should be categorised separately since they would be best allocated to areas with very different types of available resources.

The categorisation of visitors also emphasises the resources DOC has to expend to cater to the group. In short, DOC sees visitors to the areas it manages as “problems” rather than “customers”. For example, it comments on p 34 that, “Because of the significantly higher level of facilities and staff services required to maintain a Great Walk, it is unlikely that the Department will designate any more”. Later on the same page, it comments, “The strategic direction will, therefore, concentrate on reducing departmental effort and expenditure on providing and maintaining the existing level of facilities”. Could one imagine another service business, such as let us say a restaurant, making a similar statement that “additional seating, a more capable chef or better facilities will not be developed because the resources required are too high”? The issue should surely be whether customers value the additional services at least as highly as the cost of the resources needed to provide those additional services.

Levels and types of facilities and services

The approach that sees visitors primarily as a threat rather than an opportunity to provide them with something that they value also appears to underlie planning for services and facilities. For example:

- When discussing the provision of facilities and services to day visitors (p 32) DOC observes that day visitors are “a priority group for increasing effort and expenditure, because they have the potential for high environmental impacts, are increasing in number and have a high demand for accessible outdoor experiences”.
- The Department observes on p 32 that “vehicle access will be maintained to priority sites or upgraded where this is appropriate” rather than where benefits are likely to outweigh costs.
- Visitor facilities and services are to be reviewed (p 35) “to evaluate how effective these are in fostering recreational opportunities for visitors” and not for their effectiveness in providing net value to the New Zealand community.
- The Department needs to undertake more research into the “the level of information the Department should be providing” to visitors and what “they are entitled to know” (p 44) rather than undertaking market research to find out the types of information that visitors value.

- Backcountry comfort seekers “are not a priority group for interpretation services because they generally have a low level of awareness of the conservation work of the Department and the chances of engaging them in future conservation work are not considered to be high” (p 49). If the experience of such visitors would be greatly enhanced by appropriate interpretation services that is too bad!

A greater “customer focus” would assess priorities for services and facilities on the basis of the value provided by those services and facilities versus the cost of provision.

When assessing the Department’s role in relation to overnight visitors, the document states that (p 33):

The Department’s main responsibility will be to provide basic short-term camping opportunities for visitors seeking an overnight experience in the frontcountry. This group is important to the Department in assisting with conservation work, as they have long-term associations with specific sites or are often on site.

This statement raises a number of issues. Why should all overnight visitors be interested only in “basic short-term camping opportunities”? Why should they only be interested in visiting “frontcountry”? Might there not be some opportunities to provide better transport access to at least some of the more remote areas that might be highly valued by short-term visitors? Why is the “important[ce] to the Department” mentioned while value provided to customers is not?

It is clear that DOC sees overnight visitors as forming the core of its volunteers. We certainly agree that it is wise for DOC to encourage volunteers to contribute to departmental activities. We would like to see DOC paying more attention, however, to understanding how to better motivate volunteers. To continue to provide free labour to the Department, the volunteers need to receive value from their experiences. For example, specially organised quick and well-resourced trips to “backcountry” areas for volunteers with a high cost of time might be useful for encouraging such people to continue to donate their time, money and management expertise to conservation projects.

Again, on p 34 of the document, DOC comments that:

Hut and track systems will only be upgraded to cater for the requirements of backcountry comfort seekers where there is a demonstrated need for a higher level of facilities and services.

It is not clear how DOC intends to assess whether or not there is a “demonstrated need”, particularly when the Department’s “strategic

direction” is to “concentrate on reducing departmental effort and expenditure on providing and maintaining the existing level of facilities”.

On the other hand, we were pleased to find the comment on p 33 that “the Department will ensure that its lodges, houses and booked huts are available to overnight users and that they are more effectively marketed” and on p 34 that it will reduce crowding in huts and campsites on Great Walks by “introducing booking systems” and “setting seasonal hut and campsite fees”. This illustrates more of the “customer focus” that we would like to see. However, we would also like to see facilities and services planning more closely related to the “demonstrated need” as reflected in market demands.

On p 46, DOC laments that:

At the 11 major departmental visitor centres ... there is some public expectation that booking services for private sector accommodation and transport will be provided. This expectation poses a problem for the Department, since satisfying this demand would divert staff from providing important conservation information and education services.

Alternatively, it could be seen as an *opportunity* for DOC to employ staff with expertise in such areas and charge the providers of the accommodation or transportation services and the public for the valuable service that is being supplied. Even better, DOC could charge rental fees to private travel agencies to operate the businesses in the visitor centre premises.

Contracting out and concessions

The Department recognises that it can often provide services and facilities more cheaply by contracting out operations to private businesses. This includes not only the construction of roads, campsites and other facilities but also the provision of services such as guided walks with associated accommodation. DOC notes that there are approximately 500 concessionaires operating on areas managed by the Department.

In general, we support the use of contracting where it can provide services at lower cost, or provide better quality services at the same cost. Departmental concerns about the impact of such services on environmental amenities that are valued by visitors can be handled by placing appropriate regulatory controls on the concessionaires. Such a procedure would, however, again require a method of measuring the trade-offs. In this regard, too, the focus on maintaining “intrinsic values” is unhelpful.

While we have no objections to DOC regulating concessionaires to ensure effects on environmental amenities are taken into account, the Department’s approach places too much emphasis on threats rather than opportunities. For

example, on p 39 the Department states that “an application to build a structure will not be granted if building it in another place would have less harmful effects”. Surely this cannot be literally true – some proposed structures (for example skiing facilities) may have little or no value unless they are built on the proposed site. The relevant criterion should surely be an appropriate balancing of costs and benefits rather than simply minimisation of the harmful effects. Similarly, the proposed test on p 41 for allowing concessions “where they do not compromise the intrinsic natural and historic values ... and do not compromise the experiences and opportunities of other visitors” emphasises only the potential negative effects while paying no attention to the possible positive values.

The same bias is evident on p 40 where DOC expresses a concern that “reacting to proposals in an ad hoc way” will result in “over-provision of concessions”. Surely, an equally undesirable outcome would be where an unsystematic approach leads to *under*-provision of concessions.

The New Zealand Institute of Economic Research (NZIER) undertook a study for the former Ministry of Tourism which, among other things, examined concessions on public lands administered by DOC (Clough, 1994). The study reported that the largest category of concessions in the 452 in operation as at October 1993 involved hiking, hunting and fishing guides. These were followed by air and water transport or sightseeing services, including an airstrip, heli-skiing, heli-tours, heli-transport, charter boats, yachts, jetboats, and rafting. The NZIER study also reported that in some areas “unauthorised commercial operations on public lands are suspected to be significant”. Amendments to the *Conservation Act* passed in 1996 introduced a new section to the Act governing concessions.

Concessions are authorised through granting leases, licences or permits. Leases are used where sole occupation of an area of land is needed (such as for a building or skifield installation). Licences or permits create more proscribed privileges to undertake specified activities.

Section 17ZE of the Act specifies that transfers, subleases and mortgages of contracts require the consent of the Minister. Unless the concession document otherwise provides, such a transfer, sublease or mortgage effectively requires the new owner to repeat the application process. Transferability is important for giving the concessionaire an incentive to invest in the reputation of the business and to develop better ways of serving customers.

Another important determinant of incentives to invest in the business is the duration of the contract. Longer contracts will enable a return to be

earned on an investment in a reputation even if the concession contract is not transferable. Where large physical capital investments are desirable, and the capital has few alternative uses, longer duration contracts are needed to allow the concessionaire to earn a reasonable return on the investment.

At the time of the NZIER report, concessions such as guiding, bungee jumping, heli-skiing and retail kiosks had a duration of 3–7 years, with 5 years most common. Longer agreements, of 8–16 years, applied to camp ground management, charter boat, fixed-wing flying, guided trek, rafting and some skifield concessions. Concessions for alpine shops and guiding, camp grounds, cave operations, charter boats, glow worm exhibits, golf courses, lodging and restaurants, skifield operations and thermal attractions lasted for more than 17 years with 30 or more years where buildings are involved. Section 17Z of the *Conservation Act* now states that:

A lease or a licence may be granted for a term (which term shall include all renewals of the lease or licence) not exceeding 30 years or, where the Minister is satisfied that there are exceptional circumstances, for a term not exceeding 60 years. A permit may be granted for a term not exceeding 5 years but shall not be renewable.

An inability to exclude new entrants from a business activity can also reduce incentives to invest in the business. On the other hand, the ability to exclude competitors can compromise efficiency by allowing monopoly profits to be earned. Public policy often attempts to balance these concerns. In the case of inventions, for example, an entrepreneur is granted a patent or right to earn monopoly profits for a proscribed period.

The 1996 amendments to the Act specify that a lease is “a grant of interest in land that gives exclusive possession of the land”. This does not exclude entrants to an activity, however. For example, the NZIER gives the example of heli-skiing operations on land surrounding a lease for skifields and associated structures.

Section 17Y of the Act specifies that a concessionaire can be charged a rent, fee or royalty to be paid to the Minister:

The rent fee or royalty may be fixed at the market value, having regard to –

- (a) Any circumstances relating to the nature of the activity; and
- (b) The effects of the activity on the purposes of the area affected; and
- (c) Any contractual conditions, covenants, or other encumbrances placed upon intrinsic resources, natural resources, or historic resources by the concession.

Rent, fees and royalties for a concession shall be reviewed at intervals not exceeding three years.

The NZIER noted that fee setting in practice is open to negotiation between the regional conservancy and the concessionaire. The most common types of fees charged concessionaires in 1994 were:

- (a) a percentage of gross annual revenue (from 2% for older agreements to 15% for caves and retail establishments, with a modal rate of 5%);
- (b) a set lump sum fee per year (for example, \$1000 for a glow worm exhibit, but usually \$200–\$500 per year);
- (c) a formula based on a minimum fee and a percentage of gross annual revenue (for example, for guiding operations, the maximum of \$200 or 2.5% of gross annual revenue);
- (d) a percentage of improved capital value of land and structures (from 4% to 9% per year, with valuations based on government procedures);
- (e) a charge per client or client-day (for example, \$1–\$12 per bunk let);
- (f) for aircraft, a combination of per passenger fees or available seat capacity on all flights operated (the latter fee structure intended to minimise flights by emphasising the effect of operating costs on encouraging full loads); and
- (g) for one-off events, bonds for restoring damages.

The NZIER observed that DOC appears to offer “generous” discounts for prompt payments relative to the discounts typically offered in private transactions. This suggests that the Department has a very *high* time discount rate relative to private firms.

The appropriate structure for fees, rents or royalties depends on the purpose these charges are meant to serve. As we noted in chapter 2, prices serve a number of purposes in market economies, but all of these purposes are ultimately related to achieving an efficient allocation of resources. We argued in that chapter that in order to achieve an efficient allocation of resources, it is essential that:

- users have accurate information about the present and future costs – the value of opportunities forgone – of meeting their demands;
- enterprises providing goods or services have adequate information about benefits and costs, where benefits include the gains to present and future users or consumers; and
- both users and enterprises (in particular, enterprise managements) have incentives to respond to cost and benefit information.

In chapter 1, we noted that DOC had an annual budget in 1996–97 of about \$160 million, of which about \$131 million came from the taxpayers. Presumably, most of the remaining \$29 million came from fees, rents and royalties. The Department reported that 47% of its budget was spent on

visitor services, public involvement and enjoyment. That would mean an expenditure of about \$75 million on visitor services, public involvement and enjoyment and a direct income of only \$29 million. In addition, however, some of the remaining expenditure of \$85 million on “conservation services” ought to be counted as expenditure to provide services to visitors to areas managed by DOC.

It would thus appear that prices charged to concessionaires are unlikely to signal to their customers the direct monetary costs of providing those customers with the services they desire. We see no good reason why the taxpayers of New Zealand should be called upon to subsidise the activities of customers of concessionaires using areas managed by DOC.

Such subsidies are also likely to lead to an excessive call on the resources used by DOC to provide visitor services. When visitors have to pay the monetary costs incurred by DOC and the concessionaire for additional services, they will choose to impose those costs only up to the point where the marginal value of an additional service matches the marginal monetary cost of providing it. Unless the prices charged by concessionaires greatly exceed their costs, including the fees they pay to DOC, visitors using the services of concessionaires therefore are unlikely to be paying enough to cover the monetary costs incurred in servicing them.

The situation is, however, likely to be even worse than these brief calculations suggest. Additional visitors to the areas managed by DOC impose more costs than just the additional monetary costs incurred by DOC and the concessionaire. As we noted above, additional visitors are likely to impose costs by damaging environmental amenities in various ways and also by reducing the value of the recreational experience of other users through crowding, noise pollution and so on.

If New Zealand is not to experience too many visitors to areas managed by DOC, visitors should be charged a price that reflects *all* the additional costs they are imposing through denying *all* alternative uses of resources. The appendix to this chapter examines the equity and efficiency implications of subsidising visits to conservation areas in more detail.

DOC can limit the damage done by customers of concessionaires by imposing a quantity constraint on the number of customers. As the NZIER report observes, the main economic difference between such a quota and an explicit charge is that the quota creates a “scarcity rent” that will be captured by the concessionaire in the form of higher prices and profits.

It is not clear to us why the concessionaires should be allowed to capture such scarcity rents, particularly when the New Zealand taxpayer is being

called upon to subsidise DOC expenditure on visitor services. Even if revenue from concessionaires covered the cost of services explicitly provided to them by DOC, it can be argued that the scarcity rents should accrue to DOC and not the concessionaires. These rents would provide a source of funds that could be used to finance the more general conservation activities of DOC that cannot reasonably be assigned to servicing any one concessionaire. The general conservation activities of DOC, such as pest and weed eradication and native species preservation, ought to increase the value of such rents in so far as they raise the value of the experience for the customers of the concessionaire. If the scarcity rents were returned to DOC, therefore, the Department would have stronger incentives to undertake the most efficient and effective general conservation measures.

Another important function of the fee structure is that it should give concessionaires an incentive to reduce costs and provide more valued services to their customers. Flat or lump sum fees have the strongest incentive effects in this regard. The concessionaire then fully captures any increase in revenue or reduction in costs that result from improvements in its management practices (apart, of course, from the effects of taxes that impinge on all businesses).

Payments based on *capacity* rather than actual sales provide a strong incentive for the operator to maximise occupancy of facilities and may be appropriate where there are costs associated with the number of *trips* in addition to the number of customers.

Per customer charges might be appropriate when the costs incurred by DOC, or the costs of environmental damage, depend on the number of concession customers. Such charges, however, expose DOC to some risks in that its income depends on the number of customers of the concessionaire. Generally, private businesses are in a better position to cope with such commercial risks by diversifying them through the capital markets.

Fees based on a percentage of annual revenue subject DOC to the risks not only of variations in the number of customers from year to year but also variations in the prices charged for the services by the concessionaire. They might be appropriate where quantity restrictions would otherwise create large and somewhat uncertain "scarcity rents" that should, as we argued above, be returned to DOC. Where the market to provide the licensed service is sufficiently competitive, however, DOC could receive the *discounted expected value* of the rents without bearing the risks associated with demand and price fluctuations by putting the concession licence out to tender on a periodic basis and awarding the contract to the highest bidder (assuming of

course that regulation of service standards, environmental damage and so on is adequate). The NZIER report observes that such a “bid rent” process appears to have been little used by DOC in practice.

The NZIER report also argues that:

The current variation in concession fees does not appear to have any coherent pattern, with apparently similar concessions facing very different fees. Recommending a standard fee formula, and the depths of discount offered for different individual circumstances (such as risk), would increase consistency in price signalling and reduce the anomalies encountered by concessionaires operating in different districts.

The NZIER report therefore suggests that:

Greater standardisation of concession agreements, with a pro-forma guideline adaptable to different circumstances, could improve the certainty with which potential concessionaires approach the Department in negotiation.

We concur with the suggestion that DOC should take steps to encourage suitable concessions to provide visitor services. As we argued in chapter 2, generally speaking, government departments are not well-suited to running business operations. A well-structured concessions contract could usually yield greater net revenue at less risk for DOC. Just as DOC has increasingly contracted out operations such as construction and pest control, so too it could probably gain by contracting out many of the activities involved with servicing visitors by encouraging more concession operations.

While many visitor services can be provided effectively through concessions, services in some areas might not be amenable to such an approach. In particular, the potential supply of concessionaires might be too low to provide a suitably competitive market. One way around this problem would be for DOC to offer concession contracts to provide specified services, such as guiding, transportation, education or instruction, across several areas.

Another alternative for providing some visitor services would be to rely on non-profit private clubs rather than private business enterprises. For example, Department of Conservation (1996c, p 35) states that, “Where specific huts and tracks are considered to be low priority by the Department they will be offered to user groups to maintain”. While non-profit private clubs would not have to pay fees to the Department for the facilities in question, they would be responsible for all maintenance costs.

Under our preferred model for providing visitor services, DOC would become more of a contract administration and regulatory agency and less of a service provider. It would control the terms and conditions on which

services were provided to visitors to conservation areas, collect fees to cover at least some of the costs that were not attributable to particular concessionaires, and ensure that safety and environmental standards are complied with.

In so far as business operations are concerned, government is best suited to playing a regulatory and oversight role. It can even be argued that government is likely to be a more effective regulator of private businesses than of government business activities.

There is much evidence that one agency of the government, or one ministerial department, is typically reluctant to impose a penalty on another agency or ministry, even when the other agency is a state business enterprise. Similar problems no doubt arise, and probably to a greater extent, when the regulatory agency and the service provider are in the same department. On the other hand, private and even powerful companies know full well that if they are on the wrong side of the regulator they will receive fines, and the fines will be enforced.

Private companies are also often easier to take to court than their public counterparts. There have been many successful law suits against large private corporations for selling unsafe products, violating environmental standards and so on. By contrast, the government “shareholder” of a public business enterprise has the legislative capability, together with a strong financial incentive, to shield the business from law suits. Furthermore, the common law “highway rule” holds that the Crown cannot be held liable for consequential damages of its policy decisions. A person who is injured after encountering a large pothole on the road, for example, does not have the right to recover damages from the government. The court can decide that it was a legitimate matter of policy for the government not to pursue a particular line of action. The government can then not be held liable for the consequences of such a policy decision. To do otherwise would violate the separation of powers between the legislature and the judiciary – the courts effectively would be given the right to make policy.

Finally, the vulnerability of private companies to a reduction in profitability, that does so much to increase pressure to minimise costs, also makes these companies guard their public reputations. An expensive investment in advertising and public relations can be destroyed by a single violation of environmental standards. By contrast, if the public does not like the decisions of a public monopoly service provider they have few options so long as they wish to continue consuming the service.

In summary, the evidence that public ownership of business activities is the best means for enforcement of environmental, safety and other regulatory measures flies in the face of reason as well as reality.

Pricing visitor services provided by DOC

The *National Parks Act* 1980 declares that "... the public shall have freedom of entry and access to parks" while section 17 of the *Conservation Act* states that:

- (1) The Director-General may charge for the use of facilities (other than roads, paths, and tracks) provided by the Director-General on or in respect of any conservation area.
- (2) The lessee or licensee of any part of a conservation area may, to the extent that the lease or licence so provides, charge for the use of facilities provided by the Director-General or the lessee or licensee on or in respect of that part of the area.
- (3) Except as provided in subsections (1) and (2) of this section and in section 38 (1) of the Act,² public access to and use of conservation areas shall be free of charge.

DOC has, not unreasonably, interpreted these provisions to mean that:

- visitors have to be able to visit conservation areas even if there are concessionaires providing visitor services in those areas; and
- there can be no monetary charge for any visitors who are not also purchasing services from a concessionaire.

For example, Department of Conservation (1996c, p 41) comments that

Access to areas managed by the Department will be free of charge; it may be controlled to protect natural and historic values or the quality of the experience of visitors.

We understand that the Department's interpretation was also recently affirmed by Parliament when dealing with the *Conservation Amendment Bill* concession provisions. We do not question the Department's interpretation of its governing legislation. Our contention is that the decision by Parliament to make access to conservation areas free of charge is fundamentally flawed and the source of considerable inefficiency in the allocation of resources in New Zealand.

To begin with, *costs* incurred by both visitors and DOC cannot be legislated out of existence. Even if visitors are not charged a *monetary price* for visiting areas managed by DOC, they nevertheless have to expend *time and effort* to enjoy the experience. In addition, when scarce resources are allocated

² This section authorises the issue of permits for hunting in conservation areas.

by queuing mechanisms, such as booking in advance, time and effort will need to be spent securing a place before the visit is made. Even in the absence of a monetary price, access therefore will not be “free”.

Furthermore, visitors to areas managed by DOC, just like the customers of concessionaires, *impose costs* such as damaging the physical condition of the natural environment, increasing wear and tear on facilities such as tracks, littering, taking up the time of DOC officers that could be allocated to other tasks, and reducing the value of the recreational experience of other users. Particularly in peak seasons, facilities such as tent sites, bunks in huts, car park spaces, seats on boats, helicopters and buses and space on lake surfaces or boat mooring sites might become congested. Use by one visitor would then preclude use by others, or at least devalue their experience. An *efficient* allocation would distribute the limited slots to those potential visitors who value them most. This could only be done by charging users the maximum benefit forgone by those unable to obtain the desired resource.

If visitors are not charged a price to reflect all of these costs, they are effectively being subsidised. The result will be over-use unless DOC uses other non-price means of rationing the number of visitors or restricting their activities.

For example, the NZIER report discusses the case of huts (p 13):

Revenues from huts currently cover about 60% of current expenditures on them, although this is without charging for depreciation. Demand for at least some huts at certain times of the year appears strong, as evidenced by periodic crowding: this would suggest that the huts are under-priced at those periods ... The supply costs which might be expected to comprise ticket prices include:

- Administration and enforcement of ticketing
- Operation and maintenance of facilities (e.g. gas supply, painting)
- Return on capital invested
- Depreciation of structures (provision for replacement)
- Scarcity value of space occupied (rationing “rival” use of space).³

The current charges only explicitly address administration and operational costs. The Department may regard hut structures as “sunk costs” and ignore the return on capital, but without charging for depreciation it is not providing for the day when the structures will wear out and need replacing. Scarcity value is excluded from all except the Milford Track huts, with its guaranteed bunks. Even there,

³ For example, the views may be preferable without the hut being there. If so, hut users should compensate other tourists for the deterioration in the value of their experience. Hut users could be charged for hut services and the revenue so raised used to lower entry prices for non-users of the huts.

where the booking system opens in the winter before the season starts and reservations are accepted on a first come, first served basis, rationing is by queuing rather than by price ... Three of the tracks no longer differentiate between the price for camping and hut use, apparently for administrative convenience. While it may be difficult to distinguish between the cost of servicing huts and camp sites, the economic cost per hut user is almost certain to be higher because of the depreciation of the structure which will need to be replaced or lost at some future date.

Possible non-price rationing devices include queues, complicated informational barriers and physical hurdles. Potential visitors with a relatively low opportunity cost of time may prefer to have resources allocated by queuing. Relatively better educated patrons may prefer to have scarce resources allocated by complicated rules and procedures that require research and investigation – such as obtaining the right forms, finding the right person to contact and so on. Healthy young people may prefer to have resources supplied to those who can survive a physical endurance requirement – such as a strenuous hike.

Such alternative resource allocating mechanisms will usually be much less efficient, however, than explicit prices. They often will result in the scarce resource being allocated to someone other than the potential visitor who values it most. The alternative allocation mechanisms also typically use up real resources that could instead have been used for some other purpose. For example:

- Instead of wasting time, and becoming frustrated, in a queue, potential users could provide valued services for themselves or someone else.
- Ingenuity expended on discovering the right person to call for a booking, or the right form to fill out, could instead have been used to provide a worthwhile service to someone.
- Time and energy expended on strenuous physical exercise in excess of the benefits derived therefrom could instead have been used to undertake an activity of greater social value.

Money is widely used to mediate trades precisely because it is extremely effective at reducing the costs of making transactions.

The use of non-price rationing schemes also means that DOC effectively “throws away” revenue that could be used to help cover the cost of its operations. The strength of demand at peak times, and in the most desirable locations, becomes a “problem” for DOC to manage rather than a funding opportunity. Taxpayers are then called upon to fill the unnecessary funding breach. As we noted in chapter 2, however, it probably costs as much as \$1.28

to raise the last \$1.00 of tax revenue, so this is an expensive way of providing services that could be provided directly to users with no efficiency loss.⁴

Differential pricing, particularly higher peak period prices, would allow DOC to raise substantial additional funds. Greater differentiation of services, perhaps ideally implemented through concessions, would also allow more funds to be raised. For example, reserved bunks, better quality huts, prepared meals from food brought in by the operator and professional guiding could all be used more extensively than at present with little real environmental cost.

The NZIER reports (p 15) that some “user groups complain about being priced out of the back country, because of the gradual increase in charges for facilities upgraded primarily for the growth in overseas visitors”. These complaints would be lessened if the existing users had already been paying for their access to the scarce resources and the new users facilitated a reduction in the fees paid by the existing users. As it stands, these existing user groups are subsidised by the taxpayers, who undoubtedly are not very sympathetic to their “plight”.

A related objection is that user charges will be “unfair” because they will ration the scarce commodity to those most willing to pay. One reply is that non-price rationing schemes are also “unfair”. For example, rationing use to those who can survive a physical endurance requirement – such as a strenuous hike – is unfair to older people, to families with small children and to handicapped people. Ought not these people also have the opportunity to see the more fantastic sights? Allowing only rough and steep tracks in parks, and banning access by helicopter, discriminates against some categories of potential users just as money prices do. Similarly, rationing by queuing favours the healthy young⁵ unemployed on social welfare benefits who have a low opportunity cost of time.

More to the point, however, taxpayer-subsidised access to valued natural areas is a very inefficient way of redistributing monetary income. If a lack of money to spend on desired goods and services is a problem, the criterion for redistribution should be measured money incomes, not consumption of particular services such as recreation opportunities. Many voters would no doubt support subsidised access to medical care, education and other such

⁴ An appendix to this chapter presents a brief economic analysis of some of the consequences of using fees to ration the use of conservation areas.

⁵ Others on unemployment benefits might be more inclined to search for jobs, or seek health care, and so could have a higher cost of time.

“merit goods”, but it is doubtful that hikes in conservation areas fall into that category.

The NZIER report (Clough, 1994) offers another defence for not charging entry prices to conservation areas. It suggests (p 6) that *efficiency* is not served when a price deters use that could be accommodated at no additional cost. The report suggests that examples might be where additional use “imposes negligible impact on the environment, or where use is dispersed or otherwise unobservable and prices unenforceable”.

Clearly, where use is unobservable, or prices are otherwise unenforceable, a price cannot be charged. As we shall argue further below, it is not a simple matter to determine whether a user fee is enforceable. In any case, this is a practical matter rather than an efficiency issue. In other words, it is not strictly correct to say that it is inefficient to charge a price in this case – it is simply impossible to do so.

Further, even where additional use “imposes negligible impact on the environment” it might impose other costs such as wear and tear on facilities, occupying the time of DOC officers and so on. Nevertheless, the point could be re-stated by arguing that even if it is possible to charge a price for additional use it will be inefficient to do so if the real opportunity costs of that additional use is zero.

The suggestion that it may be inefficient to charge a price in cases where prices *can* be charged but the costs of an additional user are zero is related to Coase’s analysis of charging for lighthouse services as discussed in chapter 2. Recall that Coase quoted Samuelson as arguing that:

even if operators were able ... to claim a toll from every nearby user ... it costs society zero extra cost to let one extra ship use the service; hence any ships discouraged from those waters by the requirement to pay a positive price will represent a social economic loss.

As Coase pointed out, however, tolls for lighthouse services have been used in the British Isles. These tolls had a fixed and variable component (dependent on the annual number of voyages by the same shipping company). We noted in chapter 2 that Coase argued that “the form of the toll and the exemptions mean that for most ships the number of voyages will not be affected by the fact that light dues are paid”.

Coase went on to argue that charging a price for a product is likely to result in a more efficient outcome than financing the service from general tax revenue. His key point is that charging a price reveals important information about the value of the good or service to consumers. This information is not available when the product is given away at no charge.

These benefits of charging a price can be extended in the case of visitors to conservation areas. It is quite common in the United States, for example, for visitors to State and National Parks not only to be charged entrance fees but also for the toll collector to ask them for a zip code or foreign country of origin. Even rudimentary customer information such as this can have considerable value to the service provider. In particular, travel times from a patron's house can be used to derive a lower bound for the value the visitor places on the visit. In the absence of such explicit and implicit measures of value, the only alternative is to use imperfect survey techniques such as contingent valuation. Thus, even if the revenue raised by an entrance fee system is low relative to the collection costs, the value of the additional information collected could make an entrance fee system worthwhile.

In countries where there are entrance fees to conservation areas, it is usual for the fees to include a seasonal component. For example, in some seaside parks in Victoria there are entrance fees during the peak summer tourist season, while entry is free of charge at other times. A justification for this procedure is that the congestion elements of the costs are likely to be much higher during peak periods, so it is efficient to signal those costs to consumers and encourage them to shift their demand to some other time of the year when the facilities are less congested. In the off season, the efficient price might be so low that the cost of collecting it would exceed the revenue raised by more than the value of the customer information that could be obtained.

It has been suggested to us by a number of New Zealand commentators that in many parks in New Zealand it would be quite impractical to collect fees. Only in isolated instances (such as the thermal attractions at Whakarewarewa) are there fences that prevent people from seeing the attraction unless they pay a fee. In most situations it is impossible to police the boundaries of the conservation area and prevent people from entering for nothing.

The same objection applies, of course, in other countries where entrance fees actually are charged. Despite the fees, the vast majority of patrons enter parks by driving a car, or riding a bus, down the main entry road and therefore by passing through a main entrance "gate". Even when fees are charged for entry to overseas parks, rarely are they high enough to cause many patrons to leave their car unattended on a lonely back road and walk a substantial distance just to avoid paying the fee. The inconvenience of such illegal entry can be increased by ripping up, or installing barriers across, back roads that approach too closely to park boundaries and ensuring that

trespassers have to walk a considerable distance from the nearest road before entering the park or reserve.

More fundamentally, the objection that access fees ought not to be charged because it is difficult to do so amounts to saying that because *illegal trespass* in conservation areas would be difficult to detect one might as well pretend that the law, if instituted, was not being broken. The same argument would imply, for example, that tax evasion and white collar crime should be eliminated from the statute books because they are just as difficult to detect – or perhaps even more so. Tax evasion and white collar crime can involve very complicated accounting or legal manoeuvres that can occupy a barrage of lawyers and accountants for years. Trespassers in conservation areas are probably rather easier to find.

We suggest, therefore, that users of conservation areas ought to be made responsible for purchasing a ticket or other such authority before entering a conservation area. Entering conservation areas without such authority would be illegal trespass punishable by a large fine. Even if the probability of detecting violators were small, if the size of the fine were large enough the *expected penalty* (the size of the fine *multiplied by* the probability of receiving it) could be made very large, and it is this that determines the deterrence effect.⁶

In addition, if influential public commentators ceased to condone the practice, the social pressure for making a contribution to support conservation activity would be sufficient to encourage most people to purchase the required entry authority. People could continue to violate a trespassing law with a clear conscience if they were incorrectly encouraged to think that it is costless to provide them with access to suitable conservation areas. If they were informed of the true costs, however, most law-abiding citizens would choose to comply even when they could enter the area other than through the main entry “gate”.⁷

We suggest that a relatively modest program could easily ensure that more than 90% of patrons pay an access fee that covers the relevant costs. The reforms could include:

- a new law making it illegal to enter public conservation areas without appropriate legal authority;
- institution of a large fine for trespassers found guilty of illegal entry;

⁶ For further discussion of this point see, for example, Buchanan and Hartley (1996).

⁷ Buchanan and Hartley (1996) emphasise the important role of such informal social mechanisms in assisting with law enforcement.

- a program of random enforcement aimed at ensuring a minimum probability of detection of trespassers;
- a public relations campaign to inform people of the true costs of providing conservation area access;
- the stationing of officers at the main entry points to the major parks to collect fees from tour buses and individual patrons; and
- the institution of a permitting system whereby prospective travellers could purchase authorities to enter conservation areas by mail, telephone, the internet or in person in the major cities of New Zealand.⁸

The lighthouse fee discussed by Coase illustrates another point. As we noted in chapter 2, ships were charged on a sliding scale based on the number of voyages per year such that:

In the case of "Home Trade" ships, there is no further liability for light dues after the first 10 voyages in a year and in the case of "Foreign-going" ships, there is no further liability after 6 voyages.

In effect there was *price discrimination*, where different consumers were charged different prices. Coase argues that most shipping companies ended up paying a marginal price of zero for an additional voyage.

The pricing scheme can be thought of as "a contribution to the fixed costs" together with a marginal fee (in this example zero). More generally, many goods that are jointly provided to more than one consumer, but where there are some non-zero marginal costs, also have a fixed lump sum contribution to overheads and a low marginal component equal to the marginal cost of additional consumption. Such price discrimination can be used to increase the efficiency of provision of a joint good such as lighthouse services, or a conservation area, where the marginal cost of an additional visit is very low or even zero.

A two-part pricing scheme also can be seen as a "discount" for bulk or extended purchases. For example, a two-part tariff for visits to conservation areas could take the form of an annual fee (for example people could join a "Friends of National Parks" club) that contributes to fixed overheads with a discounted entrance fee equal to marginal cost for each visit during the year. Similar pricing schemes are used by most zoos and many other tourist and recreational facilities. Since the marginal fee should at least cover marginal costs, however, additional fees for guaranteed bunks, peak-period use and so

⁸ This latter service might be provided, for example, by private banks or travel agencies for an additional premium over the mail-order price.

on ought to be fully reflected in the discounted prices charged to the “club members”.

As the NZIER (Clough, 1994, p 15) observes, such bulk discounts would be used mainly by New Zealand residents since most foreign tourists would not be spending enough time in conservation areas to make the fixed fee worthwhile. Allowing such price discrimination therefore is another method of handling the objection that charging fees for the use of conservation areas would unfairly prevent many New Zealand residents from using them.

It is also useful to note that the elasticity of demand for visits to conservation areas is likely to be much lower for foreign tourists than for New Zealand residents. For a foreign tourist, the major cost of visiting a conservation area, which is one of the main things they come to New Zealand to do, is the cost of getting to New Zealand in the first place. A relatively large park entrance fee will make little difference to the total cost of visiting a conservation area in New Zealand relative to, let us say, Tasmania. On the other hand, New Zealand residents have a lower cost of getting to a conservation area, so an entrance fee will be a bigger part of the “total price”.

The higher elasticity of demand for New Zealand residents means that an entrance fee in excess of the true marginal cost will impose greater efficiency losses for New Zealand users than it would for foreign visitors. Where true marginal costs are difficult to measure, therefore, this provides another efficiency justification for a two-part pricing scheme that provides discounts to New Zealand users.

Another consequence of the relatively inelastic demand on the part of foreign visitors is that DOC will raise much more revenue by charging foreign visitors a higher price. Where the elasticity of demand is high, a *higher* price can actually *reduce* revenue since the decrease in the number of users will more than offset the revenue gained from each user.

There is another practical reason why it might be in the joint interests of conservationists in New Zealand to support fees for entry to parks. Conservation has to compete with other potential uses of natural resources. Fees enable the economic value of conservation to be demonstrated, bolstering the case for using the resources for conservation purposes rather than something else. In addition, the reduced call on taxpayer funds reduces the political opposition to setting aside land in conservation areas.

Visitor safety and risk management

As a result of the *Occupiers' Liability Act 1962*, DOC is responsible for taking reasonable care to ensure the safety of visitors to conservation areas. However, the Act preserves the common law rule of *volenti non fit injuria* – which essentially means that individuals using conservation areas are presumed to know, and to have willingly accepted, the risks they are taking.

DOC (1996c, p 53) interprets its responsibilities to be:

- providing visitor facilities that are located, designed, constructed and maintained to meet appropriate safety standards using sound building practices;

and

- making visitors aware of the risks present in Department-managed areas and of the level of skill and competence they require to cope with these risks.

As the Cave Creek tragedy made clear, however, private individuals do not have a legal right to recover damages when the Department's actions do not accord with these accepted responsibilities. As we remarked above, one of the major advantages of greater reliance on private concessionaires to provide visitor services is that the private parties would be liable for reasonable standards of care. They could be sued for damages in a court of law. DOC could also become a more effective regulator of safety standards when the Department is not itself the provider of services to the public.

A related issue is that rescue operations for visitors stranded in remote locations can be extremely expensive. Efficiency requires that the anticipated benefits of participating in dangerous outdoor activities at least equal the expected costs.⁹ When individuals can impose the costs of rescue on taxpayers,¹⁰ there will be too much participation, and too many risks will be taken. From an equity point of view, we also do not see why voluntary participants in dangerous recreational activities should be subsidised by taxpayers. In the first instance, users of conservation areas should be responsible for covering the costs of any search and rescue operations.

In some parks in the United States, visitors are now required to purchase an insurance policy as a condition of entry. If the visitor needs rescuing, the

⁹ Specifically, the anticipated *marginal* benefits should equal the *expected marginal costs*, while the *infra-marginal* benefits could equal or exceed the *infra-marginal* expected costs.

¹⁰ The Police are responsible for search and rescue operations and DOC only supports the Police. Our concern is not with which government agency incurs the expense but rather the consequences of not enforcing a user pays system.

cost of the rescue will be covered by the insurance policy. The insurance premium will depend on the risks inherent in each park and the costs of mounting a rescue operation.

An alternative to *compulsory* insurance would be to require individuals to pay for the costs of any rescue but *offer* them an insurance policy that they could purchase upon entry to the park if they so desired. DOC, or other operators in conservation areas, would need to advertise that individuals using the areas were liable for their own safety and rescue costs, but that an insurance policy was available to cover the costs.

Whether rescue insurance were compulsory or voluntary, users who had additional safety equipment, more appropriate clothing, basic emergency medical supplies, two-way radios and so on could be offered a discounted insurance premium. This would encourage visitors to take appropriate precautions when travelling in dangerous, or potentially dangerous, areas. There could also effectively be a “fine” system for visitors who do not report their locations in remote areas on a regular basis. For example, visitors could be charged a fee in advance, which could be refunded when they leave the area if they complied with the various safety regulations.

Once the policy has been in operation for some time, premiums could also be individually related. Individuals who habitually engage in dangerous outdoor pursuits, or who take less care, may then have to pay a higher premium. For example, the policies could have a “no claims” bonus that is forfeited if the individual has been rescued within the previous three years.

The major difficulty with making insurance voluntary is that, in practice, very few visitors to conservation areas are likely to have sufficient wealth to cover the cost of a rescue should one become necessary. While society could threaten to leave them stranded if they have not paid, the threat is unlikely to be credible. Imagine the media coverage if a stranded visitor with a broken leg was left to die on a lonely mountain top merely because he or she refused to pay for the cost of a rescue mission.

Where visitors who need to be rescued have not purchased the required insurance policy, they could be sued by the rescue team (which could be a private organisation) for subsequent payment. However, the possibility of declaring bankruptcy may limit the funds that the rescue service could recover from a stranded visitor. Furthermore, visitors may reason that the limited funds the rescue service could recover, coupled with the financial and public relations cost of a lawsuit, might deter litigation. If too many visitors decided that insurance was unnecessary, and the net returns from litigation were small, the rescue service would not be able to cover its costs.

On the other hand, bankruptcy imposes other costs on an individual, including a severely reduced ability to borrow for other purposes such as buying a home or starting a small business. The threat of bankruptcy may therefore encourage many visitors to purchase an insurance policy. The low probability that a rescue will be necessary should make the insurance inexpensive even though the costs of most rescue operations would be greater than the wealth of most visitors.

A policy of forced purchase of rescue insurance contracts would be less objectionable when consumers have a choice of different areas to visit. Some entrepreneurs could offer voluntary insurance and consumers could freely choose which areas to visit. However, consumers might then *self-select* so that all the visitors with few assets, and who therefore would be in little danger of being sued, visited the entrepreneurs offering voluntary insurance. More than likely all entrepreneurs would end up making the purchase of insurance a condition of entry into their conservation area.

In any case, a policy of requiring the purchase of an insurance policy would be much easier to implement when entry to the conservation area is controlled and visitors are also charged an entry fee. The rescue insurance premium would simply become another part of the entry fee.

The public no-fault accident compensation scheme in New Zealand automatically limits the liability of purveyors of goods and services for death or injury to their customers. Furthermore, as long as victims are covered by the accident compensation scheme and the public health system at premiums that do not adequately reflect the risks they take, they will not take enough care to offset the reduced care of providers. Indeed, one could speculate that “thrill-seeking” activities like bungee jumping are so prevalent in New Zealand because the accident compensation scheme absolves operators from liability and their customers from paying the full cost of their risk-taking behaviour. Certainly, the cost of a bungee jumping operation in the United States would be *much* higher than it is in New Zealand because of the high cost of insurance against injury lawsuits.

This is not to say that bungee operators, for example, *ought* to be made strictly liable for the injuries suffered by their customers. In a competitive market, some operators might offer a no-fault service while others leave more of the risks with their customers. The prices for the different services should reflect the different implicit levels of insurance. In the absence of an explicit contract between the buyer and the seller, and legislative intervention by the government, the common law would allocate risk between the parties according to different types of negligence standards.

These range from strict liability through negligence with a defence of contributory negligence to *volenti non fit injuria* – which is a type of strict liability for the victim. It has been argued that the rules adopted under the common law reflect the opportunities and costs for either party to take more care and thus tend to encourage efficient behaviour.¹¹

INSTRUMENTAL, OR INDIRECT USE, VALUES

Conservation provides additional services apart from the direct benefits enjoyed by visitors to conservation areas. Many New Zealand residents would support actions to preserve endangered species, such as the kakapo, even if they do not expect to see one of the birds alive. Preservation of native vegetation might also assist with conserving water, soil and air quality. Native species might provide useful medicines and sources of food and fibre. Native species might also be hybridised to produce more valuable garden plants.

It is often very difficult or impossible to charge for these types of benefits since, by their nature, they are often dispersed across many beneficiaries, each of whom obtains only a small return. The small value accruing to each beneficiary may not justify defining and enforcing property rights to the resource even if it were feasible, or not too expensive, to do so.

Many services with a large “public good” element have been provided through voluntary and charitable activity for aeons. Even in the conservation area, DOC relies upon clubs of volunteers to assist with conservation work. Many of these volunteers donate money and other resources in addition to time.

While people might be willing to pay for knowing native species have been preserved, they might also have an incentive to free ride on the preservation activities of others. Since the amount other people contribute to species preservation is available to an individual whether or not that person contributes, there will be an incentive to understate the true demand for the service.

Nevertheless, it is not at all obvious that the level of support for conservation activity that would be offered voluntarily would be inefficiently too low. As we noted in chapter 2, it has been argued that the tax system and the greater role of government have reduced the role of voluntary activity in modern societies. If this is so, an elimination of compulsory support for conservation through the tax system is likely to

¹¹ For further discussion see, for example, Hartley and Brito (1996).

result in an expansion of voluntary support from those who value the activity most highly.

Furthermore, as with other services of this nature, advertising can assist with funding. For example, it is difficult to charge for broadcast television service.¹² The service has for decades primarily been funded using commercial advertising. Similarly, an increasing proportion of services on the world wide web is being funded by advertising. In New Zealand, DOC has already used advertising to help fund species recovery programs. In return for contributing funds to the project, a corporation is given sole rights to use the species in its advertising. This program has been quite successful in raising funds for the Department. The Department also charges film makers for using conservation areas. Print advertisers, including tourism operators, using the spectacular New Zealand scenery also could be charged a fee. This would require that DOC – or other owners of the site – be granted a copyright on the use of New Zealand scenery for commercial purposes.

In spite of the ability to fund species preservation and the like through these indirect mechanisms, there may nevertheless be too small an amount of such activity relative to what people would desire given the cost. There may then be a case for financing the provision of some of these services through the tax system.

Making a case for public subsidy of an activity is, however, not the same thing as justifying monopoly public supply of that activity. So long as a competitive market for conservation services is feasible, private operators can compete to provide the subsidised activity for the lowest cost, subject of course to regulation to ensure high quality services are provided.

It is also not necessarily the case that indirect benefits of conservation are most effectively provided by establishing large conservation areas. For example, recovery of rare and endangered species might be more effective if it were carried out in closely monitored environments, such as zoos, than in conservation areas. Zoos have access to substantial veterinary resources, including antibiotics to help fight animal diseases and scientifically prepared foods designed to increase the probability of survival and breeding success.

¹² Furthermore, while scrambling the signal and requiring people to buy decoders can ensure viewers pay for the service, it could be inefficient because additional viewers could be allowed to see the programs at no cost to existing viewers. We have said “could be inefficient” because if some additional viewers are allowed to see the programs at zero cost the willingness of existing viewers to continue paying would be in doubt. Thus, expanding the number of viewers in this way might simply not be a realistic option.

In addition, the remaining individuals in the species are better protected from predators in a controlled environment such as a zoo, or a special centre for breeding rare and endangered species. Once recovery of the species has been ensured through a controlled breeding program, individuals could again be released into suitable “wild” environments to re-establish them in their native ranges. It is simply not correct to argue that “natural is always best” when recovery of rare and endangered species is concerned. An additional benefit of placing surviving individuals of a rare species in a closely monitored and enclosed environment is that people could be charged to visit the facility, providing additional funds to pay for the service.

On the other hand, many people might value not so much the survival of the species *per se* but rather its survival *within a natural environment*. For example, many people would be willing to pay more to see a kakapo preserved in a conservation area than they would to see the same bird preserved in a zoo or wildlife breeding centre. Many of these same people would also pay more to *know* the bird was being preserved in a natural environment, even if they never intend to look at it. This is why it might be valuable to re-introduce species into natural habitats as part of the recovery program. Choosing between *in situ* and *ex situ* conservation strategies becomes a matter of weighing up *both* the costs *and* the benefits of the alternative strategies.

Large conservation areas may also be unnecessary for the development of native genetic resources as means to ends rather than ends in themselves. Patents for genetically engineered, or hybridised, native species could encourage the development of medicines, foods, fibres and plants for use in gardens, wind shelters or riparian strips on farms. Again, “locking up” resources in conservation areas is not necessarily the most effective means of achieving the ultimate goal, which is, in this instance, to increase the ways native species can be *used* to provide other goods or services of value. Encouraging the use of native rather than exotic species in many of these applications would have the added benefit of providing additional habitat for other native species, such as birds, in the farming, forestry and urban environments of New Zealand.

Even if keeping native ecosystems intact as much as possible is considered the most effective technology for preserving native genetic material, it does not follow that the service cannot be priced. For example, drug companies could be awarded patents on new medicines obtained from New Zealand native species in return for paying for the preservation of tracts of native bushland. This has been done, for example, in Costa Rica. Merck

and Co signed an agreement with Costa Rica's National Biodiversity Institute in 1991 to obtain screening rights for medicinal uses of native plants and animals. Profits Merck earns from drugs derived from Costa Rican species will be shared with the country. In addition, Merck is training Costa Rican biologists to test specimens for medicinal properties and providing them with the necessary laboratory equipment. Of all the countries of Central America, Costa Rica has the largest percentage of remaining native rainforest area.

Since the *Treaty of Waitangi* affirmed the rights of the Maori to their lands, forests, wildlife and fisheries, it could be argued that iwi ought to have first claim on patents based on the genetic resources inherent in New Zealand native species. In fact, genetic resource royalty issues are currently the subject of a Treaty claim process, for which hearings had, at the time of writing, recently begun.

Maori already have a substantial body of information about the medicinal, food and fibre values of different native species. Explicitly recognising property rights in the genetic resources of indigenous species would provide very strong incentives to conserve these resources and develop them in ways that increase their value to society.

Private conservation of native species in “natural environments”

Market mechanisms might also be used to encourage private landowners to preserve habitats for native species. For example, Florida has introduced legislation to allow “wetlands banking”. The state or local water management districts can license owners of wetlands property as “mitigation bankers”. The licensed bankers then sell mitigation credits to private developers and use part of the proceeds to improve the wetlands. Developers are allowed to develop a wetlands area (other than one classified as “pristine”) only by simultaneously rehabilitating land in a wetlands bank. Landowners developing poor quality wetlands may need to buy as little as three-quarters of an acre of mitigation credits for every acre they are developing, whereas filling high-quality wetlands may require a ratio of 1.25 to 1.

The success of these policies could depend critically, however, on the trade-off ratios and in particular the relative quality (in conservation terms) of the areas developed and those restored. Young, M.D. *et al.* (1996, p 121) note that:

It has been argued that such schemes are simply ecologically ineffective, because of insufficient knowledge about the science of creating and destroying wetlands. For example, a study carried out in 1985 found that of 32 wetland creating projects carried out in Virginia, only 9 had been successful.¹³

An adviser to the Chicago Board of Trade (CBOT) nevertheless has suggested that the wetland banking scheme could be taken further. He has suggested that the CBOT could establish a market for habitats occupied by native species. Developers, or other individuals or groups such as local government bodies or environmental clubs, could buy and sell permits to the habitats.

Developers wishing to destroy or modify habitats occupied by native species would need to apply to have the “wilderness value” of the resources assessed. They would then have to purchase the required number of permits from the exchange before they could proceed.

Conversely, farmers, government departments or other land owners could apply to have the conservation value of resources assessed allowing them to sell permits to the exchange.

By purchasing permits and driving their market price up, environmentalists could both limit destructive development of significant

¹³ The definition of “success” is, of course, critical to this evaluation. Furthermore, the authors do not report a measure, on the same “success scale”, of the quality of the area that the development “replaced”. The authors do, however, state that:

Even if successful, mitigation efforts can result in fragmented segments of wetlands of far less richness and diversity than the areas which they are intended to replace.

This is no doubt true. The question is whether they *do* result in such a diminution in quality and, if they do, whether a gain in total area under wetland could offset the loss in quality. Young *et al.* then report another criticism:

Others have criticised the administrative framework used to oversee mitigation projects, claiming that inadequate resourcing has meant that project plans are often not carried out at all, or if they are implemented, are not monitored or maintained

The basic problem is the absence of a genuine market in environmental outputs. A bureaucratic procedure is therefore needed to assign “shadow values” for the environmental services provided by different areas. It may help the reader to imagine cars being traded in the same way. There are many attributes that people value in cars – aspects of comfort, speed, safety, reliability, durability, fuel efficiency, size, appearance and so on. Suppose that instead of setting car prices in a market, some government official was charged with producing a “car index” value – like the “environmental value” of a wetland. Cars that were “overvalued” by the index would be supplied in excess, while those that were “undervalued” would be in excess demand. Similarly, if the “environmental value” of poor wetlands is “overstated”, and of good wetlands “understated”, there will be too much conversion of good ones to bad ones.

natural areas and encourage constructive development of more of them. Developers would be required to pay the going “market price” for destroying natural habitats. That price would reflect not only the direct “use” values of natural habitats, such as the value of the resources for tourism and recreation purposes, but also the “existence value” of native species and habitats that is reflected in the price of habitat permits traded on the exchange.

Economists have also suggested that bans on trade in wildlife ought to be relaxed to increase the market value of conservation activities. In fact, a number of “animal protection acts” passed in New Zealand around the turn of the century transferred ownership of threatened wildlife from private individuals and iwi to the Crown. These acts effectively overturned Treaty rights and the prior common-law ownership rights based on “first capture”. Currently, some *Treaty of Waitangi* claims are returning some of these populations to private ownership

Bans on exports of parrots and other rare birds have been controversial in Australia. It has been argued that they raise the market price of the birds overseas and attract smugglers to the trade.¹⁴ These illegal exports can reduce the population of native birds in the wild and potentially endanger their survival.¹⁵ Licensed breeders of native species should be allowed to sell individuals to zoos or other recognised dealers.

The idea behind licensing is that it would protect native specimens in the wild (or more particularly their eggs) from harvesting.¹⁶ Licences could be enforced by an inspection system. Random checks based on measuring DNA

¹⁴ For example, Moyle (1997b) records that whereas galahs sold for \$A50 per pair in Australia in 1993, they sold for about \$A4,450 in the United States! In the same year, the more uncommon gang gang cockatoo sold for \$A1,300 in Australia, \$A18,500 in the United States and \$A28,175 in Germany.

¹⁵ Moyle (1997b, p 127) notes, however, that “the species that make up the bulk of the international trade are not recognised as endangered. Moreover, a large and legal domestic market exists for Australian wildlife. So if trade is supposed to be detrimental to a species’ chances of survival, the ban on exports alone is likely to be ineffective”. Later in the article (p 130), he suggests that “A second conservation cost of the *ban* is that it encourages *excessive* taking from the wild. The survival rate of smuggled wildlife is generally low ... Smugglers must take a large stock from the wild to ensure that enough survivors reach their destination. For rare and valued species this too has a conservation cost as populations become depleted.” (emphasis added).

¹⁶ Moyle (1997b, p 130) comments that “reputable overseas aviaries prefer captive-bred specimens as they are more familiar with humans and are likely to be healthier than wild ones”.

in blood samples could verify that wildlife purported to be raised in captivity was indeed raised by the breeder. Violations of the licence conditions could lead not only to revocation of the licence but also to large fines (to offset relatively small probabilities of detection). Indeed, the checks need not be totally random. Licensed breeders could be required to keep, and submit, breeding records. Anyone taking specimens or eggs from the wild will appear to have an extremely high breeding success rate, making them a good candidate for DNA testing.

The Parks and Wildlife Commission of the Northern Territory has produced a draft plan along these lines to promote conservation of the red-tailed black cockatoo outside of National Parks and other reserves. Commercial use of the species will be permitted on private lands under strict controls.¹⁷ The Commission states that one of the goals of the scheme would be to:

Promote retention and management of habitats on private lands and establish with landowners the concept that wildlife, wildlife habitats and biodiversity in general can be valuable economic assets “worth” conserving.

The Commission also wants to test the idea that the scheme can reduce illegal harvests of the bird. It also expects that the program will assist with developing monitoring programs for wild populations and encourage research into all aspects of the ecology, population dynamics and captive husbandry of the species. Some of this research will be undertaken by private landowners who will have an incentive to treat the cockatoo like any other economic asset. Some of it, however, will be funded from royalties paid to the Commission.

The current proposal is for a trial management zone for the program consisting of the Darwin Coastal, Daly Basin and Pine Creek biogeographic regions. An area of privately-held land will be considered eligible for harvesting if the landowners enter into an agreement to manage and protect some habitat of the red-tailed black cockatoo:

Management prescriptions for each area to be covered by agreements will be developed on a case-by-case basis in consultation with the landowners. For specific areas subject to protection (i.e. not complete land holdings) prescriptions may include:

- No clearing of native vegetation;
- No deliberate introduction of exotic plants (i.e. pasture improvements);

¹⁷ Details of this program can be found at <http://www.tasweb.com.au/bapa/eclec-1.htm#Trial Mgt Plan>, October 1997.

- Adoption of appropriate fire regimes.

Habitats subject to agreements may include nesting, roosting and foraging areas ... The areas covered by such agreements are not necessarily the areas from which harvests will occur. Areas from which harvests are allowed will be designated "Approved Harvest Areas" and will be linked to habitat protection agreements. Commercial utilisation of wild [red-tailed black cockatoo] will only be permitted in Approved Harvest Areas. Approved Harvest Areas will be selected by the Commission on the basis of all available information, the interest and commitment of the relevant landowners, the importance of the habitats contained in the agreements made under this program, the abundance of the local resource and, the predicted capacity of the resource to sustain harvests. Newspaper advertisements will be used to solicit interest from landowners in the trial management program.

Landowners who secure Approved Harvest Areas will be allocated a proportion of the total harvest quota ... for one or more of the following: eggs, hatchlings, juveniles and/or adults. The total harvest quota for any category of harvest cannot come from a single Approved Harvest Area, and in the trial phase will be very conservative.

The removal of [red-tailed black cockatoo] and their eggs from the wild will require a Permit to Take ... Persons seeking a Permit to Take will be required to provide written evidence that they possess or have access to an Approved Harvest Area and Harvest Quota. They will also be required to satisfy the Commission that they have the necessary skills and resources to undertake the harvests in an environmentally benign manner, and care for such eggs, nestlings, juveniles and adults as may be removed from the wild. Royalties for harvested birds are payable at the time the permit is issued and are non-refundable. Landowners may harvest their quota themselves by obtaining a Permit to Harvest or they may transfer their harvest quota to others. Landowners with Approved Harvest Areas and Quotas will be required to notify the Commission of such transfers.

The plan also proposes methods to limit any damage to the environment as a result of the harvesting scheme:

Harvests will be supervised by the Commission. This will ensure harvests are environmentally sensitive and comply with permit and program requirements. All harvests will be undertaken in a way that insures environmental impacts are minimised. Access to wild nests will be restricted to methods that do not jeopardise future use of hollows for nesting.¹⁸

¹⁸ One suspects, for example, that the ecological damage associated with such a scheme would have to be much less than the (generally unseen) damage associated with fishing.

The methods that are to be taken to control illegal poaching are of particular interest:

The marking of captive birds is considered an essential security measure for preventing theft of captive birds, ensuring wild birds are not traded outside the provisions of this management program, and ensuring data collected from birds are related to the same individuals over time.

Uniquely numbered microchips ... will be implanted by the Commission or their agents into juveniles, adults and nestlings (once they reach an appropriate size). The Commission will be the sole organisation responsible for issuing microchips, and will charge for them. At the time micro-chips are implanted a genetic sample will be taken for possible future DNA identification. Bands cannot be used because some wild caught specimens may severely mutilate themselves in attempts to remove them. Birds born in captivity must be marked with microchips.

Permit holders will be required to keep records showing the number of birds harvested, the number held in captivity, the number traded and their destination, the microchip numbers of the birds harvested or traded and deaths and births. Summary reports will have to be filed with the Commission annually.

The Department of Conservation and Land Management (CALM) in Western Australia also recently announced that:¹⁹

57 Carnaby's cockatoos had been raised from eggs and nestlings collected in the wild under a joint partnership with the avicultural industry ... The partnership between CALM and an avicultural syndicate, including the Rainbow Jungle native parrot wildlife park at Kalbarri, also looked at the extent to which a controlled harvest of birds could be undertaken that would benefit the conservation of the species.

CALM's Wildlife Branch staff collected 34 eggs and 34 newly hatched chicks from 68 nests. These were given to five aviculturists for rearing and resulted in 26 chicks from the eggs and 31 from the nestlings. Carnaby's cockatoos generally lay two eggs but research has shown either only one egg hatches or in the event both hatch, one of the nestlings dies.

Further monitoring of the nests from which the eggs and chicks were taken revealed that 42 chicks were successfully raised in the wild from the remaining eggs and nestlings. This level was in line with past research observations. This meant that combined with the captive breeding program, the number of chicks that survived was more than double the rate that would occur naturally.

¹⁹ See the press release at <http://www.calm.wa.gov.au/news/>, October 1997.

CALM will sell 10 of the raised birds by tender to licensed aviculturists to provide more resources for on-going conservation efforts, including restoring nest sites in the wild.

All of the captive raised birds are being DNA-tested and having micro-chips inserted for identification. The DNA tests will also help determine the sex of each bird so they can be paired up before they begin breeding in about three years' time.

A related debate has raged recently over trade in ivory. The population of African elephants has declined substantially in recent decades. The decline provoked a 1989 ban on international trade in ivory under the Convention on International Trade in Endangered Species (CITES). A recent meeting of CITES (in June 1997) has allowed limited resumption of trade in ivory.

It is not widely recognised that the decline in elephants in Africa has not been consistent across the continent. Whereas Kenya and Tanzania have seen their elephant populations decimated by poaching, herds in Zimbabwe, Namibia, Botswana, and South Africa have grown. In fact, Zimbabwe and Botswana claim their elephant herd is now too large, and that if left unchecked, elephants will destroy their own environment and physically threaten the lives and crops of people living close to them (Hill, 1997).

Kenya and Tanzania banned trade in ivory products before the CITES international ban was put in place. Yet they suffered the largest decline in elephant numbers. The southern nations of Zimbabwe, Namibia, Botswana, and South Africa permitted, even encouraged, trade in wildlife products and saw numbers of wildlife increase. In the countries where hunting of native animals is illegal, the wildlife is seen as a pest. The sooner the wildlife can be eliminated, and replaced by more valuable cattle, the better. Local villagers have an incentive to turn a blind eye to illegal poaching, if not assist the poachers. The ban in trade in ivory and other valued wildlife products also raises the market value of those products and makes poaching more lucrative. Corruption of officers in the wildlife service in Kenya was a recurring problem.

In the southern African nations, however, wildlife is recognised as an economic resource to be used sustainably. For example, the *Parks and Wildlife Act* of 1975 in Zimbabwe officially recognised that wildlife was the property of those who lived on the land with it. In both the commercial and the communal areas, the Department of National Parks and Wildlife Management (DNP) can place restrictions on the use (hunting or ranching) of threatened or endangered species, but generally the DNP restricts itself to giving technical advice to commercial farmers and to encouraging the development of wildlife management in agriculturally marginal communal

areas. The Zimbabwe National Conservation Strategy (Government of Zimbabwe, 1987) states:

Wildlife and protected areas are accepted as renewable resources that can and should be used correctly on a sustainable basis for the benefits of both the people and the resources. These benefits may take aesthetic forms such as scientific, cultural, and recreational values, or they may take material forms such as enhanced productivity from land.

Evidently, the economic approach of making wildlife a resource valued by the local population has been a more effective conservation strategy than bans on trade. The latter devalue wildlife and encourage moves to eliminate it in favour of exotic species that can be farmed. The former strategy makes native species assets rather than liabilities, and encourages people to farm them in place of exotics that are less suited to the local environment.

Scientific research

Another reason for preserving native species and habitats is that scientists still have much to learn about New Zealand's endemic ecosystems. Many scientists view scientific research as an end in itself – they enjoy making original discoveries and knowing more about the world around them. The community at large, however, views most scientific research as a means to an end rather than an end in itself. In particular, greater scientific understanding of natural ecosystems has instrumental value in assisting the agriculture, forestry, water supply and other natural resource-using industries and helping protect the natural ecosystems on which much tourism and recreation depends.

The benefits from scientific research into native species and ecosystems thus are also likely to be very dispersed. Any one beneficiary may gain very little from the research. Indeed, many of them might not even be aware of the contribution made by scientific research into native wildlife. Scientific research thus has the characteristics of a public good as discussed in chapter 2. As we also noted in chapter 2, however, simply because a good or service has these characteristics it does not automatically imply that the amount that would be provided in a free market economy would be inefficiently too low. Voluntary action can be very effective at providing many public goods. Indeed, in the present case of scientific research, private endowments and private contributions fund a good deal of it, particularly in the United States. Nevertheless, even in the United States the community also uses government action to help encourage the provision of scientific research.

The government basically uses two methods to help overcome the problem that scientific research is a public good that may be under-supplied in the market place. One is the use of patents, copyrights, trade marks and the like. The property rights in research results enable the researcher to reap monopoly profits for a specified period. A monopoly in the use of the research results is inefficient *once the research has been done*. The policy on patents, recognises, however, that these ex-post efficiency losses can be more than offset by the incentives that are thereby provided to undertake expensive research programs. A patent approach also encourages research in areas that are likely to have a high commercial payoff, and in that sense be of value to the community.

Public subsidy of scientific research is also used to counter the public good problem associated with research. This method has its own efficiency problems. The bureaucrats handing out the research funds might not have a very good method of choosing which projects are the most worthwhile to invest in. After all, if we already knew the likely value of the research, there would be less of a need to undertake it in the first place. In addition, however, the administrator of research grants is likely to be influenced by political and personal considerations such as personal relationships with researchers, a desire to build relations with research organisations that might be the source of future employment or employees, or a demand from politicians to spend more on projects in particular electorates or areas of research.

Despite its shortcomings, the political approach of subsidising research can be more effective than patents in some circumstances. For example, some basic research might not lead to patentable inventions – or might do so only after a very long time lag. Patents are more effective at encouraging research likely to have relatively immediate commercial application. More basic research might also have much greater efficiency losses if the results *could* be patented. Simply because they are more basic, the results are likely to have much more far-reaching implications, implying that the losses of not incorporating them into existing applied research could be very large.

In the area of conservation biology, we have already argued that patents might be suitable to encourage research into areas such as pharmaceuticals or genetic engineering. The basic research into the biology or ecology of native species is, however, much less amenable to this approach. It is not easy to see what results could be patented, or when it would be wise to patent them were it possible to do so. More than likely, much of this research could still be most effectively carried out in academic institutions, the Crown Research Institutes and in DOC.

An immediate question that arises is whether DOC should do any of its own research into wildlife biology. An alternative would be to contract out all of this activity.

We can see a number of reasons for DOC retaining an in-house research capability. The first is that DOC may need to have some research capability in order to contract out research in an effective way. It takes some scientific expertise to judge the value of research proposals. While some of this can be done with expert panels and a peer review process, there may also be some value in having internal expertise to service these panels and ensure consistency in their deliberations.

DOC would also be charged with advocating the level of funding for conservation research versus other spending priorities of government. Some scientific expertise may assist in this advocacy role. Here again, however, DOC might be able to effectively contract much of the relevant expertise.

Perhaps the best reason for retaining a scientific capability within the Department is that there is a very strong interaction between management and research in conservation biology.²⁰ Managers with daily experience of a conservation area have considerable amounts of information about the behaviour and interactions of species and the effects of environmental changes on them. Much of this information is not written down, and therefore is unknown to the scientific community at large.²¹ Furthermore, requiring local DOC officers to write down and communicate *all* their observations might not be very efficient when it is not known in advance which type of information might prove to be of critical value. Conversely, new research results in conservation biology might often be useful, for example, in saving a particular species from extinction. It is thus critical that field officers have the ability, and incentive, to keep up with recent research results.

The above arguments suggest, therefore, that the scientific capability within DOC should be focused more on the applied end of the spectrum – in communicating results from the field back to researchers, and communicating results of research to field workers. More basic research might, however, be better done on a contractual basis. Competition for

²⁰ In economic terms, we are arguing that there are substantial *economies of scope* between conservation biology research and management of conservation areas. These economies of scope mean that the activities might be provided at least cost by the one organisation, even if there are some offsetting losses through the lack of competition.

²¹ See the kaka example discussed in chapter 3.

research funds can then be relied upon to help produce better results for the same research budget, while the relationship with day to day management of reserves is more remote, giving DOC less of an advantage from carrying out the research in-house.

Our view on the role of research within DOC appears to be shared by the new management within the Department. In a press release on 16 October 1997, the Department stated:²²

The Department of Conservation's Science and Research unit will develop closer links with the field staff and managers it services, Director-General Hugh Logan announced today.

A review of the role of DOC's Science and Research unit was undertaken this year as part of the overall restructuring of DOC.

"Our scientists need to make sure the research they do is tied directly to conservation work and the requirements of field staff and managers. This means a change in the way research needs are determined, with a clearer focus on what is needed for conservation management, and a change in how we incorporate new research results into management practice."

"This decision does not mean a revolution for Science and Research. The number of staff and their locations will stay the same in general, and current research will continue. However, it is a philosophical change in the way staff approach their jobs. Science and Research will have a much greater client-provider relationship, with field staff and managers as the clients and scientists as the providers. This will make sure that the results of research are used effectively in DOC's conservation management work in the field."

Mr Logan said it was crucial that excellent science underpinned conservation management, and scientists would continue to have a role as advisors to management. However, scientists would not be able to pursue issues that were not management priorities.

"Science has already made significant contributions to conservation management, but more can be done. Resources are not limitless so we need to look at becoming more effective if we want to achieve more. This needs to happen through better techniques and better use of technologies, which science can help with."

Thus far, we have considered the funding of research into conservation biology. Another issue that such research raises, however, is that it provides another reason for preserving native species and habitats. Indeed, some people within DOC told us that they viewed preserving native species and

²² Departmental press releases are available on the DOC internet site (<http://www.doc.govt.nz/pressrel/>, October 1997).

habitats for the purposes of scientific research to be their *primary* responsibility.

The current practices of DOC, however, do not necessarily produce a close link between the desirable environments from the point of view of scientific research and the supply of conservation areas. For example, the recovery of formerly disturbed environments may provide more information about ecological processes and the relationships between native species than could be learned from more complex and less dynamic systems. These needs for scientific research will not be met, however, by a conservation strategy that places the greatest value on the least disturbed areas.

An alternative mechanism for providing conservation areas for scientific research could involve funding for conservation activity being provided through the scientists rather than directly to the Department. For example, research scientists could have funding for conservation activity included as a “voucher” with their research funds. Different conservation areas would then need to compete to supply scientific resources, just as they could compete to provide tourist and recreation areas.

In such a more market-driven milieu we would probably find different conservation areas specialising in providing different types of resources. Some areas might be primarily of interest for tourism and recreation, while other areas would specialise in attracting scientific research projects. The major consequence of the altered funding regime, however, is that conservation managers would need to become more responsive to the needs of their customers.

ACHIEVING CONSERVATION GOALS IN CONCERT WITH OTHER ACTIVITIES

As we noted in the introduction to this chapter, conservation is not just an issue that pertains to “reserved areas”. Effective conservation strategies will integrate conservation into the economic system so that *all* resource users face prices that reflect total costs and benefits and not just subsets of those costs or benefits as reflected in current market prices.

Putting a price on conservation outputs

In this regard, a particularly damaging result of not charging for access to conservation areas managed by DOC is that it “spoils the market” for private entrepreneurs. By “giving away” valued recreational opportunities without monetary charge, the Department makes it difficult for private owners of comparable resources to charge for allowing people to use them. In effect, the

market price of using natural habitats for recreational purposes becomes zero. Private landowners are given a signal that native habitats are of no economic value. The resources should instead be used for anything else that can yield a positive monetary income.

It is thus quite hypocritical for environmentalists to demand on the one hand that there be no monetary fee for entering national parks, yet on the other hand to criticise iwi, for example, for using native bushland to produce timber, or as land for exotic forestry, rather than nature preservation and “eco-tourism”. If eco-tourism is to grow in size to reflect its true value to the community, the government has to stop driving the market price of eco-tourism opportunities to zero.

Similarly, if drug companies were to be charged the true opportunity cost for access to native genetic resources in conservation areas, private land owners would have a greater incentive to preserve natural habitats in competition with DOC. The voucher scheme for financing conservation activity of value to scientific research also need not be restricted to conservation areas managed by DOC. Private land owners able to provide habitat more suitable for scientific research purposes ought to be eligible to receive the funds associated with the voucher. Finally, the marketable permit system for providing natural habitats that people value whether they visit them or not would also encourage private conservation activity.

Compensation for land use restrictions

The other side of this coin, so to speak, are the provisions in the RMA for compensation to private land owners when their property is placed under a “heritage order”. Section 189 of the RMA allows a heritage order to be issued:

for the purpose of protecting –

(a) Any place of special interest, character, intrinsic or amenity value or visual appeal, or of special significance to the tangata whenua for spiritual, cultural or historical reasons; and

(b) Such area of land (if any) surrounding that place as is reasonably necessary for the purpose of ensuring the protection and reasonable enjoyment of that place.

For the purposes of this section, a place may be of special interest by having special cultural, architectural, historical, scientific, ecological, or other interest.

Section 193 then specifies that:

Where a heritage order is included in a district plan then, regardless of the provisions of any plan or resource consent, no person may, without the prior written consent of the relevant heritage protection authority named in the plan in respect of the order, do anything including –

- (a) Undertaking any use of land described in section 9(4);²³ and
- (b) Subdividing any land; and
- (c) Changing the character, intensity, or scale of the use of any land – that would wholly or partly nullify the effect of the heritage order.

Section 195 allows for appeals to a heritage order on the grounds that the decision “has caused or is likely to cause serious hardship to the appellant” or it would “render the land which is subject to the heritage order ... incapable of reasonable use”.

In the event that a heritage order is made, Section 198 provides that the owner may apply to the Environment Court for an order giving the heritage protection authority the option of either withdrawing the protection, or taking the land under the *Public Works Act* 1981. Before granting such an application, the owner is required to satisfy the Court that:

- (a) The applicant has tried but been unable to enter into an agreement for the sale of the ... interest in the land subject to the heritage order or requirement at a price not less than the market value the land would have had if it were not subject to the heritage order or requirement; and
- (b) The heritage order or requirement renders or will render the land in respect of which it applies, incapable of reasonable use.

We have received legal advice that the term “incapable of reasonable use” is likely to be interpreted rather conservatively, especially given the use in subsection (a) of the phrase “the market value the land would have had if it were not subject to the heritage order or requirement”. Furthermore, even if a land owner can obtain adequate compensation for the effects of a heritage order, it might take a long time, and involve considerable legal expense, to do so.

The expectation on the part of private land owners that their land might be subjected to a heritage order can, under these circumstances, have quite perverse effects. Land owners will have an incentive to intervene first and ensure they have no features on their property that could draw the attention of the heritage protection authority. It is in the owner’s interest to have any buildings that could have historic value demolished as soon as the owner

²³ This section of the RMA defines use to include “erection, reconstruction, placement, alteration, extension, removal, or demolition of any structure ... any excavation, drilling, tunnelling, or other disturbance of the land ... any destruction of, or damage to, or disturbance of, the habitats of plants or animals in, on, or under the land ... any deposit of any substance in, on, or under the land”. It is interesting that this section effectively preserves exotic plants and animals in addition to native ones.

thinks they might be so regarded. Wind breaks should be formed solely from exotic species in case a decision to rearrange fields at a later date is prevented on the grounds that it will destroy a significant habitat for wildlife. Plantation forests or riparian margins should be planted with exotic trees rather than native species.

Upton (1997) asked the question, "How do we secure, in the public interest, those remnant ecosystems that remain in private ownership?" He argues that the number of significant areas is so large, and the size of each of them is so small, that regulation under the RMA is the only practical method of maintaining conservation outputs. He maintains:

There's no question that councils have the power to stop bush being cleared or wetlands being drained. But councils are also under an obligation to ensure that any such rule is the most appropriate way of achieving the desired end "having regard to its efficiency and effectiveness relative to other means". No one has tested that provision in court yet, so it may be that simply creating reserves on private land by a rule in a plan is legally acceptable. But it is scarcely going to make an ally of land owners who consider they have some rights at stake and, moreover, some expectation of compensation if they are expected to maintain a reserve for the public good. The fact that the SNA [significant natural area] is still there is *prima facie* evidence that the land owner is not intent on its immediate destruction.

Mention of compensation has drawn particularly hot fire from Forest and Bird. Why, they ask, should land owners be compensated for not destroying habitat when there has never been any suggestion that there should be compensation for not polluting air and water.²⁴ The answer is that air and water have always been in public ownership whereas much land is privately owned.²⁵ There are rights and expectations that can't simply be trampled on because they're inconvenient. Maori people feel that point particularly keenly.

Even more problematic, from the regulatory standpoint, is the issue of effectiveness. Without an army of inspectors, councils have no way of knowing what is going on down the back of the farm. The reality is that the land owner is the only effective guardian of any natural values requiring protection, and if he's

²⁴ See, however, the discussion of the "polluter pays principle" in chapter 2.

²⁵ This answer is, at least superficially, different from the one that would follow from Coase's analysis. Recall from the discussion in chapter 2 that Coase would argue that the allocation of property rights should depend on transactions costs and the net benefits from moving from either "default position" to the likely ultimate outcome. The reader is referred to chapter 2 for further discussion of this issue. The two arguments could be consistent if it could be shown that the "historical allocations of rights" reflect the relative transactions costs and net benefits in the different cases.

off-side he won't be doing much good. There are more ways of wrecking a forest than chopping it down ...²⁶

A blanket ban on anything that might affect special habitat isn't the friendliest starting point. Neither is inaccurate information. Finding out what land owners want in return for permanent protection might reveal some quite modest demands: help with fencing, pest control and rates. There may be trade-offs that are available – protection of habitat in return for development rights elsewhere.

But there will be cases where land owners have bought land with an expectation of development and insist that they should be able to proceed. In these cases councils are confronted with a choice: to regulate or negotiate. It's a judgment that is legally theirs to make, but negotiation has to be the first best strategy in all cases. Lack of it runs the real risk of wholesale destruction by land owners trying to beat new rules coming into force.

A similar point has been made by Epstein (1996b, p 45) when commenting on the *Endangered Species Act* in the United States (emphasis in original):

With respect to the current system of habitat designation, one important point is that loss of habitat *prior to* designation carries with it no adverse legal consequences. The anticipation effects in this market are therefore enormous. If there is any sense that private land will be subject to controls, then the best strategy for the private owner is to destroy the habitat before it becomes protected: 'shoot, shovel and shut up' becomes the war cry. It may not work in all cases. Sometimes the habitat is too valuable to the owner; sometimes it is connected with the property rights of other individuals. And indeed there has already been a response in the form of a "safe harbour" promise that any large property owner who undertakes habitat improvement will not have to pay the price down the road in the form of future development restrictions. But these covenants are not universal in scope, and require confidence that they will be respected over time when the remedies for government breach are uncertain at best. Absent strong ownership rights, the unmistakable incentive remains in all cases: destroy habitat now in order to preserve freedom of action later.

Another important point that Epstein makes (1996b, p 46) is that "the designation system is a crude instrument that works (at least as a first approximation) as an all-or-nothing choice". In some circumstances the greatest social value might be achieved by a compromise that allows the

²⁶ In correspondence with us, Brendan Moyle claimed that several recent studies show that extending protection to private land owners results in sub-optimal conservation:

Private landowners have little incentive to comply with an imposed policy and can not be monitored or punished to force compliance. In New Zealand, the failure of authorities to stamp out the illegal harvesting of wood pigeon is a consequence of low detection odds and low penalties for poachers.

private owner to derive *most* (but not all) of the original economic benefits from use of the property while simultaneously providing *most* (but not all) of the conservation benefits that could be provided by banning any uses other than conservation.

Yet all that is lost because there is no negotiation to be had since the government is still in designation mode. Instead the critical variable is one which has the private owners, or their property rights association, lobbying government to make sure that the designation does not take place, or at least does not take place quickly, or bypasses their lands. So designation systems have two substantial costs: one is destruction before designation, and the other is use of the political process to deny, delay or deflect the designations that might come.

Inadequate compensation for the effects of heritage protection orders might enable some readily identified resources to be protected at less cost to taxpayers. Benefits to taxpayers who value conservation are likely to come at a substantial cost, however, since natural and other resources that could become the subject of future heritage orders are likely to be destroyed.

Inadequate compensation for heritage orders will also interact with under-pricing of publicly provided recreational opportunities to cause more damage to environmental and other assets. If users had to pay to use public conservation assets, natural and historic resources on private property would have a much higher market value, and heritage orders would cause much less of a diminution in market value. The combination of spoiling the market for private conservation services and penalising "good citizens" who choose to preserve natural and historic assets turns such assets into unambiguous liabilities to be eliminated at the first opportunity.

The ability to restrict the use of private property through heritage orders, while not paying full compensation to the landowner, has another consequence. It has the effect of indicating to taxpayers that the cost of conservation is less than it really is.

Epstein (1996b, p 51) argues that this could explain the political popularity of regulatory restrictions on land use. He asks the question: if designation without compensation can be so injurious to conservation, why has it been supported so vigorously by committed environmentalists? He suggests that the primary explanation is the desire to "hide" the true social cost of conservation:

The scopes of the habitat designations are in some cases so large and pervasive that there is no belief that the (unwashed) public would ever accede to them if these transactions were put on budget. So the private calculation of the firm environmentalist is to take the risk of interim dislocations in order to expand as vigorously as possible the scope of government action. If that is the case, then we

have here, as in other cases such as rent control,²⁷ a preference for off-budget devices that conceal the true costs of government actions from the public at large. At this point we can identify a powerful convergence between the protection of private property and the strengthening of responsible democratic influences, one that is all too easy to overlook. The just compensation requirement forces the government and the public to make explicit trade-offs between different goods, in order to determine their value to the polity at large. Environmental groups may think that their preferred programs could not survive this scrutiny. But it hardly follows that they should therefore win out by covert means.

In support of the claim that hiding the true cost of conservation will lead to greater resources being devoted to it, Epstein observed earlier in his paper (1996b, p 34) that:

Before the decision in *Sweet Home* the government over a 25-year period spent \$253,900,000 to purchase about 360,000 acres of land for critical habitat. Yet a single designation for the coastal California gnat-catcher brought 3.8 million acres of coastal scrub habitat underneath the jurisdiction of the Fish and Wildlife Service.

Thus far, we have focused on the efficiency implications of heritage orders that are not accompanied by adequate compensation for the damage inflicted on property owners affected by those orders. Epstein also argues (1996b, p 74) that strong equity principles are at stake:

There is little question that the benefits of preserving endangered species are regarded as societal in the strongest sense of that term. No one posits that those persons who live and work in the vicinity of the endangered species benefit disproportionately from its preservation. Think of the various rationales that are put forward for species preservation: continuity with nature's past; the preservation of a reservoir of plants, animals and chemicals that will provide new pharmaceuticals and new food sources; the psychological awareness that the world is a better place because humans have done their part to preserve biodiversity. The arguments for biodiversity in all its fullness have been articulated with considerable force. Let us accept that all these rationales are completely valid. Not one of them bears any trace of localism; none of them posits some larger set of benefits to those persons whose land provides habitat for the protected species than for the public at large. But the burdens are surely disproportionate, given the losses of livestock and other valuable property are

²⁷ Here Epstein footnotes Justice Scalia's dissent in *Pennell v. City of San Jose*, 485 United States 1, 15, 21-24 (1985), "which attacks the off-budget nature of rent control subsidies as a way to avoid the scrutiny of the political process".

concentrated on those few members of society whose property is located in some critical habitat region.

Epstein (1996b, p 46) speculates how different the incentives, and outcomes, would be under a system where governments were required to treat heritage orders like other forms of “takings” of private property for public purposes:

A system of voluntary purchase or condemnation radically changes the incentives for both sides in the predesignation period. In this new environment, it is always to the advantage of an owner to bring valuable habitat to the attention of the government, and to take steps to preserve it in its ideal condition for sale ... the owner has no incentive to skimp on preservation because his best opportunities lie with sale, and not development. The hard task may well lie in getting the government to respond quickly enough when the offer comes its way. Yet even here that constraint should not loom large. The government may be the only party who can condemn land, but it is not the only party that can buy in a voluntary transaction. The Audubon Society, the Nature Conservancy, or any one of a thousand charitable or business organisations can come forward to make the purchase, just as environmental organisations can buy up pollution rights in the open market in order to retire them – while reserving the right to resell them if conditions change ... The switch from the regulation mode to the purchase mode thus has the important advantage of widening the field. Buying land to preserve habitat need not be any more (or less) difficult than other transactions associated with land. And so too selling the land. Governments too often act like a museum. Once the purchase is made, then resale is quite unlikely, especially on so sensitive an issue as conservation. The reason, of course, becomes clearer when we peel back the convenient label, “the government as owner”, and find beneath it an elaborate mechanism which gives many different groups and persons a lever on the process of government decision-making. No one single person has a firm hand on the tiller, and the internal institutional arrangements, unlike those of a corporation, freeze in place a political status quo, and do not shift rapidly with market and technological developments. Non-profits – an important category of institutions on conservation matters – also have conservative characteristics that put them in an intermediate position, with some resemblance to both government and private profit-making institutions. For these structural reasons “a” private charitable owner may also find it difficult to sell land, but on balance may have an easier time of it. The private charity will not face the broad scale political pressures, and it is better able to reinvest the proceeds in habitat if that should prove necessary.²⁸

²⁸ The Nature Conservancy in the United States has allowed oil production on some of its properties, judging that the revenue so raised allows it to purchase sufficient land to make the transaction an unambiguous net gain in conservation output.

Case study – native vegetation retention in Australia

A recent assessment of land cover disturbance in Australia (Graetz *et al.*, 1995) estimated that 52% of Australia's forests and woodlands had been cleared or thinned in the 39% of the Australian continent where more than 90% of its population live. Of the remaining 61% of the continent, 24% was assessed as being "substantially or significantly disturbed". Satellite images have revealed that there is little native vegetation left in the main agricultural areas. Land clearing is continuing. The National Greenhouse Gas Inventory Committee estimated that between 1983 and 1993 an average of 500,000 hectares of land were cleared per year for agricultural purposes, although there is considerable uncertainty about the exact figure.²⁹

Clearing of native vegetation can not only reduce biodiversity, with an associated loss in amenity value, genetic resources and so on, it can also increase erosion, raise the water table, reduce water quality, increase water run off and reduce soil fertility. If lost native trees are not replaced by exotic ones, the reduction in tree cover can also reduce stock shelter and increase wind damage.

On the other hand, it would have to be admitted that agricultural practices, such as in much of the major wheat growing regions of Australia, can increase soil quality and fertility. Scientific research has identified trace element deficiencies in some Australian soils, which can be rectified through the application of artificial fertilisers. The common practice of placing sheep on wheat fields after harvesting, and rotating cereal crops with legumes or other pasture crops, helps build up soil fertility. Regular ploughing can contribute to the health of soil. Other practices, such as improving the nutritional value of grasses (by introducing exotic species) or providing permanent watering points, have assisted the survival of *some* native species (such as kangaroos) in the rural areas of Australia. Active farm management can reduce the population of ferals, which could have beneficial effects on native species. Artificial structures such as dams and levies can reduce some of the damage – environmental and economic – associated with floods or droughts. Furthermore, in so far as amenity values are concerned, most people would argue that, for example, deciduous trees in autumn colours, or some Northern Hemisphere pines, can add visual variety and beauty to the landscape. It is simply not true that all landscape modifications necessarily reduce the amenity values incidentally provided to other people.

²⁹ Quoted in Industry Commission (1997, p 38).

Nevertheless, it is not unreasonable to presume that land clearance in Australia has been, and probably continues to be, excessive from the point of view of efficient resource use. A major reason for this presumption is that, in Australia as well as New Zealand, users of natural areas are not charged enough to cover both the cost of providing tourism and conservation services and the opportunity cost of the land. The deficiency of revenues is typically not as great in Australia as it is in New Zealand, but *by reducing the market value of native vegetation* it nevertheless acts as a disincentive to preserve major privately owned areas of native vegetation. Since the market value of native habitat understates its true value, land clearing does not impose a financial penalty equivalent to the loss in social value. In addition, the threat of controls on land use without adequate compensation in Australia, as in New Zealand, encourages land owners to rid their properties of significant indigenous habitat before it comes to the attention of conservation or environment departments.

While tax concessions for clearing land have been abolished in Australia, a number of other tax-based incentives to clear land remain. Edwards, Dumsday and Chisholm (1996) have suggested that tax concessions for expenditure to *remedy* land degradation may indirectly raise the amount of degraded land by reducing the costs of revegetation and thus the costs of degradation. The same authors also suggested that low nominal values for livestock inventories can artificially raise the cost of reducing stock numbers during droughts. Retention of stock would then exacerbate the effects of overgrazing. They also argue that interest rate subsidies in “exceptional circumstances” may encourage higher risk farming practices, particularly with regard to stocking levels. Drought assistance measures such as fodder subsidies could reinforce these effects by reducing the costs of feeding stock during droughts (Freebairn, 1983).

Land taxes may also discourage conservation – again because the services provided by natural habitats do not have a market value commensurate with their social value. Land that is left uncleared can be assessed at the same rate as cleared land even though it is producing little, if any, monetary income. Some states even provide reduced taxes for land used for primary production, with the lower rates not applying to land used for conservation purposes. Conservation organisations also typically have to pay taxes on land *purchases* even though once again the land may not be used to produce much money income.

Leasehold as opposed to freehold tenure may also give farmers less of an incentive to maintain or improve the value of the assets under their control

(such as soil, water and vegetation resources), particularly if lease renewal is uncertain and there is a chance of inadequate compensation for capital improvements. Ironically, attempts to control degradation through making lease renewals conditional on maintaining asset values could be counter-productive. Suppose farm assets are degraded by drought, infestation by rabbits or some other such factor beyond the operator's control. The resulting uncertainty of lease renewal would then weaken incentives and perhaps result in a further deterioration of asset quality.

Apart from removing, or ameliorating, such perverse incentives, there are other actions governments can take to encourage the retention of native habitats. At the national level, Australia has a number of programs, such as Landcare, Save the Bush, One Billion Trees, National Corridors of Green, Urban Forests and Grasslands Ecology, aimed at encouraging revegetation. The National Heritage Trust, to be funded from part of the proceeds from the part sale of Telstra, will contribute substantially to these initiatives.

Landcare is perhaps the best known program aimed at developing a "conservation ethic" in the community. Landcare is a package of measures including educational and voluntary activities and financial incentives. Landcare helps promote community groups, industries and governments to work cooperatively to integrate management of native vegetation with extensive revegetation.

In addition to Landcare, Save the Bush and One Billion Trees have also provided grants for management of native vegetation. Save the Bush provides funds to state and Territory governments to assist in developing and implementing remnant native vegetation strategies. One Billion Trees funds community groups, local authorities and land owners to implement revegetation projects.

The Industry Commission (1997, p 43) notes that tax concessions have also been introduced to promote conservation of native vegetation:

Section 75D of the *Income Tax Assessment Act 1936* (ITAA) provides primary producers and other businesses using rural land with a 100 percent tax deduction in the year of expenditure for capital expenditure primarily for the purpose of combating or controlling land degradation. Relevant eligible works include pest and weed control, fencing out degraded areas and areas identified in an approved management plan, and tree and shrub establishment. Land holders are also able to claim a 20 percent tax rebate on expenditure for prevention of land degradation under the ITAA.

The Industry Commission comments (p 49):

Under the current land care tax provisions, benefits obtained are dependent on the individual farmer's marginal tax rate, even though the external benefits of retaining native vegetation are unlikely to be affected by the marginal tax rate.³⁰ In a survey of land care tax provisions, Mues, Moon and Grivas (1996) found that ... for tree planting, expenditure per farmer was small and 50 percent of farmers surveyed placed little or no importance on section 75D when deciding whether or not to establish trees or shrubs. The current land care tax deductions only apply to capital expenditure for conservation. Without provision to cover maintenance costs, there is little incentive for land holders to ensure conservation is ongoing ... Another criticism ... is that the lag between expenditure and receiving tax benefits may have impacts on cash flow³¹ ... Tax concessions also provide little scope to target particular problems or areas or vary the level of support according to the anticipated social benefits ... Furthermore, tax based mechanisms ... add further complexity to the tax law, with consequent increases in administration and compliance costs. The main argument in favour ... is that the infrastructure for administering the tax system is already in place and the concession can therefore be delivered relatively cheaply.

Tax concessions have the advantage that they reduce the amount of "churning" in the system relative to subsidies. In order to pay subsidies, the funds first have to be raised through the tax system and then paid back to some of the same people as beneficiaries through a new disbursement system. The Industry Commission makes this point after discussing some advantages of subsidies:

In contrast to tax concessions, government grants and subsidies offer more scope to target particular problems and vary the level of support according to the anticipated social benefits of the project. Grants and subsidies can therefore be awarded more competitively according to the specific merits³² of the landholders and/or habitat ... Groups and non-landholders can also receive assistance, and assistance can be provided irrespective of the landholder's income. Government expenditure on grants and subsidies is also more transparent, and is more easily adjusted than tax based measures, since tax concessions could become open

³⁰ In better seasons, however, marginal tax rates are likely to be higher and these might also be the times when the farmer is otherwise more likely to remove native vegetation to expand productive opportunities.

³¹ Given the small amounts involved in practice, and the ability to borrow, this would not seem to be a large obstacle.

³² The "merits" of the land holders may, however, have more to do with their political position (such as whether they are in a marginal electorate) than any efficiency criterion relating to externalities most worthy of being subsidised.

ended.³³ However, administrative costs may be higher for grants and subsidies than tax concessions due to the need to set up administrative systems.

Given the defects of both tax concessions and subsidy schemes, our preference would be to first remove the perverse incentives, including in particular:

- the devaluation of native habitats that occurs because of the underpricing of government-provided services from native habitats;
- the tendency to turn assets into liabilities by inadequate compensation for administrative controls on native habitats; and
- the inadequate incentives to maintain asset values under leasehold as opposed to freehold land tenure.

The regulatory mechanisms are mainly under the control of state and local governments in Australia. All states except Tasmania have legislation controlling vegetation clearance on private land, although in Queensland the controls apply only to leasehold land. In the Northern Territory controls apply to pastoral land and Crown leases.

These controls are usually not accompanied by adequate compensation for affected landholders, making voluntary cooperation unlikely. In addition, enforcement is difficult due to a lack of resources in regulatory agencies, the size and remoteness of regulated areas, and problems of proving landholders are not complying with the regulations. As a result:

- landholders have an incentive to destroy vegetation before it is noticed, or by not preventing fires, pests or other “accidents” from destroying it;
- ongoing management of land set aside is not encouraged; and
- there is open hostility to the policy in rural communities, further complicating enforcement.

The state and local governments also have a number of tax and subsidy arrangements aimed at encouraging the retention of native vegetation. Some local governments, such as the Brisbane City Council, impose an “environmental levy” to raise funds to purchase remnant bushland. Landholders in some catchment areas also pay levies to fund flood mitigation works. Murray Council in New South Wales levies farmers to pay for tree planting and other environmental rehabilitation. Queensland and

³³ Subsidies may also be open-ended if they are based on expenditure levels under the control of the recipient.

New South Wales have performance bonds to encourage mining companies to rehabilitate mined land.

States and Territories also provide grants and subsidies for fencing to protect native vegetation, assessment and maintenance of native vegetation for land care purposes and management of native vegetation areas. The main form of local government incentive for conservation of native habitats is rate rebates.

Most states have grants or subsidies for landholders entering voluntary agreements with the state government to manage native habitats on their property. The management agreements vary in duration, the level of incentives provided and whether future landholders are bound by the agreement.

The focus of the management agreements is often on preventing clearing, grazing and other destructive acts, but there usually is no requirement to maintain the area to a particular standard. Subsidy payments also usually relate only to the initial decision to change the status of the land. The result is inadequate incentives to maintain habitat quality.

Another problem is that the agreements allow landholders to choose the portion of their property that they set aside. As a result, they have an incentive to allocate the “less productive”³⁴ parts of the property to conservation.

We would argue, however, that the fundamental problem is that the market value of native habitats does not reflect their social value. A major reason for this is, in turn, the under-pricing of publicly owned substitutes.

Subsidy of voluntary conservation efforts in New Zealand

New Zealand also has a number of programs for promoting conservation on private property through the use of covenants. These probably would not be necessary if markets were modified so that prices reflected the true value of conservation services. In particular, the heavy or complete subsidy of use of public conservation areas by taxpayers greatly devalues similar services that could be provided by native habitats in the private sector. Subsidising private entities to maintain native habitats through assistance with fencing and perhaps rate relief then appears as a second best response to this

³⁴ A proviso here is that farming productivity may not be perfectly correlated with productivity in producing conservation outputs.

situation. A preferable response would be to take steps to remove the distortions that are the source of the problem.

It might be argued that the public good nature of the indirect benefits provided by native habitats would justify a subsidy for retaining, or a tax for destroying, such habitats even if markets for the direct benefits were functioning as they should. As we argued in chapter 3, however, while these benefits are likely to be large in total the indirect value of an additional small area of native habitat is not likely to be large relative to its direct benefits. Hence we contend that the *primary* difficulty with private conservation is the absence of a suitable market for *direct* conservation services.

The Forest Heritage Fund was established in 1990, and since its inception has conserved over 100,000 ha of indigenous forest through the use of covenants. The Fund receives an annual allocation from the government, which is administered by a committee with assistance from DOC. The fund provides finance for projects that protect forests, such as:

- financing and negotiating the purchase of forested areas for its clients, including local authorities, who need to be prepared to manage the areas under the *Reserves Act 1977*;
- assistance with fencing, surveying and legal costs to landholders who do not wish to relinquish title but who nevertheless wish to place a covenant on their property in order to protect native forest; and
- assistance with fencing to protect native forest from grazing.

Eligibility of projects depends on them meeting a number of criteria:

Representativeness. The extent to which the type of species, habitats and communities in the forest remnant are already represented in conservation areas.

Sustainability. The extent to which biological assets and ecological processes in the area are likely to persist with the size and shape of the area and the nature of surrounding activities being important determinants.

Landscape integrity. The importance of the remnant in maintaining ecosystem processes – such as nutrient cycles, water flows and energy flows – in the landscape of which it is part.

Amenity. The value placed on the remnant by visitors.

A related program, Nga Whenua Rahui, was established in 1991 to help conserve indigenous forests and associated ecosystems on iwi land. The fund receives an annual allocation from the government, which is administered by a committee with assistance from DOC.

Unlike the Forest Heritage Fund, the criteria and mechanisms of Nga Whenua Rahui promote retention of ownership and control (tino rangatiratanga). The agreements combine cultural use of the forest with acceptance of public access. Finance provided by the fund covers fencing costs, and registration and legal expenses.

Since its inception, Nga Whenua Rahui has conserved over 75,820 ha of indigenous forest. A DOC Fact Sheet (*Nga Whenua Rahui* in Department of Conservation, 1996a) reports that “eleven blocks of over 2000 ha ... including three blocks over 10,000 ha” have been conserved and that “for the larger blocks, a cash consideration payment is paid in respect of an agreement for long-term protection coupled with public access”. The Fact Sheet also notes that two blocks in the eastern Bay of Plenty contain “significant rare coastal forest to inland steep beech forest”. There are also “six large projects involving 38,000 ha adjoining the Raukumara Forest Park and, while significant in their own right as reserve areas, each adds greatly to the buffer effect on the forest park itself”.

There are also many smaller areas that have been conserved under the scheme, including 20 projects under 100 ha. These smaller projects typically involve fencing to exclude grazing farm animals.

The Queen Elizabeth II National Trust is an organisation that is more independent of DOC and the government than the above two trusts. It is managed by a Board of Directors with a chairperson appointed by the Minister of Conservation. It was created by the *Second National Trust Act 1977*, before DOC existed. It is funded by government grant, donations, interest on investments and membership fees. Members elect two of five ordinary directors on the Board. The remaining three represent rural landholders, Maori and conservation interests.

The QEII Trust has a similar purpose to the above trusts of encouraging private landholders to place covenants on their land. In this case, the covenants are, according to a DOC Fact Sheet (*Queen Elizabeth the Second National Trust* in Department of Conservation, 1996a), designed “to protect a landscape feature or area of open space ... from future development or thoughtless land use”. The Trust has registered over 1000 open space covenants aimed at conserving wetlands, streams, lakes, forests, forest remnants, tussock grassland, archaeological and geological features, coastline and rural landscapes. The Trust has also approved, but not yet registered, a further 350 covenants. Covenants are usually in perpetuity and, while in force, are binding on all subsequent owners or leaseholders.

A covenant document defines the area covenanted, states the purpose of the covenant, details responsibilities for maintaining fencing and conditions of public access and specifies activities that cannot occur in the covenanted area. Management of the covenanted area remains with the owner or leaseholder, although a representative of the Trust visits each site annually. An open space covenant need not prevent farm activity.

As with the analogous Australian institutions, a potential weakness of all these programs is that they appear to be designed to have land placed under covenant but provide little incentive, or financial support, to encourage ongoing management of the areas. They perhaps represent an outdated attitude to conservation that “locking land away” is all that is needed. In fact, however, ongoing management to eradicate ferals, weeds, control fires and so on is needed if worthwhile conservation outputs are to be delivered.

Apart from the land covenant trusts, there are a number of other programs aimed at subsidising private conservation efforts in New Zealand. Tu Kakariki, the New Zealand Tree Program, was launched in 1990. Its objectives are to:

- promote coordinated community, individual and official action to conserve and plant trees;
- undertake advocacy and informational campaigns to promote the value of trees; and
- encourage the use and conservation of indigenous plants.

Finance for the program is provided by a number of private firms, while DOC has provided staff support.

Project Crimson Trust is a charitable trust sponsored by Carter Holt Harvey in partnership with DOC. The trust allocates funds to community conservation projects. It has a particular focus on pohutukawa and rata conservation through growing seeds in prisons and planting trees.

DOC also sponsors an annual program of community events aimed at promoting conservation and presents a number of national and regional conservation awards each year. It also runs a Conservation Volunteers program to encourage people to contribute to activities such as pest and weed control, revegetation, giving nature talks, assisting with research by counting birds and so on.

CONCLUDING REMARKS

As we noted in chapter 2, the institutional arrangements under which decisions are made affect the incentives decision-makers face. They also affect the information that decision-makers have about costs and benefits.

Markets both generate information on costs and benefits and provide incentives for decision-makers to act on that information. Much more extensive use of market processes in the conservation sector would produce a more efficient outcome. Greater reliance on market processes would mean that resources are better used to satisfy the demands of visitors to conservation areas at a lower overall cost. Market processes can even be adapted to incorporate a demand for conservation of natural habitats that stems from people valuing the mere existence of natural areas whether or not they intend to visit those areas. Finally, market mechanisms could also be used to better match the supply of habitats suitable for scientific investigation to the demand. The following chapter discusses private involvement in conservation in more detail.

A potential defect of markets is that not all costs and benefits are reflected in market prices because property rights to many scarce resources have not been defined. Users therefore do not have to compensate others for forgone opportunities, and tend to discount costs. While markets are a powerful mechanism for maximising market value, that maximisation can be at the expense of unpriced resource uses. The main solution to this problem involves changing property rights to ensure all items of positive social value also have a positive market price.

Under-pricing of publicly provided conservation services has the undesirable effect of discouraging private land owners from valuing native species and ecosystems. It also results in direct resource losses as resource-consuming non-price rationing mechanisms are used to limit the number of visitors. In addition, because DOC does not raise sufficient revenue to pay for its conservation services, taxpayers are called upon to fund the activities of the Department. Tax revenue is, however, quite expensive to raise. The disincentive effects associated with taxation, combined with the administrative costs for the government and the taxpayers, mean that it costs at least \$1.28 to raise a marginal dollar of tax revenue in New Zealand. Taxes need to be treated like the scarce resource that they are and not used to finance operations that could be financed by user charges.

An alternative to both commercial and political resource allocation mechanisms is voluntary activity. In many societies including New Zealand, private individuals form clubs and other voluntary associations to provide

services that would otherwise be under-provided. Such voluntary activity could also be relied upon to provide conservation services were the government to become less involved but the opportunities for private action were to be made available.

APPENDIX – SOME EFFECTS OF CONSERVATION AREA ACCESS CHARGES

Economic models can be used to elucidate some of the likely efficiency and distributional consequences of charging for access to conservation areas. A very important issue in this regard is the interaction between conservation policy and the general taxation system.

It might be thought that since expenditure by DOC in 1996–97 was only \$NZ160 million, compared with total “general government consumption expenditure” of more than \$NZ13,200 million,³⁵ the explicit cost³⁶ of conservation has only a trivial effect on the overall burden that taxes impose on the economy. However, any *additional* tax imposes quite high burdens because economic activity is already so distorted by the existing level of taxation.

Furthermore, much of the distortion engendered by the tax system involves people working less than they otherwise would and engaging in “too much” non-market activity at the expense of supplying market labour and consuming marketed goods and services. The absence of fees for the use of conservation areas exacerbates this distortion by further encouraging people to spend more time in leisure pursuits and less time producing and consuming marketed goods and services.

Recreational use of conservation areas is also likely to impose congestion and other costs that were detailed above. When people do not have to pay for these costs, they will tend to use conservation areas beyond the level where the marginal benefits they obtain from their use compensate for all the

³⁵ For the purposes of this discussion, we have treated income transfers as “negative taxes”, so the “taxes” we refer to in the analysis could be thought of as taxes *net of* transfers. This understates the efficiency costs of government since the extra taxes needed to fund transfers, along with the transfers themselves, will both impose additional efficiency losses. The figure for general government consumption expenditure is taken from the national accounts data available on the Treasury web site at http://www.treasury.govt.nz/pubs/bmb/budgets/1997/toc_befu.htm.

³⁶ Conservation also has implicit (or non-budgetary) costs in so far as it prevents alternative uses of the same resources. These are discussed in chapter 6. The current discussion focuses only on explicit monetary expenditures.

marginal costs they impose on others. Subsidising recreational use of conservation areas by using taxes on market activity to fund the explicit monetary costs of conservation thus exacerbates the costs associated with over-use.

This appendix sketches a basic economic framework that can be used to examine some of these issues. Because of the interactions between the tax system and conservation area access charges, the questions are best addressed using the type of general equilibrium economic models that are also used to measure the efficiency costs of taxation.³⁷ Such a detailed analysis is clearly beyond the scope of this study. However, the essence of the approach may be illustrated with a simple model. To keep the algebra to a minimum, this discussion also will ignore some of the important, but more subtle, issues discussed above such as:

- the costs and distributional effects of non-price rationing in the absence of charges;
- seasonal pricing and two-part tariffs (although the fixed fee example discussed below suggests some of the benefits of a two-part tariff);
- the effects of uncertainty about marginal costs and the interactions of that with the elasticity of demand;
- the value of the information about customers, and the strength of their demand, that may be obtained through charging; and
- the consequences of not charging for search and rescue services.

In order to examine the effects of charging in the context of the distortions engendered by the tax system we need a model where consumers are choosing between market and non-market activity. One non-market use of time will be spending time in conservation areas. We assume this yields direct benefits to consumers, but also imposes two types of costs. There will be explicit costs associated with managing and serving visitors. We shall assume that these are proportional to the total time people spend in conservation areas. In addition, time spent in a conservation area imposes congestion and other “external” costs on other users of the same areas.

The distributional implications of charging for access are perhaps as important as the efficiency implications, since the main argument mounted against such charges is that they are “unfair”. To examine equity, we need a model where individuals differ in income (or, more accurately, the utility they obtain from participating in market activity) and the utility they obtain

³⁷ See, for example, Diewert and Lawrence (1995).

from using conservation areas. We shall again examine perhaps the simplest case one could imagine by assuming there are just four types of people.³⁸

One type has high productivity in labour market activity, but also high productivity when using conservation areas. Perhaps these people are highly educated and thus obtain additional benefits from conservation areas as a result of their greater understanding of biology, geology, ecology and so on.

A second type of person also obtains high benefits from visiting conservation areas, but has low market productivity. Perhaps their education was in areas that do not contribute greatly to their market productivity but nevertheless enable them to obtain substantial benefits from observing nature. Alternatively, the large benefits they obtain from visiting conservation areas may be of a more emotional nature and thus not closely related to market productivity.

The remaining two types of people obtain fewer benefits from visiting conservation areas. However, the third group, like the first group, has high market productivity. Although these people might not have sufficient education to enable them to appreciate the finer aspects of ecology, they nevertheless have other knowledge or skills that are valued in the marketplace.

Finally, the fourth group of people lack ecological education or emotional benefits from observing nature while also lacking marketable skills or knowledge. They have low productivity spending time either in conservation areas or supplying labour to the market.

We shall use π_1 , π_2 , π_3 and π_4 to denote the proportions of the four types of people in the population.

Everyone in the economy has a time endowment (excluding sleeping time) of 1 unit that can be allocated to market production (h_x), recreation in conservation areas (h_y) and "other activities" ($1-h_x-h_y$). The activities we have in mind in the latter case could include, for example, recreation outside conservation areas, watching television, spending time with one's family, going to church (that is presumed also to give one feelings of "well-being" or utility)³⁹ and the time that is needed to enjoy consuming marketed goods and services.

³⁸ For a far more general treatment, technical readers may wish to consult Brito, Intriligator and Sheshinski (1997).

³⁹ One might also suppose that time spent in charitable activity gives people similar feelings of "well-being" but it would raise an analytical complication in so far as it provides benefits to others that we would also need to take into account.

Time spent in market activity attracts a tax at the rate $\tau_b + \tau$ per unit of market income, where τ_b funds “general government” expenditure⁴⁰ and τ funds⁴¹ explicit conservation expenses. If the real wage (the rate of exchange between an hour of “effective” market time and a unit of marketed consumption goods or services) is w , the consumption of marketed goods and services by a person with market productivity of μ will be:

$$x = w\mu h_x(1 - \tau_b - \tau). \quad (\text{EQ 4.1})$$

We will assume that μ takes the value of either 1 or $m > 1$.

Time spent in conservation areas will yield utility that depends on individual “productivity” in that activity, but also on the total amount of time spent in conservation areas by all other people. Specifically, we shall assume that if H is the per capita⁴² time spent in conservation areas, an individual with “productivity coefficient” v spending time h_y in a conservation area will obtain a utility level:

$$V(g(H)v h_y) \quad (\text{EQ 4.2})$$

where $g(0) = 1$, $g' < 0$, $V' > 0$, $V'' < 0$ (the latter condition implying decreasing marginal utility from time spent in conservation areas).⁴³ Symmetrically with market productivity, we will assume that v takes the value of either 1 or $n > 1$.

Market consumption and “other” uses of time are also assumed to provide utility according to the function:

$$U(x, 1 - h_x - h_y) \quad (\text{EQ 4.3})$$

where U_1 and $U_2 > 0$, U_{11} and $U_{22} < 0$ (so again marginal utility diminishes) and $U_{12} > 0$ (so additional marketed goods and services provide more utility when there is more time available to enjoy them). While “other” time is

⁴⁰ Recall that, in practice, total taxes also will have to fund transfers. Thus, τ_b should be interpreted as taxes paid *net of* transfers received.

⁴¹ Currently in New Zealand, some DOC expenditure is funded by fees rather than directly from the budget. We examine the effect of fees later in this appendix.

⁴² Throughout the analysis we assume the population is fixed. Of course, in practice the presence of foreign tourists in conservation areas exacerbates any costs due to crowding or use and the number of tourists effectively becomes another “policy variable” that could influence the efficiency and distributional implications of charging for access.

⁴³ See also appendix 1 to chapter 2 and the discussion of why people value diversity of experiences in chapter 3.

assumed to contribute positively to the utility obtained from marketed goods and services, we assume there is neither a positive nor negative “interaction” effect between time spent in conservation areas and other sources of utility.⁴⁴

The final component of utility will be the benefits obtained by individuals from “general government” expenditure. It is difficult to know how much people value such expenditure since they do not have to reveal their preferences for it in the marketplace. The national accounts simply value government expenditure at cost.⁴⁵ Doing likewise, the utility obtained from that expenditure can be written as a function of the per capita level of expenditure G :

$$W(G). \tag{EQ 4.4}$$

We shall assume for simplicity that those benefits do not interact with the benefits obtained from market goods and services or time spent in conservation areas. Specifically, total utility enjoyed by the individual will be given by:

$$U[w\mu h_x(1-\tau_b-\tau), 1-h_x-h_y] + \phi V(g(h)\vee h_y) + W(G) \tag{EQ 4.5}$$

where ϕ represents the “trade-off” between the two sources of utility apart from G .

The individual then chooses h_x and h_y to maximise utility (treating the level of G as independent of any one person’s allocation of time) subject to the constraint $h_y \geq 0$.⁴⁶ Using the Kuhn-Tucker conditions for a maximum when one of the choice variables can be constrained to equal zero, the maximum will occur where:

$$w\mu(1-\tau_b-\tau)U_1 - U_2 = 0 \tag{EQ 4.6}$$

and:

$$h_y[U_2 - \phi g(h)\vee V'(g(H)\vee h_y)] = 0, h_y \geq 0, U_2 \geq \phi g(h)\vee V'(g(H)\vee h_y). \tag{EQ 4.7}$$

⁴⁴ One could imagine separating time spent in conservation areas into skiing, fishing and other activities that yield greater benefits when suitable market goods are also available, and other activities that are less reliant upon having suitable equipment.

⁴⁵ A justification for this convention is that it allows the value of national production to add up to the value of national income and thus assists with maintaining the accounts.

⁴⁶ It is important in this example that we allow for the possibility that individuals may choose to spend no time at all visiting conservation areas.

Equation (4.6) shows how taxes drive a wedge between the marginal benefits of consuming market goods and services U_1 and the marginal cost of producing them $U_2/w\mu$. The second equation either requires time spent in conservation areas to be zero or, if it is non-zero, the marginal benefits from using time in the two *untaxed* activities have to be equal.

Denote the solutions to these equations by $h_x(\mu, \nu)$ and $h_y(\mu, \nu)$ where the solutions take account of the fact that, by definition:⁴⁷

$$H = \pi_1 h_y(m, n) + \pi_2 h_y(1, n) + \pi_3 h_y(m, 1) + \pi_4 h_y(1, 1). \tag{EQ 4.8}$$

In addition, if we assume the explicit costs of providing conservation services depend on the per capita time spent in conservation areas, αH , the tax rate τ will have to solve:

$$\alpha H = w\tau[\pi_1 h_x(m, n) + \pi_2 h_x(1, n) + \pi_3 h_x(m, 1) + \pi_4 h_x(1, 1)]. \tag{EQ 4.9}$$

Similarly, the per capita level of “general government” expenditure will satisfy:

$$G = w\tau_b[\pi_1 h_x(m, n) + \pi_2 h_x(1, n) + \pi_3 h_x(m, 1) + \pi_4 h_x(1, 1)]. \tag{EQ 4.10}$$

A numerical example

To draw more specific conclusions we need to choose some particular functions for U , V and g . The resulting analysis will of course depend on the functions we have chosen. In practice, one would want to relate the functional forms to data on individual behaviour and production relationships as is done in the taxation literature. The following discussion should therefore be taken as illustrative of the types of conclusions that might be drawn from a more thorough investigation.

For the following calculations, we took:

$$V(y) = \log(1 + y), U(x, h) = x^\gamma h^\delta, g(H) = e^{-\beta H}. \tag{EQ 4.11}$$

Then equation (4.6) becomes:

$$\frac{w\mu(1 - \tau_b - \tau)}{w\mu h_x(1 - \tau_b - \tau)} = \frac{\delta}{\gamma(1 - h_x - h_y)} \tag{EQ 4.12}$$

⁴⁷ While H depends on the time spent in conservation areas, individuals ignore this relationship when making their *own* choices – so the derivative of the function g does not appear in (4.7). This is what makes time spent in conservation areas result in a negative externality for other users.

that is,

$$h_x = \frac{\gamma}{\gamma + \delta}(1 - h_y). \tag{EQ 4.13}$$

Equation (4.13) implies:

$$1 - h_x - h_y = \frac{\delta}{\gamma}h_x. \tag{EQ 4.14}$$

Also, in the case where $h_y > 0$, (4.7) implies:

$$\delta[w\mu h_x(1 - \tau_b - \tau)]^\gamma(1 - h_x - h_y)^{\delta-1} - \frac{\phi v}{e^{\beta H + v h_y}} = 0. \tag{EQ 4.15}$$

Now substitute (4.14) into (4.15) to yield four equations (4.16):

$$\delta[w\mu(1 - \tau_b - \tau)]^\gamma \left(\frac{\delta}{\gamma}\right)^{\delta-1} \left[\frac{\gamma(1 - h_y)}{\gamma + \delta}\right]^{\gamma + \delta - 1} - \frac{\phi v}{e^{\beta H + v h_y}} = 0 \tag{EQ 4.16}$$

and also substitute (4.14) into the government budget constraint (4.9) for explicit spending on conservation to provide a fifth equation:

$$\alpha H = \frac{w\tau\gamma(1 - H)}{\gamma + \delta}. \tag{EQ 4.17}$$

The five equations (4.16) and (4.17) are then solved, along with the definition (4.8) of H , for the six variables $h_y(m,n)$, $h_y(1,n)$, $h_y(m,1)$, $h_y(1,1)$, H and τ . To solve this problem we need to compare the utility levels individuals would get were they to visit the areas at all (so $h_y > 0$) versus the utility they would obtain were they to choose to stay away – in which case, the relevant equation (4.15) or (4.16) balancing marginal costs and benefits would not apply. Thus, when one or more of the h_y are equal to zero, the number of equations and variables both drop in tandem.

A complication in this case is that the decisions of a person choosing $h_y > 0$ depend on the amount of congestion in conservation areas and hence on the decisions of others. Once an individual has decided to set $h_y = 0$, however, his or her decision no longer depends on what others do.

Essentially, the problem has to be solved by examining outcomes in a number of cases and seeing which decisions make people better off, taking the actions of others as given. The people most likely to stay away from conservation areas (that is, set $h_y = 0$) are those with high market productivity and low productivity from visiting conservation areas.

We chose parameter values so that the ratio of explicit expenditure on conservation to private consumption expenditure, and the ratio of general government expenditure to private consumption expenditure approximated the corresponding values for New Zealand as revealed in the national accounts and budgetary data. We also aimed to get time spent in other activities as roughly 30% of time spent working (so if we think of working time as 45 hours per week, time in other activities would be about 14 hours per week) and average time spent in conservation areas as ranging up to about one third of time spent working. We also aimed to get the consumption of the individuals with higher market productivity one and a half to two times the consumption of the low productivity individuals. The proportions of people in each group were chosen so that people with high market productivity were in the minority. Also, we wanted to ensure a positive, but less than perfect, correlation between high market productivity and high productivity in visiting conservation areas.

The results presented in Table 4.1 correspond to the following parameter values: $\gamma = 0.6$, $\delta = 0.2$, $\beta = 4.0$, $\varphi = 0.5$, $w = 0.8$, $\alpha = 0.035$, $\tau_b = 0.2$, $m = 1.5$, $n = 1.25$ and $\pi_1 = 0.15$, $\pi_2 = 0.05$, $\pi_3 = 0.15$, $\pi_4 = 0.65$.

TABLE 4.1: Financing explicit costs with taxation

	(m, n)	$(1, n)$	$(m, 1)$	$(1, 1)$
h_x	0.7303	0.5699	0.7500	0.7114
h_y	0.0262	0.2401	0.0000	0.0515
$1 - h_x - h_y$	0.2434	0.1900	0.2500	0.2371
x	0.6988	0.3635	0.7176	0.4538
<i>Utility</i>	0.6213	0.5010	0.6211	0.4875

Note: m = “high market productivity”, n = “high nature observation productivity”. Also, “*Utility*” excludes the utility from “general government” expenditure. It would be a constant for all individuals.

The solution for τ corresponding to the solution in Table 4.1 is $\tau = 0.002624$. Thus, while the “general” tax rate is 20%, the tax needed to explicitly cover direct conservation costs (about 0.33% of private consumption expenditure) is just over 0.26%. The numbers in Table 4.1 also imply that per capita expenditure on “general government” is approximately 0.1318 or 25% of average private consumption expenditure.

For the parameter values we have specified, group 3, which has high market productivity but low productivity from spending time in conservation areas, chooses not to go to conservation areas. Thus, 85% of the

population would use conservation areas under this scenario. Individuals who have both high market productivity and high returns from spending time in conservation areas would, however, choose to spend very little time in the conservation areas. These results reflect the assumption that $m = 1.5$, so that market time is considerably more valuable for these two groups of people.

The 5% of the population who have high productivity from visiting conservation areas, but low market productivity (such as people who lack market skills but are well-educated in ecology or derive substantial emotional benefits from visiting conservation areas), spend almost five times as much time in conservation areas as do the 65% of individuals who have low productivity in both pursuits. Since there are 13 times as many people in the latter group, however, they nevertheless will supply the majority of time spent in conservation areas.

Now suppose that instead of funding direct conservation costs through general taxation those costs are instead financed by fees for using conservation areas. The remaining parameters and specification of the model are left unchanged.

Since we have assumed the externality is related to time spent in the conservation areas, it seems reasonable to first examine a use-related fee. With a fee f proportional to time spent h_y the requirement that costs αH be covered will imply that $f = \alpha$. Consumption of market goods and services will now depend on h_y as well as h_x :

$$x = w\mu h_x(1 - \tau_b) - \alpha h_y \tag{EQ 4.18}$$

so the derivatives (or marginal benefits) of spending time in different activities will also be more complicated. The conditions for maximising utility corresponding to (4.12) and (4.15) now become:

$$\begin{aligned} w\mu(1 - \tau_b)^\gamma [w\mu h_x(1 - \tau_b) - \alpha h_y]^{\gamma-1} (1 - h_x - h_y)^\delta = \\ \delta [w\mu h_x(1 - \tau_b) - \alpha h_y]^\gamma (1 - h_x - h_y)^{\delta-1} \end{aligned} \tag{EQ 4.19}$$

and, when $h_y > 0$,

$$\begin{aligned} \alpha \gamma [w\mu h_x(1 - \tau_b) - \alpha h_y]^{\gamma-1} (1 - h_x - h_y)^\delta + \\ \delta ([w\mu h_x(1 - \tau_b) - \alpha h_y]^\gamma (1 - h_x - h_y)^{\delta-1}) - \frac{\Phi v}{e^{\beta H} + v h_y} = 0. \end{aligned} \tag{EQ 4.20}$$

From (4.19), we can now write h_x in terms of h_y as:

$$h_x = \left(\frac{\gamma}{\gamma + \delta}\right) \left[1 + \left(\frac{\delta\alpha}{\gamma w\mu(1 - \tau_b)} - 1\right) h_y \right] \tag{EQ 4.21}$$

while (4.20) can be written:

$$[w\mu h_x(1 - \tau_b) - \alpha h_y]^\gamma (1 - h_x - h_y)^\delta \tag{EQ 4.22}$$

$$\left[\frac{\alpha\gamma}{w\mu h_x(1 - \tau_b) - \alpha h_y} + \frac{\delta}{1 - h_x - h_y} \right] = \frac{\phi v}{e^{\beta H + v} h_y}.$$

When only $h_y(m,n)$, $h_y(1,n)$ and $h_y(1,1)$ are positive, for example, we get 6 equations to solve for the 6 variables $h_x(m,n)$, $h_x(1,n)$, $h_x(1,1)$, $h_y(m,n)$, $h_y(1,n)$ and $h_y(1,1)$. There are fewer equations, and fewer variables to solve for, when more of the $h_y = 0$. Again, we solved the model for the different possible outcomes and allowed people to choose $h_y = 0$ or $h_y > 0$ depending on what made them better off. The solutions for the same parameter values as above are presented in Table 4.2.

TABLE 4.2: Financing explicit costs with a use-related fee

	(m,n)	(1,n)	(m,1)	(1,1)
h_x	0.7289	0.5895	0.7500	0.7231
h_y	0.0285	0.2180	0.0000	0.0366
$1 - h_x - h_y$	0.2426	0.1925	0.2500	0.2404
x	0.6988	0.3697	0.7200	0.4615
Utility	0.6225	0.5007	0.6223	0.4882

A fee related to time spent visiting conservation areas reduces h_y for the people with low market productivity. The reduced tax rate encourages them to supply more market labour, while their allocation of time to “other activities” rises along with their consumption of marketed goods and services. The people with low productivity in both pursuits are made better off by the switch from tax to fee financing of conservation. On the other hand, the 5% of the people who have low market productivity yet obtain large benefits from visiting conservation areas are made worse off by the switch to fees. This is not surprising since they are large users of the conservation services.

The individuals with high market productivity but a low productivity from visiting conservation areas are of course made better off by the reduction in taxes. Since they choose not to go to conservation areas, there is no offsetting loss in utility from the access fees.

The interesting case involves the people with high market productivity and also high productivity from visiting conservation areas. Despite the fee for visiting conservation areas, they spend more time there. The reduction in taxes has a big benefit for these people since they have high market incomes, while the access fees have only a small cost – the fee is just $0.035h_y$, and for these people $h_y = 0.0285$. Furthermore, the fall in time spent in conservation areas by the 70% of low market productivity people greatly reduces congestion and makes visits more attractive despite the imposition of fees. The reduced taxes also enable these people to maintain their consumption even though they choose to work less.

The remaining groups of people also consume more marketed goods and services. However, the low market productivity people have to supply more labour in order to do so.

Only people with low market productivity but high conservation productivity are made worse off by the switch from taxes to fees. In particular, *the most disadvantaged individuals would prefer use-related fees to tax financing of conservation expenses.*⁴⁸

The utility levels reported in the tables ignore the benefits of general government expenditure. In the switch from taxes to fees, however, the revenue raised by the unchanged general tax rate would increase from 0.13184 to 0.13316 (in per capita terms). This is an increase of over 1%, and is almost as large as the taxes formerly needed to finance conservation expenditure but now replaced by fees. The larger general revenue could be used to further cut the general tax rate, increase general government expenditure, or to provide a compensating transfer to the 5% of the population made worse off by the switch from tax to fee financing of conservation.

Another particularly interesting feature of this example is that if the low market and low conservation productivity people (those with $\mu = 1$ and $\nu = 1$) were to choose not to visit conservation areas, the resulting utility levels (ignoring the effects of general government expenditure) would be 0.6241, 0.5069, 0.6223 and 0.4879. Since the (1,1) people are made worse off (their utility is 0.4879 instead of 0.4882) they choose to set $h_y = 0.0366$ instead. If

⁴⁸ Average utility levels (weighting the utilities in the tables by the proportions in each group) rise as a result of the switch from tax financing to financing by fees. Since utility is an ordinal concept, however, we should not make too much of this result. How should we weigh the utility gains of some against the losses of others? As we suggested in chapter 2, it is impossible to devise an *objective* way of measuring differences in welfare or otherwise making interpersonal comparisons of welfare.

they had decided to stay away from the conservation areas altogether, however, they would still be better off than they were under tax financing of explicit conservation expenditures. More significantly, however, *everyone else would be better off as well*. Since there are so many of the (1,1) people, their decision to choose $h_y = 0.0366$ instead of $h_y = 0$ creates high congestion costs for everyone else.

Instead of charging people for the amount of time h_y they spend in conservation areas, we could use a fixed annual fee F that is paid by anyone who spends any time at all in conservation areas, but which can be avoided by not visiting the areas in any one year.

When $h_y > 0$, the conditions for maximising utility corresponding to (4.13) and (4.15) now become:

$$h_x = \frac{\gamma}{\gamma + \delta}(1 - h_y) + \frac{\delta}{\gamma + \delta} \frac{F}{w\mu(1 - \tau_b)} \tag{EQ 4.23}$$

and,

$$\delta [w\mu h_x(1 - \tau_b) - F]^\gamma (1 - h_x - h_y)^{\delta - 1} = \frac{\phi v}{e^{\beta H + v} h_y} \tag{EQ 4.24}$$

Then, if only $h_y(m,n)$ and $h_y(1,n)$ are positive, for example, the definition of H and the budget constraint for financing explicit conservation expenditure imply:

$$H = \pi_1 h_y(m, n) + \pi_2 h_y(1, n) \tag{EQ 4.25}$$

and,

$$\alpha [\pi_1 h_y(m, n) + \pi_2 h_y(1, n)] = F(\pi_1 + \pi_2) \tag{EQ 4.26}$$

This would give us 6 equations to solve for $h_x(m,n)$, $h_x(1,n)$, $h_y(m,n)$, $h_y(1,n)$, H and F . Similar sets of equations can be derived in the other cases. The solutions for the above parameter values are presented in Table 4.3.

TABLE 4.3: Financing explicit costs with a fixed fee

	(m, n)	(1, n)	(m, 1)	(1, 1)
h_x	0.6844	0.5299	0.7500	0.7500
h_y	0.0892	0.2961	0.0000	0.0000
$1 - h_x - h_y$	0.2264	0.1741	0.2500	0.2500
x	0.6521	0.3342	0.7200	0.4800
Utility	0.6337	0.5385	0.6223	0.4879

Corresponding with the solution in Table 4.3 we have $F = 0.0049319$. With a fixed fee regardless of time spent in the conservation areas, the people (1,1) with low productivity in both pursuits would have to pay nearly four times the $0.0366 \times 0.035 = 0.001281$ they pay in the case where fees depend on use. As a result, they choose not to go to the conservation areas at all. The utility of *everyone* is now higher than in the tax financed case, even ignoring the effect of changes in general government expenditure. In addition, however, general tax revenue rises still further to 0.13388 – which works out to a greater than 1.5% increase in general revenue. This revenue gain is greater than, and on top of, the eliminated taxes originally raised to finance explicit conservation expenditure. The gain in efficiency in the fixed fee case reflects both a lessening of the tax distortion and the gain from reducing the negative externality associated with too many people using the conservation areas.

With a fixed fee for visiting conservation areas, only the people who obtain substantial value from their visits choose to go. The 80% of people with $v = 1$ choose $h_y = 0$. All the people with $v = n$ now spend more time visiting conservation areas. The reduced congestion raises the benefits of doing so, while the fixed fee does not discourage additional visits the way a use-related fee does.

While the people with low productivity in both pursuits are better off under a fixed fee than under tax financing, they would prefer use-related fees. However, a fixed fee achieves a better outcome for most people than do use-related fees. More generally, a combination of a fixed fee and a use-related charge (that is, a two-part tariff) might achieve even better outcomes than either alternative alone. The additional degree of freedom introduced by having both a fixed and a variable component to the fee should allow management to pursue other objectives, such as maximising the utility of a particular group or a weighted average of utilities reflecting, for example, the political influence of different groups.

The detailed implications of this model depend on the particular assumptions we have made. We would, however, expect similar results to hold in more realistic models.

5. PRIVATE INVOLVEMENT IN CONSERVATION

Private involvement in conservation encompasses a wide range of activities with a variety of aims and objectives. Many private sector organisations that are not primarily or explicitly related to the conservation of specific habitats or species, for example private forestry operations, nevertheless produce conservation outputs.

Private organisations with other primary goals, such as farmers, may also have the production of conservation outputs as a primary goal for *part* of their activities. Examples include basic land regeneration and desalination as practised by participants in the Australian government's Landcare program. Replanting and regeneration of forests by land holders is an important part of conservation in New Zealand, with care now taken to ensure that the result maintains habitat and amenity values. Private land owners care about the quality of the land and other resources they are managing and generally do not wish to deliberately destroy environmental assets.¹

Eco-tourism, such as the current development at the Nobbies in Victoria, offers the incentive of tourist income to maintain and improve habitats and species conservation. Many eco-tourism operations also help to better educate people about wildlife and natural areas and thus contribute indirectly to the demand for, and support of, conservation as a resource use.

Private conservation is rarely an end in itself, although some of the authors of this report have personal acquaintances in Australia who have purchased private property for the sole purpose of enhancing its conservation output. These people have revegetated the property with native species, eradicated feral animals and taken other steps to enhance the conservation outputs of the land solely as a "consumption activity" for themselves and their family. The activity may perhaps be seen as analogous to "hobby farming", although there is no intention to earn any money income from the property.

More usually, however, conservation outputs in the private sector are produced in combination with other outputs such as tourist services, lumber

¹ A referee also informed us that he had seen farmers in New Zealand use the QEII conservation covenants to set aside natural bushland before sub-dividing the land for rural residential purposes or coastal property development. The covenant helps to enhance the value of the property for people looking for a residence with access to native bushland since it gives them some confidence that the bush will not be cleared.

or farm products. Many people involved in other types of primary production nevertheless value their job in part because it allows them to serve the goal of furthering conservation as an end in itself.

Business owners who see conservation as central to their business success have strong incentives to add value to the conservation assets they control. For example, operations based around viewing native animals in their natural habitats provide strong incentives for owners to eliminate predators, monitor food supplies, examine the source of, and treat, any diseases the animals contract, and take steps to ensure breeding success. These methods of *enhancing* conservation values would not *normally* be encouraged by the predominant “lock it away and leave it alone” attitude to conservation.

The examples discussed in this chapter have been chosen to illustrate the variety of private conservation efforts.

PLANTED FORESTS IN NEW ZEALAND – UNINTENDED CONSERVATION OUTPUTS

Tourism and farming are not the only private sector activities that can be combined with conservation. Another important one is forestry.

Commercial forestry has become an important growth industry in New Zealand. In 1992, approximately 96% of New Zealand’s wood production was sourced from forests of exotic species, mainly *pinus radiata*, which is disease resistant and has been hybridised to grow faster than its natural rate.² The substantial growth in exotic forests³ has, however, raised questions about the environmental effects of these plantations and their effects on the surrounding habitat relative to alternative land uses such as farming.

One of the major environmental concerns is that commercial forestry is leading to further loss of native forests. The commercial forestry programs are, however, primarily created from afforestation of land formerly used for either grazing or cropping. For example, in the winter of 1995, 709 square km of land was used to plant new forests. Of this only 16% was on scrub land while most of the rest was on former pasture.

The areas occupied by exotic forests are subject to planning controls under the *Resource Management Act*. Evidence of the effects of exotic forests

² The original habitat for this species is North America.

³ According to the Statistics New Zealand internet site, <http://www.stats.govt.nz/>, the area under plantations of exotic timber grew at about a 7% annual rate between 1993 and 1995. While the (small) area allocated to horticulture also grew over this period, the areas allocated to grazing and “other” farm use both declined.

on water and soil quality, the survival of endangered species and the appearance of landscapes has been presented to the Environment Court. Environmentalists have opposed plantations of exotics in Environment Court proceedings on the grounds that they are “monocultures” and are “artificial”.

Of course, many of the agricultural activities that pine plantations displace are also monocultures and many are equally artificial. Furthermore, some indigenous forests, such as the forests dominated by beech trees, which occupy 2.87 million ha (28,700 square km) or 47% of the non-planted forest area of New Zealand, are substantially monocultures in so far as the dominant trees are concerned. While there are many smaller shrubs and plants in the beech forests, so also many smaller native plants, and the animals that rely on them, find suitable habitats in pine plantations.

Plantations of exotic trees in New Zealand have in fact been shown to provide substantial *positive* environmental externalities. In particular, they have been demonstrated to provide improved water and soil quality and to assist with maintaining biodiversity on areas being reforested.

Data collected in New Zealand forests have demonstrated that planted forests have a substantial and comparable level of biodiversity and species richness to many native forests (MacLaren, 1996, p 131):

In assessing the relationship between species richness and foliage height diversity, the authors found a positive relationship for indigenous birds and a negative one for exotic birds ... the main effect of replacing native forest with conifer plantations is not a reduction in species-richness or bird diversity but a change in avifaunal composition.

Planted forests seem to be inhabited by a larger proportion of insect eating birds relative to nectar eating birds than can be found in the indigenous forests (MacLaren, 1996, p 130):

In general young conifer populations are poor habitat for birds, but species that feed on insects seem to thrive in the older plantations. These birds include the silvereye, grey warbler, fantail, whitehead, tomtit, robin, brown creeper, shining cuckoo, and long tailed cuckoo.

Levels of vascular plants and other understorey cover have been estimated by a number of studies of plantation forests. Of the species present, a high proportion were natives and the composition was unchanged between first, second and third rotations.

A study of the Rai Whangamoia forests in 1971 reported a total of 34 species of sapling in the exotic plantation forests. It found evidence that the practice of thinning increased the understorey cover. A 1989 study on the

Canterbury plains found 84 native forest understorey species – a total of 21 ferns, 46 dicotyledons and 17 monocotyledons – in an area not previously covered by forest because it was characterised by dry windswept conditions.

Other studies have shown that the growth of understorey cover can be stronger in exotic forests than in native forests. This could possibly be due, however, to the better quality of land on which the exotic forests are growing.

There are disadvantages associated with exotic relative to native forest habitat. The major one is the relative lack of appropriate hollow or standing dead trees. Although dead trees are necessary habitat for various fauna species, it would not be economically viable to leave such trees standing between rotations. Furthermore, pine logs themselves form poor habitats as they are often weak and easily blown over in storms. Nevertheless, MacLaren (1996, p 130) records that pine forests can provide appropriate hollows for wildlife:

Of major interest to New Zealanders was the discovery of 20 long tailed bats in a cavity in a dead radial pine tree, near Tokara. The nearest indigenous forest was 3 km distant so it is likely that the pine plantation was used for foraging. Under most silvicultural regimes, however, large, hollow, dead trees are rare.

Another major ecological problem with exotic forests is that they do not provide food for the main nectar and fruit eating birds. These species often feed directly on larger native trees that are absent from the pine plantations.

MacLaren (1996, p 134) summarises the animal biodiversity issues as follows:

Indigenous forest contains a much greater diversity of native animals than does exotic forest which in turn is a much better habitat for forest animals than is farmland. As conversion of indigenous forest to exotic is now rare and in most cases controlled by the RMA, and as conversion of farmland is commonplace, we can conclude that – unless indigenous forest is cleared for farming – current trends will benefit biodiversity. Although no fixed data exists on the effects of planted forests on water yield, it is widely understood that well managed forests reduce flooding and sedimentation relative to pastoral areas.

Better monitoring of water quality has revealed a sustained reduction in nutrients, including nitrogen and phosphorus, in the run-off from planted forests as opposed to the run-off from pastoral land. According to MacLaren (1996, p 132), this reduction has been of considerable environmental benefit, reducing toxic algae blooms and improving the recreation and conservation values of such waters:

Planted forests have also been shown to deliver gains in aquatic biodiversity relative to agricultural land uses. Water quality is better in the planted forests than

in pastures with lower temperatures as a result of shading of water ways, lower nutrient counts and more stable water flows.

Planted forests provide other indirect conservation outputs including improved soil quality. Indeed, improving soil quality and preventing erosion are significant management goals in planted forests. Trees, including exotic varieties, have been shown to deliver lasting improvements in controlling erosion relative to plants with more shallow root systems. Pastoral usage tends to have the most significant long-term negative impact on the quality of soils. Planting forests on agricultural land can restore some of the damage done by farming. Exotic pines tend to increase the acidity of soils. However, this tends to be a beneficial externality, as most native New Zealand shrubs prefer an acidic soil.

Forests have in fact been suggested as an alternative “crop” on farms that could be used to rejuvenate the soils in preparation for other crops, and reduce erosion, run off and sedimentation of rivers. This would enable New Zealand farming to provide conservation outputs in a way that also yields a commercial return.

In summary, plantation forestry has converted much former pasture land into an environmentally beneficial and commercially attractive business. Observations on plantation forests have strongly refuted the widespread assumption that planted forests of exotics are “biological deserts”.

It is conceivable that if the institutional incentives and constraints were modified, the ecological benefits of plantation forestry might be enhanced. In particular, plantations of native tree species rather than exotics may provide a wider range of habitats for native animals. Most New Zealand native trees that are suitable for timber are very slow growing, making them uneconomic relative to the exotic pines.

Allowing patents on genetically-modified native trees would provide an incentive for timber firms to produce faster-growing native species. The firms would also need to be guaranteed, however, that if they did develop plantations of native species they would be allowed to harvest them when the time came to do so. Under the current resource management regime, most companies would have considerable doubts on this score.

Furthermore, to make such a project feasible, the government probably would need to charge for the use of publicly owned conservation areas. Under those circumstances, a firm planting a forest of native trees could also earn revenue from hiking, hunting and fishing fees while it was waiting for the trees to mature.

In the United States, some of the large lumber and paper corporations earn almost as much revenue from hunting, fishing and hiking fees as they do from trees. They employ biologists to ensure they obtain the maximum overall benefits from their forests. Overwhelmingly, however, these multiple-use private forests are found in the south-eastern states, where there are fewer publicly-owned conservation areas with zero or low entry fees. In the west coast states, where there are many more publicly-provided low cost recreational opportunities, the private lumber firms and paper companies tend to manage their forests for single purposes of wood production.

Timberlands West Coast Ltd., New Zealand, is pursuing another strategy for combining logging of native trees with conservation outputs. They have proposed a 500 year “sustainable forest management plan”. They intend to use some of the world’s larger helicopters to lift out individual trees from the South Westland forests. The aim of the project is to utilise the native timbers that are superior to exotics for some purposes while having minimum impact on forest vistas and ecosystems. The corporation claims that the trees to be logged will be:

carefully selected because they are already in decline and on the slow slide to a natural death ... only those trees that are past their prime, damaged or unstable will be harvested and then only singly or in small groups, to minimise the impact on young and healthy specimens surrounding them. The foliage, which contains most of the nutrients that return to the earth when a tree dies naturally or blows down, will be left behind, cut to ensure contact with the ground so that it breaks down. And there will still be many dead and dying trees left in any given section of the forest to provide a natural home and food supply for insect and bird life. If natural regeneration is not sufficient, the same foresters who harvest the trees will plant Rimu seedlings for future generations. (Food and Agriculture Organisation, 1996b).

EXAMPLES OF PRIVATE CONSERVATION ACTIVITIES IN NEW ZEALAND

There are many projects in New Zealand that illustrate how conservation can be promoted as a commercial activity in combination with tourism. The eco-tourism ventures of Gerry McSweeney and his wife Anne Saunders were discussed in chapter 3. While these ventures are centred on providing accommodation to tourists in areas adjacent to National Parks, they have also shown how tourism can be used to provide real conservation benefits.

The guided walks, and associated luxury accommodation, on the Milford Track are another prominent example of combining tourism and

conservation, as are many of the 500 or so concessions currently operating in areas managed by DOC. Policies toward concessions were discussed in chapter 4. In this chapter, we examine some private sector businesses that are less clearly dependent on the conservation activities of DOC.

Ngai Tahu Whale Watching

A community trust owned by the Maori people of Kaikoura in partnership with their affiliated tribal people, Te Runanga o Ngai Tahu, operates a whale watching activity out of the former fishing town Kaikoura on the north-east coast of the South Island. Numerous species of whales, particularly sperm whales, humpback whales and orca (so-called “killer whales”), dolphins and New Zealand fur seals swim along the coast, attracted by the abundance of squid found off the continental shelf, which drops away about a kilometre off-shore. Tourists are able to hear the underwater communications between the mammals using a marine phone. Weather permitting, there are up to four departures daily, year round.

Whale Watch Kaikoura was launched in 1987 as a local Maori initiative. Ngai Tahu have the only two current licences to undertake the activity, although a number of competitors have entered the market using helicopters and aircraft instead of boats. Other operators have opposed the Ngai Tahu monopoly on boat tours and have applied to DOC for concessions to operate competing businesses. Ngai Tahu have argued in the High Court that the *Treaty of Waitangi* protected their interest in whale fisheries, including whale watching, and that DOC did not have the legal right to control the activity without consent from the iwi. They have also argued that the Department of Conservation should restrict tourist activity to one operator, in order to limit disturbance to the whales.

Whale Watch Kaikoura has won New Zealand’s Tourism and Conservation awards for excellence. It was also the global winner of the British Airways “Tourism for Tomorrow Award” in 1995 after being selected from 15 finalists and a record 120 entries for the “green tourism” award.

According to news reports at the time of the British Airways award, the Tourism Minister commented, “I am proud that a New Zealand company has been internationally recognised as having the highest possible standards, and [being] futuristic in its approach to tourism”.

Labour Department community employment group manager Parekura Horomia said he hoped the award would “provide inspiration to other communities. Whale Watch Kaikoura is a great example of what motivated New Zealand communities can do to generate local economic development”.

Other communities should “think laterally about how they could use local resources to create new business opportunities and jobs”.

Conservationist and media personality David Bellamy, who chaired the judging panel, said the awards promoted the effective management of tourism and that was what Whale Watch had accomplished. Dr Bellamy also praised Whale Watch for transforming Ngai Tahu’s marae into an education centre.

Whale Watch’s general manager, Mr Stone, said Whale Watch was the first of about 30 commercial whale-watching operators in New Zealand, but remained globally unique in that whales could be seen off Kaikoura for 12 months of the year. This was due to the proximity of the continental shelf to the shore and the fact that three ocean currents – one along the Hikurangi trench from Tonga, another from Antarctica and a third from the Chatham Rise – rose from the deep to create an abundance of nutrients at the start of the sea mammals’ food chain.

Mr Stone also stated that in the 1994-95 financial year Whale Watch expected to take 44,000 people out in its four boats and “feels it cannot expand its operations further without harming the whales. We are conscious as a business that if we overstep the mark, and scare the whales away, we no longer have a business”.

The Yellow-eyed Penguin Conservation Reserve

On the Otago Peninsula near Dunedin, a private farm has been turned into a tourist operation for viewing the locally endangered yellow-eyed penguin. The farm is adjacent to the ocean and only 5 minutes from the royal albatross and seal colonies at Tairoa Head that are managed by DOC. The owners have established a penguin “hospital” to care for sick and neglected birds, a series of nesting boxes, a set of tunnels leading to hides to prevent tourists disturbing the penguins while they look at them, a program of trapping predators and a revegetation program to return much of the area to native bushland. The reserve employs zoology students from the nearby University of Otago in Dunedin as guides. The students have been undertaking research based on the penguins in the reserve. Before each tour, the guides give a brief overview of the biology of the yellow-eyed penguins and other penguin species. Visitors can stay on the reserve in a lodge, while the reserve also sells souvenirs and snacks.

According to part-owner Howard McGrouther, the operation is profitable mainly because people are so interested in penguins. He suggested that there were not many other species that would prove as attractive, and capable of

supporting a tourism business. We venture to suggest, however, that this may be partly because the publicly provided recreational opportunities in conservation areas are given away at no charge. If people had to pay to visit areas managed by DOC, private conservation activities would also become more attractive, implying that more farms would be turned back into areas supporting native species.

The McGrouthers have apparently received both support and hostility from other people living in the Dunedin area. For example, there have been demonstrations at the property with protesters carrying signs such as “penguins are not for profit”. Other local residents know that the McGrouthers have a “penguin hospital” where sick and injured penguins can be nursed back to health. It is a common practice to bring penguins in need of such care to the reserve. Apparently, at least one local wildlife officer refused to bring penguins to the reserve for some time, arguing that he did not wish to support an operation that was making a profit out of wildlife. This argument would seem, however, to confuse means and ends. Surely, if the aim is to ensure the survival of the birds on the South Island of New Zealand⁴ then anything that assists in achieving that goal ought to be given a fair trial. If it works, then it is a good means of achieving the end. Whether or not someone is able to earn a living by providing that service is surely beside the point.

Another objection to the McGrouther reserve was that it was wrong to provide artificial breeding boxes for the birds because it was “unnatural”. This would seem to be a rather strange argument. In the first place, DOC itself provides breeding boxes for other penguins elsewhere in New Zealand – we saw them for example at Tiritiri Matangi Island near Auckland. DOC also provides breeding boxes and artificial feeding stations for many other birds in areas, for example on Kapiti and Tiritiri Matangi islands, where the natural vegetation has been disturbed and suitable nesting sites or food sources are unavailable. Again, the key issue is not whether these facilities are “natural” or “unnatural” but whether or not they assist the survival of the birds.

The McGrouthers have spent considerable funds building the facilities for the tourists and the birds, keeping predators off their reserve and researching the biology of the penguins. According to the owners, they have had better breeding success with the penguins than other conservation areas for the species on the New Zealand mainland.

⁴ The species is also found on some sub-Antarctic islands.

The Yellow-eyed Penguin Trust

While it is a very different operation from the conservation reserve, the Yellow-eyed Penguin Trust, which is also in Dunedin, also represents private involvement in conservation. The Trust was established by a group of local volunteers in 1987 with the aim of “helping the government save a local species”. The Trust has no measurable objectives it is accountable for, apart from saving the yellow-eyed penguin as a native species in the Dunedin area.

A spokesperson for the Trust told us:

The Trust is in a strong position to attract public support for our cause. The species we are saving is cute and appeals to the emotions and people are motivated to help us. An Endangered Moth Trust or Scabweed Trust wouldn't attract the same public support but would contribute just as much to the conservation of biodiversity.

As we argued in chapter 3, however, biodiversity is not really satisfactory as an end in itself but rather only as a means to an end. In order to conserve the “cute” species much else will need to be conserved as well.

The Trust has ten volunteer board members and three half-time staff. It has rented office space in Dunedin, rented farmland for a plant nursery and owns several properties where yellow-eyed penguins nest.

When we discussed voluntary organisations in chapter 2, we noted that effective leadership was critical to the survival of such organisations. This was confirmed in the following statement made by the spokesperson:

It is the energy, motivation and commitment of a few key volunteers which is the strength of the Trust. However, because their Trust responsibilities are on top of their personal ones the volunteers are vulnerable to burnout. When they leave, they take the knowledge they developed over the years and new people have to start from scratch.

The dairy foods producer, Mainland Products, is a major sponsor of the Trust. Funds from the firm, together with specific grants from the New Zealand Lottery Board, private foundations and trusts, the Ministry for the Environment and Greenpeace, enabled the Trust to purchase several areas of private land. Other sources of funding include more than 2,000 subscription donations, bequests, regular contributions from nursery supporters and in-kind support from local law firms and a Toyota dealer.

The major areas the Trust is involved with are:

- Omihi – 3 ha that is privately owned but is fenced and maintained by the Trust;

- Otekiho – 5 ha purchased and fenced by the Dunedin City Council in 1991, managed by the Trust;
- Okia Reserve – 231 ha (2.31 square km) purchased by DOC and the Trust in 1991, annual contribution to running costs from DOC, revegetation done by the Trust, fencing and control of noxious plants and animals done jointly by DOC and the Trust;
- Otago peninsula – 16 ha purchased by the Trust, managed by DOC; and
- Tavora Reserve – 40 ha purchased in 1993, 28 ha leased for grazing, under conservation covenant, revegetation done by the Trust, managed by DOC.

Apart from purchasing or managing the above areas, the Trust has also contributed to fencing and land purchase at a number of other locations. It has also supported the research of graduate students, spoken to schools and community groups, co-sponsors an annual one day seminar with DOC, and has produced information brochures and a video on the yellow-eyed penguin.

As with the Supporters of Tiritiri Matangi (discussed in chapter 2), revegetation is a major part of the work of the Trust. Volunteers from community groups assist with planting. The plant nursery produces an average of 3,500 plants per year for revegetation projects.

Okia and Tavora Reserves are open to the public at no charge, although they do not have the tunnels and hides present at the private Conservation Reserve discussed above. We also believe that none of the Trust properties uses penguin nesting boxes. A spokesperson for the Trust told us that she believes, on the basis of recent research,⁵ that “yellow-eyed penguins alter their landing behaviour if people are within 75 metres”. As a result,

The Trust suggests a precautionary approach to eco-tourism until more is known. We have to ask how much more successful a species would be without any disturbance whatsoever.

The implicit assumption behind this statement is that less “disturbance” would automatically favour survival of this species. This is not necessarily the case, however, as is evidenced by the “interventionist” practices of DOC with regard, for example, to control of weeds, feral animals, fires and, in some areas, the provision of “artificial” breeding boxes, veterinary care and feeding stations. The Trust spokesperson added:

⁵ She cited a report by Wright (in progress).

There can be a dichotomy between eco-tourism and conservation. A tourist operator's main aim is to provide an income for themselves. This can tempt the operator to "farm" the one attractive species specifically for viewing by people. The operator is motivated to conserve this species and conservation gains can be made. However, there is the potential for the one marketable species to become the focus and ecosystem conservation to be ignored. The result is a single species that continues to require intensive human management rather than a self-sustaining ecosystem.

On the other hand, to succeed at maintaining the species in anything other than a totally captive, zoo-like environment – which is not what most people are interested in seeing – the operator will need to pay attention to the wider ecosystem. For example, the McGrouthers have undertaken research into diseases suffered by the yellow-eyed penguins, and into their food sources and how environmental factors may affect those food sources. A major benefit of charging entry fees is that it provides a substantial additional source of income that can be used, and is being used in the case of the McGrouther Conservation Reserve, to assist with the conservation of the species. The funds available for preservation of the yellow-eyed penguin would be even greater if *all* the reserves where it can be seen charged entry fees.

Having a number of reserves attempting to conserve the species also allows different approaches to be tested out. For example, the use of nesting boxes, or intensive intervention to fight disease or predators, could be more effective than a totally "natural" approach simply because the environment the penguins now are experiencing is considerably different from the "original natural" ecosystems in which they evolved, and ecosystems resembling those are probably lost forever. Rather than all wisdom for species preservation or research lying with one party, many different managers will try their own ideas. This is one of the great strengths of decentralised processes.

The spokesperson for the Trust continued:

There is virtually no market for ecosystem conservation because there is a low demand for it. People do not have an immediate, tangible use for the components of an ecosystem so they aren't motivated to pay for its conservation. The monetary value of conservation is as the long-term, raw ingredients of life, including human life, but market forces work for simple, short-term desires driven by subjective values.

One problem with this observation is that the market value of environmental assets is currently so low, and for many such assets undoubtedly below the true social value, *because* many of the services are being given away for free.

If tourism and recreational uses of conservation areas had a monetary price that more closely approximated their true opportunity cost, people would more readily perceive the true value of the areas. In addition, of course, there would be substantially greater funds available to support conservation activities. It is, unfortunately, just not true that conservation does not cost money. Funds are needed for research, fencing, pest and weed eradication, revegetation, providing appropriate facilities to control adverse impacts of the tourists and trampers, and so on.

This is not to say that tourism and recreation are the only source of value for conservation, or that conservation should only be funded from that source. As we noted in chapter 4, there are non-use values of conservation that are not easily captured in market prices. There is also a strong argument for direct public funding of basic scientific research – although as we argued in chapter 4, there is also a strong argument for providing funds for the associated conservation activities through vouchers attached to research grants rather than directly to the reserve managers regardless of the services they are providing.

It is one thing to argue that conservation would be under-valued in the marketplace and that it therefore should be subsidised through the use of tax revenues, perhaps channelled through research grants or other avenues. It is quite another thing to argue that all conservation activity should be provided by a monopoly publicly owned organisation. It is even more difficult to justify that public monopoly giving away marketable services at a zero price in order to eliminate, or minimise, the private opportunities to compete in businesses that rely on conservation activity.

The implicit claim made in the above quote that governments will also be more far-sighted than private businesses is also difficult to accept. In the first place, the handsome discount that DOC provides for early payment of funds by concessionaires (discussed in chapter 4) suggests that DOC has a very *high* rate of discount relative to a private business. Furthermore, the time horizon of most politicians barely extends beyond the next election. Look at how fiscal policy was run in most democratic countries once politicians were freed from the constraint of balancing budgets except in time of war or other crises. Continuing budget deficits financing recurrent rather than investment expenditures imply ever-expanding tax burdens on future generations and are hardly a sign of concern for the future at the expense of the present.

Private businesses, on the other hand, have an incentive to maximise the value of the assets they control. Actions that decrease future values at the expense of current income reduce the value of assets. Interest rates, or rates

of return on assets, represent the market trade-off between current and future income. Entrepreneurs have an incentive to forgo current income by investing in a business whenever the resulting increase in expected future income represents a rate of return at least as great as the appropriate risk-adjusted interest rate for that type of investment.

The key problem for market preservation of conservation assets is not that private individuals are insufficiently far-sighted. Rather, the key problem is that market values do not reflect some of the “social” value of certain assets, just as some conservation services do not have a market price. Having a government organisation giving away conservation services for free of course *exacerbates* these problems.

The final point made by the spokesperson for the Trust was that:

The Trust considers the main strength of DOC to be its coordinated, integrated approach to the conservation of biodiversity. We rely on its staff for their breadth of experience and the overview that comes from working on a range of interlinking issues, resulting in an intimate understanding of the intricate workings of an ecosystem. They are part of a nationwide network of knowledge, facilitating the easy access to information that can happen within one agency. DOC's expertise in conservation management is not duplicated elsewhere in the community ... Fragmented conservation bodies, each focusing on a different aspect of ecosystem conservation, would ... create ... inefficiencies ... For a lot more effort, less conservation would be achieved. To be efficient, conserving biodiversity requires an overview. One integrated organisation offers economies of scale.

Again there are a number of responses to these assertions. While it may be true that “DOC's expertise in conservation management is not duplicated elsewhere in the community” there is a chicken and egg problem here. Few other organisations have had an incentive to develop such expertise. Under the current institutional arrangements the expertise does not have a high market value. Even so, there is considerable evidence that DOC is not the fountain of all wisdom with regard to conservation management. Despite the limited incentives to do so, various private groups and organisations (including the Supporters of Tiritiri Matangi, the Otorohanga Kiwi House and Orana Park)⁶ have shown how DOC's performance in conservation management can be improved upon. In an economy that placed a higher premium on being able to manage conservation assets, we would expect the competitive market to produce many innovations in conservation

⁶ These organisations were discussed in a number of previous chapters.

management and quickly outperform a centralised bureaucracy. That has been the result in almost all other areas of resource management.

It is interesting to note that the spokesperson did not claim DOC superiority in scientific research. Since there are still strong incentives for other parties to engage in such research, DOC is in a competitive market in so far as those services are concerned. Despite its privileged access to the “raw material” for ecological research, however, DOC does not appear to produce better outcomes than the market of competing scientists.

The suggestion that the “intricate workings” of natural ecosystems favour centralised methods of allocating resources is probably the opposite of the truth. The superiority of decentralised decision-making mechanisms is *enhanced* when resource allocation decisions are very complicated, and require a great deal of information to get right. Large bureaucratic organisations need to simplify the decision-making environment in order to operate. With many layers of staff between senior decision-makers and the people in the field, the senior staff cannot possibly know all relevant information for all decisions. Yet they still need to monitor employees to ensure their actions are consistent with the overall goals of the organisation. Inevitably, simple, easily monitored and inflexible “rules of thumb” and operating procedures are developed.

Even if the management of large bureaucratic organisations were capable of assimilating and acting upon detailed information, local decision-makers do not have strong incentives to produce or reveal relevant information. Under private ownership, decision-makers personally gain by acting upon information about how to achieve ends at lower cost, or how greater benefits might be provided by modifying enterprise goals. In large bureaucracies, individuals who reveal information about cost saving measures, or better ways of doing things, are often asked to do more with the same, or fewer, resources and thus are penalised rather than rewarded.

The failure of the centrally planned economies was most evident in the most complicated resource allocation tasks that required the greatest degree of coordination. Similarly, complicated manufacturing tasks in market economies, such as the production of automobiles or computers, are now carried out by many decentralised firms that sub-contract to the final assemblers.

It might be thought that improved computer and communications technologies would have increased the ability of large bureaucratic organisations to compete. As the worldwide trend toward greater contracting out shows, however, the fall in transactions costs for trades

between firms has exceeded the fall in transactions costs within firms and further advantaged decentralised market processes. Indeed, even DOC is now contracting out many more tasks than it did in the past, including pest and weed eradication, fencing, track construction and maintenance and so on. While these tasks might not seem like “conservation work”, there is little else apart from these tasks and the scientific research – and as we argued above, the scientific research is already done on a competitive basis with academic and industry researchers.

Chapter 2 discussed the many reasons why decentralised market processes are usually superior resource allocation mechanisms to centralised bureaucracies. The reader is referred to that discussion for further details.

Wainui conservation reserve

Another private for-profit conservation reserve was opened in New Zealand in April 1994. Mr Roger Beattie set aside part of a farm at Wainui on Banks Peninsula as a reserve for preserving, and allowing tourists to see, native New Zealand birds. Mr Beattie fenced off 20 hectares of native forest. He used a 2.2 kilometre six-foot high, predator-proof, fence using a combination of deer netting, rabbit netting, bird netting and electric fencing with 5 live wires. Feral animals remaining in the reserve were eliminated using baited traps. After considerable lobbying, Mr Beattie was given permission to release weka birds into the reserve.

Mr Beattie believes that his reserve is the largest predator-proof area of native forest on mainland New Zealand. The project progressed from the planning stage to completion in less than a year. It took only two months to rid the preserve of predators.

Unfortunately, the funds Mr Beattie could obtain from allowing tourists to visit the reserve were not sufficient to justify eliminating cattle from the property. As we have argued above, a primary reason for this is that tourists are not charged to visit public conservation areas – when the publicly provided good is given away for free, it spoils the market for privately provided competing products.

A consequence of not removing the cattle from the property was that the fence was punctured by one or more cows, allowing the weka to escape and feral animals to re-enter the reserve. The fence has since been repaired and the new feral invaders eliminated by poison traps. Mr Beattie is also working on a new design for the fence to make it more robust to cow hooves. When he is satisfied with the ability of the fence to permanently protect the

enclosed birds, he will again apply for permission from DOC to release some rare birds into the reserve.

On a visit to the reserve in early 1997, we noted that already there is a very large number of native birds in the reserve. The native bush in the centre of the fenced area is also regenerating very nicely. The regeneration could be assisted by planting of native trees. This would also be justified if Mr Beattie could obtain sufficient funds from tourists visiting the site.

One of the factors explaining Mr Beattie's ability to pioneer with the reserve is that his father is an inventor, and long-standing supplier, of insulators for electric fencing. This illustrates one of the strengths of using decentralised market processes to supply conservation services rather than centralised "central planning" mechanisms. There is an extremely large amount of information potentially available about better ways of supplying conservation services. Much of this knowledge is scattered among many different people, many of whom may be unaware of its relevance to the conservation business. A decentralised market mechanism gives these people an incentive to consider how their skills or knowledge might be applied to conservation, and to experiment to discover better ways of doing things. All wisdom on conservation activity, as on other matters, does not reside in Wellington.

SEAL ROCKS PTY LTD – A DIFFERENT TYPE OF ECO-TOURISM VENTURE

Seal Rocks is an Australian fur seal breeding colony visible from the Nobbies on Phillip Island, Victoria. A private company, Seal Rocks Pty Ltd., is constructing an "eco-tourism" project on land leased from the state government. The same company will later operate the project as a franchise.

Many conservationists no doubt would object to this type of technological development. The fact is, however, that people want to come to look at the seals whether the facilities are there or not. Providing appropriate facilities enables the tourist flow to be better managed and can actually lessen the inevitable impact of the tourists on the environment.

Seal Rocks Pty Ltd promises to create an "eco-marine experience" by using state of the art technology. It will construct a new viewing tower and visitor centre to replace the current dilapidated facilities – which are basically little more than a shed in poor repair, housing a snack shop and coin-operated binoculars that can be used to see the seals when the windows are not too foggy.

The aim of the project is to provide a “zoo of the future” where visitors can study and view animals in their natural state. Revegetation of the present site and habitat conservation will be a primary focus for the venture.

The firm aims to cater not only for tourists who currently visit Phillip Island primarily to look at fairy penguins but also for school and educational visitors. It will build a fully equipped research centre.

When the development is completed, Seal Rocks intend to employ 40 people including a full-time scientific adviser for wildlife management. The first stage of the current development, due to be completed by 1998, will cost approximately \$A12 million. A further \$A40 million of expenditure is planned for the next stage, which will include a tunnel connecting to an observation tower closer to the off-shore seal colony, and an underwater viewing area.

The new visitor centre is expected to maintain the current 800,000 visitors per year that the current site receives. The centre has been designed to complement the other tourist developments on the island, such as the Penguin Parade, and to help encourage visitors to stay on the island longer.

Conservation benefits for this project are considerable with attention being paid to the habitat and environment surrounding the seals. The company will establish, for its own use, a fully equipped research centre to monitor the animals. The facilities will also be leased to universities for research. Conservation benefits on a larger scale will include the improvement in the area surrounding the current facilities, revegetation, active management of existing penguin burrows and extension of current board-walk facilities to enable visitors to see more while causing less damage.

Seal Rocks does not intend to exclude non-paying visitors from the site. Rather, current plans indicate they will be provided with improved facilities and a new visitor centre. No additional charges have been envisaged and the plans are for the Seal Rocks development to provide a superior conservation experience for all who visit.

THE BOOKMARK BIOSPHERE RESERVE IN AUSTRALIA

An interesting example of private-sector participation in conservation is taking place in South Australia. The Bookmark Biosphere Reserve covers 6,060 square km in the north-east of South Australia and includes areas of flood plains and wetlands rich in waterfowl and other animal life, upland

risers or terraces, and land reputed to contain some of the best remnants of Mallee vegetation in Australia.

There are 22 separate areas within Bookmark, including a private property, a pastoral lease, South Australian National Parks and Wildlife Reserves, Primary Industry Forest Reserves, and Local government and National Trust Reserves. Private funds from United States and Australian sources enabled some of these areas to be incorporated into Bookmark, and provided some of the facilities for tourists that are included within them. Day to day management of the land is carried out by private owners of Beldora Station and the leaseholders of the grazing rights to the Chowilla Reserves in addition to staff of the South Australian Department of Environment and Natural Resources, the Australian Nature Conservation Agency, the National Trust of South Australia and the Local Councils of Renmark and Paringa.

The Bookmark Biosphere Trust is charged with coordinating the efforts of the different decision-makers, choosing long-term goals for the Reserve and stimulating the changes needed to achieve those goals. Individuals on the Trust include representatives from the bodies in charge of day to day management of the land, local politicians and scientists connected with the CSIRO, the Murray-Darling Basin Commission and the University of South Australia.

The Bookmark Biosphere Reserve is not merely intended to preserve wildlife and natural habitat. It is also aimed at finding solutions to a number of environmental issues, particularly the rehabilitation of degraded land. The Biosphere Reserve Trust also hopes to develop “environmentally sustainable” economic activities for people living in the region. To this end, it has investigated further development of:

- tourism based on the Reserve’s natural and cultural attractions (such as tours of wineries, historic buildings and Aboriginal sites, and river boat rides);
- a meat processing and recreational hunting industry centred on sustainable livestock grazing, the sustainable harvesting of kangaroos and waterfowl, and the eradication of feral goats, rabbits and carp;
- the farming of Cape Barren Geese;
- the establishment of plantations of Murray Cypress Pine for timber production;
- the use, and perhaps breeding, of different varieties of saltbush as a stock fodder crop to replace introduced species;

- producing honey in selected sites where the domesticated bees will not be too disruptive to the propagation of native plants;
- growing the Darling or Murray Lily or Acacias as a cut flower crop, and Mallee eucalypts for florist foliage or eucalyptus oil;
- commercial fruit production from the Quandong, an Australian native tree;
- commercial cultivation of the Warrigal Spinach for human consumption;
- cultivation of halophytic species that can yield table oil and stock fodder in addition to reducing soil salinity; and
- an aquaculture industry based on halophytic algae, brine shrimp, freshwater prawn, yabbies and native fish.

There is also some mining in the Bookmark Reserve area. The Biosphere Reserve Trust has approved its continuation subject to a requirement that the mined area be rehabilitated once the mining activity is complete.

A useful feature of this process is the explicit recognition that conservation can be consistent with other uses of the land and resources. There also appears to be a recognition that superior conservation, as well as other, outcomes can be achieved when land and is actively managed rather than “locked up” and left alone. For example:

- Superior conservation outcomes can be achieved with active fire control programs or deliberate modification of lakes and water courses (such has been done with Lake Limbra in the Reserve area).
- Developing industries based on native species will give people an economic stake in species preservation and may be a more effective conservation strategy in the long term.
- Radical changes in land use, such as “locking up” vast tracts of land previously used for a different purpose, are likely to adversely affect native species that have adapted well to current land use patterns.
- More generally, when land use patterns are changed, it is prudent to monitor the effects and ensure the changes are gradual in order to limit undesirable and unpredictable consequences.
- Confiscation or control of well managed private land that contains endangered species or valuable habitats will discourage private conservation efforts unless the previous owners are adequately compensated.

On the other hand, there may be a danger that management of the Bookmark Biosphere Reserve is not sufficiently decentralised. There is a tendency

toward a “planning mentality” in some of the activities of the Reserve Trust. An alternative approach would allow private owners to manage resources while the Trust encourages them to take account of the *interdependence* of their activities with those of other owners in the region.

EARTH SANCTUARIES LTD

Adjoining the Danggali National Park portion of the Bookmark Biosphere Reserve, but across the state border in NSW, is the privately owned and operated Scotia Sanctuary. Scotia started operations in February 1994. The property is two former sheep stations with 24 main dams and 3 sub-artesian bores. It has two homesteads and, as at Danggali, shearers’ quarters that can be used by campers. It can accommodate up to 50 visitors a night. Scotia contains 65,000 hectares of Mallee and Black Oak woodland containing over 100 bird species and is a continuation of the Danggali habitats. The Sanctuary caters to schools, special interest groups and the general public. It offers guided tours, fauna surveys, and star talks in addition to unguided walking tracks.

Scotia is the largest project to be undertaken by Earth Sanctuaries Ltd., a private company founded in 1969 by Dr John Wamsley to develop the Warrawong Sanctuary in South Australia. The original Warrawong Sanctuary consisted of 14 hectares at Mylor in the Adelaide Hills.

The land was originally a dairy farm and devoid of native vegetation. Approximately 100,000 trees and shrubs have since been planted. Over a kilometre of creeks and pools were constructed. The land was surrounded by a fox- and cat-proof fence and the animals that once lived there have been reintroduced. An additional 13 hectares adjoining the original property has been added to it. The aim is to create an environment where the public can see the animals that lived in that area 200 years ago.

The sanctuary was completed in 1982. In 1985, Wamsley opened Warrawong to the public. In 1993, he established Earth Sanctuaries Ltd as a registered company, offered shares to the public and turned conservation into a private business. It currently costs an adult customer \$A85 to stay overnight at Warrawong Sanctuary. This payment entitles the customer to a full dinner, a guided sunset walk, a full breakfast, a guided dawn walk, and a bed in “a famous Warrawong luxury tent”. In addition to charging tourists to visit and stay at Warrawong, the Sanctuary earns income from a licensed restaurant, craft shop and native plant retail nursery.

Wamsley did not start Warrawong Sanctuary with the intention of making it a commercial development. Rather he proposed it as an example

of what could be done in conservation. In particular, he strongly believed that predation by feral animals was the main threat to native Australian wildlife and that, if the ferals could be eliminated from an area through effective fencing, the native animals would survive very well.

Wamsley anticipated that after people saw the success of his approach to conservation, perceptions on how to conserve wildlife would change and the “Warramong model” would then be adopted. Unfortunately this was not the case:

There was hope, at first, that conservation groups and government departments would emulate the project. However, it soon became evident they would not. This is because “active land management” is an expensive business. It is no cheaper to manage land for bandicoots than it is for sheep. Therefore there has to be an income. At Warramong tourism provided that income. (Wamsley, 1996, p 158).

Wamsley also suggested that the Department of Environment and Natural Resources (DENR) exhibited a lack of interest and even open hostility to his approach as a result of “philosophical problems”. Wamsley, for his part, does not mince words when discussing government-owned wildlife services (Wamsley, 1996, pp 157, 160, 162):

The point is this – the present directions are not just failing, they have failed. We have twice as many species of Australian mammal move across the threatened line over the last ten years as the previous ten. We have had as many species cross that line over the last twenty years as the previous 200, yet today we are talking about band-aids ...

The world wildlife problem can be stated very simply. It is only the solution that is enormous. The most successful monopolies the world has ever seen have been developed around wildlife. We have world conventions signed by our governments that virtually ensures the loss of our wildlife. The only confidence trick carried out on the world which approaches this is called Communism and the two are remarkably similar ... In Australia each endangered species has a recovery group associated with it. This recovery group is rewarded on failure, not success. The more endangered its species, the more funding. Yes we have Communism running rampant...

In any event, Wamsley’s ideas were not adopted as a model for national conservation efforts in the way Wamsley had hoped they would be. Wamsley says that the commercialisation of his venture was a direct response to the lack of government interest in his method. He says that the overriding aims of his company are “public education” and “species conservation”, not making money, although he intends to give shareholders reasonable value for their investments:

We are not eco-tourism operators. Earth Sanctuaries Limited is about exploiting the tourist for the benefit of our wildlife ... an Earth Sanctuary is a place where our exquisite wildlife can be seen as they once were all over wild Australia, because they are still in the wild. There are not any foxes chasing them, or goats and rabbits out-grazing them, in an Earth Sanctuary. (Wamsley, 1996, p 163).

Wamsley founded Warrawong in South Australia, as he claims that was the only state where it was not *illegal* to establish a private wildlife sanctuary.⁷ However, when he actually tried to establish his sanctuary he says he was treated as one of Don Dunstan's (the then Premier of South Australia) "political prisoners". He was locked up in 1975 for attempting to erect the feral proof fence around his land without planning approval. The government said it was acceptable to establish a sanctuary, provided that there was no fence around it.

One wonders why DENR was so violently opposed to a private property owner building a fence around his property that would be sufficiently robust to *exclude* feral animals. Why should they care? It does not appear to interfere in any way with what they, or anyone else, is doing. Presumably, there would have been no objection if a private property owner wished to build an exceptional fence around his property to *enclose* his exotic farm animals. Maybe they were opposed to anyone showing how conservation could be better achieved than the way they were doing it. Perhaps their funding sources could be threatened if species they were looking after were moved away from the brink of extinction. Perhaps they did not want promulgation of the idea that fences were needed for effective conservation. After all, if conservation areas need to be fenced for effective conservation, it would no longer be difficult to enforce a charge for entry. Conservation could become an entirely private activity like other forms of land use and the parks service would be out of business.

Wamsley was released from prison only on the condition that the fence not be put up. The first action he took upon release from prison, however, was to build his fence.

The obstructionist behaviour of DENR continued when Wamsley proposed to build tourist accommodation at Warrawong. The South Australian government would not issue planning permission for the

⁷ Since the Healesville sanctuary near Melbourne was originally private (although it is now part of the Melbourne zoo), if Wamsley is right then either the laws in Victoria changed after Healesville started or Healesville does not fit the definition of a "sanctuary" that Wamsley is using.

construction of solid buildings. Wamsley therefore decided to construct the only buildings that didn't require planning permission, namely tents. Even this decision was challenged in the Supreme Court, although in the end Wamsley won.

Recently government harassment of Warrawong has taken the form of direct competition at heavily subsidised prices. DENR has opened the Cleland Wildlife Park, approximately 5 km from Warrawong. Dr Wamsley singles out the introduction of *subsidised* night walks by the park just after the introduction of night walks at Warrawong as a deliberate attempt to steal visitors from him:

Our competitors are the Department of Environment and Natural Resources, and the Adelaide Zoo, which are both funded by the South Australian government. While we have to pay land taxes, vehicle duty, income taxes, council rates and so forth, our competitors do not. They are covered by no rules when it comes to development, signs, animal availability and similar issues. We are covered by rules every which way we turn. (Wamsley, 1996, p 161).

Despite this deliberate, and potentially illegal,⁸ attempt of the wildlife park management to bankrupt Warrawong, it appears to be surviving – no doubt because DENR cannot provide as good a quality “product” to its customers.

Another impediment to private conservation was highlighted by recent protests against the release into a local creek of wild platypus bred at Warrawong:

If we allow the platypus to go under the fence into the stream and be killed by foxes we are protested against by greenies. We cannot keep platypus here as we can only support 4 in the dam and the national parks will not allow us to sell any to anyone so the only alternative is to release them.⁹

When places such as Warrawong Sanctuary are restricted from trading wildlife for money,¹⁰ not only is private conservation discouraged by the lost funds but also valuable animals can be “wasted”:

We could bring hundreds of millions of dollars into Australia to spend on management of protected areas if we were allowed the same “trading rights” as

⁸ If Wamsley is right in his claim that the night walks at Cleland Park are subsidised, the actions may be illegal under the “predatory pricing” provisions of the *Trade Practices Act*.

⁹ Personal communication.

¹⁰ It is illegal for Warrawong to sell Australian animals overseas or to government agencies. It can, however, sell or exchange wildlife with any other private sanctuary or individual within Australia.

Taronga Zoo. We are Earth Sanctuaries Limited. We do not get one cent of our funding from the government. Therefore, we are not allowed to manage our wildlife for the benefit of our wildlife. Taronga Zoo has just announced it is spending hundreds of thousands of dollars for research on platypus to learn what we already know. They are doing this so they can export platypus. They have already attempted to export platypus. You see Taronga Zoo is part of the monopoly. Earth Sanctuaries Ltd is not. (Wamsley, 1996, p 162).

Warrawong Sanctuary has been fox- and cat-free for 10 years. All the animals introduced that were rare or endangered elsewhere in Australia have thrived. The brush-tailed bettong increased from 6 individuals to over 300, the long-nosed potoroo from 4 individuals to over 100, the Sydney subspecies of the red-necked pademelon from 2 individuals to over 50, the southern brown bandicoot from 4 individuals to over 200. Dr Wamsley credits the absence of foxes and cats from the Sanctuary for his dramatic success in breeding these species at Warrawong:

The only difference between Warrawong Sanctuary and any other bit of Australia is simply that Warrawong Sanctuary is fox- and cat-free. Thus, the hypothesis was proven. Australia did not lose its wildlife through farming and grazing. Australia did not lose its wildlife through mining. Australia did not lose its wildlife through land clearance. Australia lost its wildlife through foxes and cats.

Probably the most remarkable result was the numbers of the different individuals which could co-exist there. Warrawong Sanctuary contains more big kangaroos than it could if it only had big kangaroos. This sanctuary contains more wallabies than it could if it just contained wallabies. Warrawong Sanctuary contains more bettongs than it could if it just contained bettongs. Warrawong Sanctuary contains more bandicoots than it could if it just contained bandicoots and so forth.

Although Warrawong is small, it had proven something very important, but it did not really do much itself. (Wamsley, 1996, pp 157–158).

Some “conservation professionals” have rejected Wamsley’s claims that fencing followed by eradication of feral animals is the best strategy for conserving wildlife in Australia. The main alternative technology for feral animal control that has been used in Australia as well as New Zealand involves aerial spreading of baits that are fatal to foxes and other feral animals, but non-fatal for native animals. It is plausible that this technique could be more cost-effective than building sanctuaries surrounded by feral-proof fences. A significant factor in comparing the two methods is that the aerial spreading of baits is a much less permanent solution – except in the case of off-shore islands where reinfestation by ferals can be controlled. The larger up-front capital cost of the fencing solution is more appropriate for

funding through private capital markets, while government organisations might be better able to justify ongoing expenditures for baiting programs than the larger one-off cost of constructing fences. An advantage of encouraging private entrepreneurs to provide conservation is that the alternative methods, and other similar experiments, could be tried to see which of them is more cost-effective.

The executive director of operations for the New South Wales National Parks and Wildlife Service, Alastair Howard, commented in an article on Wamsley in *The Sydney Morning Herald*, 13 April 1996, that:

By erecting animal-proof fences ... you end up with a series of open-range zoos. Nobody is objecting to the approach that John Wamsley is taking, but as an agency we are not in a position to erect that sort of fencing around national parks and nature reserves, nor is it necessarily appropriate in most cases. There may be some situations in localised areas where that's an appropriate method to be used for some species that are under serious threat.

The environment writer for *The Sydney Morning Herald* comments:

Mammalogists such as Dr Tim Flannery, from the Australian Museum, are highly supportive of Wamsley's work, but question what the sanctuaries contribute nationally to the protection of the environment. Other key scientific issues are whether in-breeding can be avoided ... and whether the fences prevent the free movement of native species. Scientists also question whether it is appropriate to bring creatures such as bilbies from the Northern Territory for reintroduction in South Australia.

The reporter also quotes the executive director of the Australian Conservation Foundation as saying the erection of fences is "only one element of the answer" to Australia's "environmental woes".

The breeding of platypus at Warrawong has been cited by some ecologists as proof that Wamsley is more interested in publicity than ecology and conservation. The platypus is not rare or endangered. The conclusion must therefore be that the only reason to breed them is for self-promotion.

Wamsley countered this argument by saying that platypus breeding did indeed give much valuable publicity to the aims and objectives of the sanctuary. More importantly, however, it demonstrates that the sanctuary concept is a viable alternative to the established captive breeding methods of zoos and research organisations.

Zoologists from the University of Melbourne to whom we spoke about Warrawong argued that the key conservation problem to be solved in Australia is the explanation for the previous decline in populations of native species in the areas that are now being transformed into sanctuaries.

Conservation requires that the fundamental problems in these areas be addressed. Increasing populations of native animals in an “artificial environment” does nothing to address the decline in populations that are occurring elsewhere on the continent.

Furthermore, creating an artificial environment in an area where these animals never lived before and then transporting animals to that location “can hardly be considered natural”. Nobody can be sure of the natural requirements of the species in question. Macropods have diverse dietary requirements – for example many species of native grass or tree bark – and to put them in an artificially created environment with no consideration as to what they will eat, and no effort to find out, is not the way to go about conservation. They continued:

A better way is to find locations that already have established populations rather than create new environments for the introduction of species. Then one can concentrate on the management of specific species and a specific environment and half your problems are solved as the species already exists there. Then you can concentrate on land regeneration and habitat management, confident that you are not creating an unsustainable population.

Wamsley countered these arguments by pointing to the success of the breeding programs at Warrawong:

We are building a name as the place to come to see wildlife and I would estimate that in 25 years we will be the only place where you will be able to come to see 100 species of wildlife. Since 1969 Earth Sanctuaries has successfully reintroduced more species of rare and endangered wildlife, back into the wild, than all the National Parks, Wildlife Services and Zoos of Australia combined.¹¹

The zoologists we spoke to argued, however, that breeding success does not necessarily equal survival. The small initial populations of animals in the sanctuaries have also raised concerns of potential genetic diversity and genetic mutations:

Small populations in closed captive environments are highly susceptible to genetic mutations in a few generations and to base the whole survival of a species on this is not possible. The same goes for the physical size of the sanctuary which is far too small to be natural and gives an unrealistic impression of what is required to achieve species conservation.

Wamsley acknowledges that some of these problems do exist at Warrawong. He explains that the physical size issue will be resolved with the opening of,

¹¹ Personal communication, although the latter claim is repeated at the Earth Sanctuaries web site <http://www.esl.com.au/wlife.htm>.

and the expansion of, the other Earth Sanctuaries. He stressed that Warrawong was meant as a test for his methods of species conservation. He is slowly addressing the size and over-population pressures at Warrawong by adding more land and by culling animals:

We once had to cull one quarter of the entire species of Brush Tailed Bettongs due to lack of room at Warrawong. It is the easiest and most efficient method of population control and something the national park service couldn't get away with.

He acknowledges problems with the lack of genetic diversity and would welcome other animals to "spice up the genetics" but says that lack of cooperation with government authorities has proved the main obstacle. "The State and National Parks services will not allow inter breeding of their animals".

Wamsley emphasised that the construction of the new, larger sanctuaries is part of a strategy to ease the current problems with Warrawong and to enhance the conservation value of the whole company. Animals are now transported from Warrawong to Yookamurra for reintroduction into a larger environment.¹²

Yookamurra Sanctuary is the second stage in the development of the private conservation program of Earth Sanctuaries. Yookamurra Sanctuary Pty Ltd was formed in 1989. In the same year, work commenced on the 13 km vermin proof fence surrounding the property. The feral fence at Yookamurra has been constructed to better suit the habitat (only 6 feet tall so that kangaroos are better able to jump over it, with electrified outriggers).

Yookamurra applies the practices and strategy learnt at Warrawong on a larger scale. The fence was officially closed by Sir Mark Oliphant in December, 1990. By 1992 vermin had been eradicated and introductions of wildlife began. Wamsley claims that his company is the only organisation in the world to have eradicated rabbits from as much as 1,200 hectares (12 square km). Earth Sanctuaries achieved this result at Yookamurra Sanctuary:

¹² Brendan Moyle has suggested in correspondence with us that the approach of Earth Sanctuaries Ltd may be even more suited to New Zealand than it is to Australia:

Island avifaunas (such as in Hawaii and New Zealand) are already genetically homogeneous as a result of the "founder effect". That is, island species are based on a small population that arrived many centuries ago. Only those species that could cope with the consequent lack of genetic heterogeneity survived ... Further, New Zealand is much more prone to catastrophes than Australia. These catastrophes include volcanic action, tidal waves, tropical cyclones, glacial action, forest fires and periodic submergence beneath the sea. I would be optimistic that many New Zealand species could cope with the disturbances associated with "fragmented" sanctuaries.

It is interesting to compare the results of a private sector enterprise clearing ferals from its land with the results of a public sector enterprise trying the same thing. After the rabbits had been eradicated from the Yookamurra Sanctuary I decided it was our time for some glory. But alas, the day I was about to announce our results, the *Adelaide Advertiser* proclaimed, "Rabbits Eradicated from Torrens Island". Torrens Island is controlled by the South Australian government and is about the same size as Yookamurra Sanctuary. I went over to Torrens Island to congratulate them and noticed a rabbit. "You have not eradicated your rabbits", I blurted out at the environmental officer there. "No", he replied, "but we have eradicated most of them". I was beginning to understand what our real problems were all about. (Wamsley, 1996, p 159).

Wamsley credits the eradication of rabbits and other ferals for aiding the survival of other species in his sanctuaries:

A survey made after [Yookamurra Sanctuary] had been rabbit-free for two years showed that about six million trees and shrubs had germinated and survived because it was rabbit-free. If we put the whole cost of Yookamurra Sanctuary down to the survival of those six million plants, it makes them cheaper per plant than it costs Greening Australia to grow plants. (Wamsley, 1996, p 159).

Following the eradication of feral animals, Earth Sanctuaries has released specimens of the bilby, numbat, stick-nest rat, boodie and woylie into Yookamurra. It is planning to release a number of other endangered mammals in the near future. Earth Sanctuaries claim at their web site:¹³

Of the twenty most endangered species of Australian wildlife, ten once lived in the Murray Mallee. The bilby, numbat, stick-nest rat, boodie and woylie have already been reintroduced. It is planned, over time, the others will be reintroduced and mammals such as the red-tailed phascogale, banded hare-wallaby, bridled nail-tailed wallaby, chuditch and western barred bandicoot will once again live, in the wild, in the Murray Mallee.

Wamsley discusses the problems he encountered obtaining bilbies for Yookamurra. At the time he was speaking, in 1994, he still had not obtained any bilbies (Wamsley, 1996, pp 161–162):

We have been negotiating for five years to get bilbies for Yookamurra Sanctuary. Here we have over a thousand hectares of fox and cat free Australia. Bilbies once lived there. The Northern Territory Conservation Commission says it is suitable for bilbies, but we have not been able to release bilbies there ... I would have thought that those in charge of the "recovery" of the bilbies would be asking us if they could put them there.

¹³ <http://www.esl.com.au/yooka.htm>, August 1997.

Jack Giles of the Dubbo Zoo tells me that he would be delighted to supply us with bilbies if the Northern Territory Conservation Commission allows it. The Northern Territory Conservation Commission tells me they have no problem whatsoever with Dubbo supplying bilbies for Yookamurra Sanctuary provided the National Bilby Recovery Group allows it. The National Bilby Recovery Group will not talk to us ...

We thought we had found our way through all this mess. The acting director of the Conservation Commission, Ken Johnson, said on radio that Yookamurra Sanctuary could have its bilbies, but the difficulty with acting commissioners is that they are just acting ...

This created problems with the South Australian wildlife authorities ... Earth Sanctuaries was about to bring back bilbies. Something had to be done. The National Parks and Adelaide Zoo joined forces. They formed the State Bilby Recovery Team. They would intercept Yookamurra's bilbies. They would put them on display at Adelaide, Cleland and Monarto zoos. After they had received the glory, then and only then would Yookamurra receive its bilbies...

The zoologists that we spoke to criticised the reintroduction of bilbies into South Australia by Earth Sanctuaries on the grounds that this could be contrary to natural processes:

We have not determined the reasons why the initial Bilby populations in the area have declined from their present levels. These could be due to numerous factors not related to feral population growth in those areas. Small macropods are very susceptible to change in climate and habitat and it might well have been that there was a natural population decline in the area. We don't know why. It is important to find out the causes of population trends rather than to assume the decline was just from feral activity.

The reduction in the area of natural grassland has been known to cause a decline in many species of macropods. This had been attributed to a number of factors including farming and pastoral expansion as well as natural changes in climate and ecological or local environmental factors. While these factors are being investigated, however, species continue to move closer to extinction.

Yookamurra has recently purchased an additional 600 hectares of land on its western boundary and a further 1,000 hectares on its northern boundary. It is envisaged that up to \$A500,000 of the capital raised from a recent share offer will be spent upgrading facilities at Yookamurra Sanctuary. The sanctuary has a restaurant and shearers' accommodation for up to 40 guests and employs three full-time staff as well as a number of part-time guides. Wamsley reported that Yookamurra made a profit for the first time in the 1993-94 financial year.

Earth Sanctuaries now also plans to eradicate feral animals from the 65,000-hectare Scotia Sanctuary that borders the Bookmark Biosphere Reserve by constructing a 125 km electrified feral-proof fence. This is intended to be done in three stages, with the first 40 km stage due to be complete in 1998. Recent investment by institutional investors has enabled half a million dollars to be spent to employ 12 trainees to work on clearing vegetation and constructing the 40 km fence.

The new employees will eventually be trained as guides and park managers. The backgrounds of these people are diverse but well suited to the tasks involved, with several coming from land care and resource management backgrounds.

By clearing the remains of the farm operation and replanting vegetation, Earth Sanctuaries hope to create ideal habitats for rare and endangered mammals such as the bilby, the bridled nail-tailed wallaby and numbat. These animals would not be released for several years yet, as the park would have to be made totally feral-proof.

It is anticipated that as many of the animals as possible would come from Yookamurra Sanctuary. Animals from a zoo or other captive breeding environment would be too tame on release. Unfortunately, as the above discussion of the bilby shows, Earth Sanctuaries has often had difficulty obtaining from government conservation organisations enough individual animals to start breeding populations. As the organisation expands, it hopes to be able to provide all its breeding stock from its own properties. This illustrates additional conservation benefits that can be obtained when conservation is freed from the stranglehold of monopoly control.

Other Earth Sanctuaries include Buckaringa and the newest Earth Sanctuaries, Tiparra and Dakalanta. Buckaringa is 1,600 ha (16 square km) situated in the Flinders Ranges and is the first sanctuary to be constructed in an area which is one of the last remaining refuges for a rare and endangered species. Buckaringa is already on the way to being a major conservation and tourist success:

Buckaringa is currently home to approximately 120 yellow-footed rock wallabies, living in the steep rocky gorges, where they find food and shelter. In the last century they were less dependent on this rocky domicile, but scrub clearing, grazing, predators by way of fox and feral cat and man himself, made them head for (further up!) the hills! While the rock wallaby still clings tenuously to his environment, others were not so lucky ... sixty species of mammal lived in the Flinders Ranges just 150 years ago ... today, only twelve remain. (<http://www.esl.com.au/bucka.htm>, August 1997).

Earth Sanctuaries welcomed cooperation it received from other land owners in the Buckaringa area:

Extensive negotiations took place between Earth Sanctuaries and land holders in the area to finally establish what will now become Buckaringa. This expensive infrastructure included "land swapping" and purchases agreeable to all, and one of the final benefits – a bypass road – has already been named the "Buckaringa Scenic Route", and is a significant tourist attraction. (<http://www.esl.com.au/bucka.htm>, August 1997).

The intentions of the development at Buckaringa with regard to promoting eco-tourism are also set out in the web site:

With tourism in the area set to expand, this particular development will be of great benefit to the surrounding district, as a quality tourist attraction. When the project is complete, 40 self contained cabins, together with support buildings such as a reception centre, containing a restaurant, craft shop, educational and conference facilities, will create a backdrop and wildlife habitat of inestimable value. Education will play a major part in Buckaringa's development, groups of visitors will be taken, with an interpreter, and shown what the Flinders Ranges are all about. (<http://www.esl.com.au/bucka.htm>, August 1997).

A variety of animals is set to be reintroduced into Buckaringa sanctuary, including bilbies, eastern quolls, mala wallaby, the stick-nest rat and phascogales. It is expected that the sanctuary will cost around \$A2.5 million to establish. Upon completion, Earth Sanctuaries expects Buckaringa to make a substantial contribution to the local economy in addition to the educational value of the area.

With the development of Buckaringa, Earth Sanctuaries finally appears to be receiving a more cooperative response from governments. Both the South Australian state government and local councils in the area have provided the sanctuary with support:

In particular, the state government supplied \$200,000 towards the construction of a road to bypass Buckaringa Sanctuary so that the sanctuary could be developed. The local council built this road, as well as supplying some of the funds necessary.

The latest Annual Report of Earth Sanctuaries also notes that the company purchased 1,800 hectares at Cape Elizabeth on Yorke Peninsula in December 1994, for \$A302,500. Altogether, they now have 14,000 ha (140 square km) for Dakalanta Sanctuary on Eyre Peninsula and 3,000 ha (30 square km) on Yorke Peninsula for Tiparra Sanctuary. A joint development with the District Council of Central Yorke Peninsula is planned. The Council controls about 1,000 ha of sand dunes adjoining the Cape Elizabeth purchase. This will be the first joint development between Earth Sanctuaries and a government

organisation and the Report comments (p 12) “the success of this project could well determine our future directions”.

Fences for Tiparra and Dakalanta Sanctuaries are also currently under construction. Following their completion, the main focus will be land regeneration. Tiparra Sanctuary is along the South Australian coastline and it is anticipated that 20 km of coastline will eventually be included in the project. A coastline sanctuary is also under development in New South Wales.

There are currently six separate Earth Sanctuaries run as individual companies. Each of the new sanctuaries pays fees to Warrawong to compensate for the “intellectual property” developed by the original Earth Sanctuary. For example, Yookamurra pays 10% of its income to Warrawong for the purpose of being an Earth Sanctuary. Dr Wamsley aims to have 1% of the Australian landmass under protection in 25 years.

In addition to developing sanctuaries it owns, the company sells its expertise in fence building, feral eradication and wildlife management to other individuals or organisations wishing to establish wildlife sanctuaries. It has already completed a private sanctuary for an individual in South Australia and has fenced off a sanctuary in Western Australia for that state’s parks service.

Earth Sanctuaries has 1500 shareholders (20% from overseas) and has issued 18.5 million shares. In the three years 1992–93 to 1994–95, Earth Sanctuaries Ltd earned revenue of \$A2.03 million, generating a net cash flow after taxes and interest of \$A263,018. It paid \$A52,740 in dividends to shareholders and \$A101,475 in taxes. The company also raised \$A2.67 million from new share issues and invested \$A3.44 million in the purchase of new property, plant and equipment.

“Shareholders’ weekends” are a popular method of displaying the achievements of the sanctuaries to the owners. In 1997 there were 6 planned shareholders’ weekends covering all of the major sanctuaries. The popularity of the weekends was seen in 1996 when all of the weekends were booked out and people were turned away. The philosophy behind them is summed up by this quote from the web site:

Shareholders have taken the opportunity to see first hand what their investment dollar is achieving and have a real say in the future directions of the Company. It is important that shareholders understand that they are the owners of our various projects. It would be difficult to imagine that the shareholders of our National Parks (tax-payers) would ever get as much say in the running of National Parks that our shareholders do in running Earth Sanctuaries. (<http://www.esl.com.au/week.htm>, August 1997).

In another innovation, the company has pioneered the use of a “Green Accounting” framework in its latest annual report. This section of the annual report is designed to better evaluate the “environmental success” of the company for investors and shareholders in the form of information not normally present in traditional financial statements. More specifically, this section of the annual report includes valuations for environmental assets that are not normally included in financial reports. Wamsley describes his business as conservation:

Most of the assets are ignored by the financial statements. If we had a fire and half of the trees and animals were destroyed the financial accounts would not register this loss of assets because no value is placed on them.

To counter this problem, Earth Sanctuaries calculated values for trees, different animal species and other assets and included these in the annual report. The valuation methods are unique to Earth Sanctuaries. The values are only intended to provide information to shareholders and management, since they are difficult to compare with values presented in more conventional accounts. However, it is anticipated that in the future it will be possible to compare company variables, such as revenues, costs, profits and share prices with other “conservation” companies. In particular, a major element in the share price of the company should be the value tourists place on the natural environments the company has preserved and developed. As the company is more successful at breeding rare species, its share prices should rise to reflect the greater earning potential.

Another important element of putting conservation into the private sector is that it establishes very strong incentives for owners to minimise costs. Profits and share prices depend not only on revenues but also on costs. Wamsley is highly critical of the lack of focus on the costs of government conservation efforts:

The SA government spent millions to relocate koalas from Kangaroo Island to the mainland ... millions of dollars.

He questioned the current focus of government conservation policy by asking rhetorically:

How much does it cost to save a species? ... Easy \$5 million ... that’s as much as it costs to build a sanctuary and save a species ... The main question is ... how much is a species worth?

Earth Sanctuaries was created as a company rather than the more common trust arrangement for a number of reasons. The most important of these is accountability:

As a company we are bound by the Corporations law, Australian Securities Commission and various state and federal acts. This ensures that our actions are accountable to our shareholders ... With a trust like the World Wildlife Fund (WWF) you donate a dollar and have no idea where that dollar goes or how much is spent on actual conservation. With the company model all money has to be accounted for and demonstrated to the shareholders.

This is where the green accounting model is important to demonstrate where the money goes into accumulating assets not normally included in the financial accounts.

Dr Wamsley is highly critical of the focus of conservation groups like the WWF. He says conservation groups are more interested in making money than real conservation. When he approached WWF to obtain "WWF Approved" status for Warrawong, the reply from the WWF "was send us \$A50,000 and we will approve you".

CONCLUDING REMARKS

The examples of private production of conservation outputs that we have discussed in this chapter have extended the many other examples contained elsewhere in the report. The examples have been chosen to illustrate the range of activities that can be combined with producing conservation outputs to varying degrees of success.

Tourism and recreation are largely complementary activities with conservation, and many private sector organisations that produce conservation outputs fund much of their work through tourism and recreation. This is a major reason why we have stressed throughout the report that it is very important that DOC does not subsidise tourist and recreational use of the conservation areas it manages. Such subsidies spoil the market for private operators and may result in much less conservation output in the country as a whole. Private businesses that cannot earn a return on conservation outputs will have no incentive to provide them, even if they could be supplied at very little cost. In addition, the absence of a charge by DOC will reduce the revenue available to DOC to finance costly activities such as control of feral animals and weeds, or species recovery programs.

The examples also show that it cannot be argued that monopoly government control of production is essential to achieve conservation outputs. Conservation can be run as a private business activity. Government subsidisation of tourist and recreational use of publicly managed conservation areas therefore suppresses private involvement in conservation and would appear to be unwise, or counter-productive public policy. In

addition, however, if DOC were a commercial organisation such subsidies could be illegal under the *Commerce Act*. Subsidisation of the government product from alternative sources of revenue might be seen as a form of *predatory pricing* used to inhibit competition in the market place.

Perhaps the government is a superior provider of tourist and recreational services in natural areas. Perhaps it does have “economies of scale or scope” that enable it to provide the services at lower cost, or of a superior quality, than competing private operators. If so, it has nothing to fear from competing on an equal and fair basis. It should not, however, be allowed to subsidise its operations using taxpayer funds or funds earned from other activities and by predatory pricing drive private competitors out of the market.

The Earth Sanctuaries example also shows that the private sector can provide mechanisms for concerned individuals to support conservation activity even when it does not provide direct benefits that can be charged for. Many conservationists in Australia and overseas have purchased shares in Earth Sanctuaries primarily because they want to support its conservation activity. The strong investor interest in share issues by the company has in turn been a significant factor in enabling it to expand the area of Australia it has placed into sanctuaries.

The examples presented in this chapter, and elsewhere in the report, have also demonstrated some of the advantages in using a decentralised system to provide conservation as well as other goods or services. Time and again, private entrepreneurs have developed innovative new technologies that have assisted the conservation effort. It is very difficult for a centralised bureaucratic organisation to compete with numerous private individuals in discovering new uses for resources and new ways of doing things. It is also very difficult for a government-owned organisation in conservation, as in other industries, to be as successful as a private business with “bottom line” performance requirements aimed at minimising costs and maximising efficiency.

We have presented a vision of how the private sector, and the decentralised market and legal systems, could be used to efficiently supply conservation services, just as they provide myriad other goods and services demanded by consumers. We are confident that, in the long term, conservation will become largely a private sector activity, with a decentralised legal regulatory process modifying incentives where high costs of monitoring property rights or making market transactions limit the efficiency of markets. Our confidence is based on the belief that the community cannot afford to have such an increasingly vital component of its

standard of living allocated through inefficient command and control mechanisms.

There is also little doubt, however, that the shift to greater reliance on markets and decentralised legal processes will take some time. Public opinion may only change after the deficiencies of centralised control become much more acute. In the interim, the central government will continue to be heavily involved in the conservation sector in New Zealand.

The next two chapters discuss the goals, structure and management processes of DOC and suggest ways in which some of the inefficiencies of centralised control might be lessened. We thus shift our focus from the long-term vision to issues that are more relevant for a shorter time horizon. In doing so, we do not wish to imply that moderate reform of the existing institutions will be sufficient to achieve the ultimate goal of maximising the benefits that current and future generations of New Zealand residents obtain from the available natural resources. Furthermore, the long-term strategy of moving toward a largely private conservation industry needs to be kept in mind in order that the short-term reforms do not stand in the way of achieving the long-term goal.

In particular, we strongly advocate that, in addition to re-examining the operations of DOC, the government take a very careful look at the land currently managed by DOC. Areas that:

- are primarily used for tourism and recreation,
- have a local volunteer group dedicated to their conservation,
- are most suitable for multiple or alternative resource use, and/or
- are primarily of interest to Maori

ought to be allocated to (various types of) private ownership. Land use by these owners would, of course, have to comply with laws aimed at ensuring resource use is sustainable, and also with general laws of the land pertaining to such matters as employment relations, safety, or anti-competitive activity.

Areas that are currently allocated exclusively to producing conservation outputs that are joint and very diffuse in nature¹⁴ should be retained in public ownership until mechanisms¹⁵ have been developed to ensure those diffuse

¹⁴ We have in mind here chiefly the indirect scientific and research benefits supplied through use of many if not most of the scientific reserves, ecological and sanctuary areas, specially protected areas and wildlife sanctuaries.

¹⁵ Examples of the mechanisms we have in mind are the scientific research area vouchers or the “habitat banking” schemes that were discussed in chapter 4.

benefits are adequately reflected in market prices. Experience gained with regulating privately owned areas predominantly supplying direct conservation benefits could then be applied to the more difficult cases (where the major benefits are indirect and diffuse) at a later date.

Pricing is another area where the long-term strategy ought to constrain short-term policies. In particular, where the government continues to provide services in competition with private entities, the government ought not to be allowed to subsidise its operations using taxpayer funds or funds earned from other, non-competitive, activities.

6. NET CONSERVATION VALUE TRADES

A “net conservation value trade” is an exchange of resources that results in a *net* gain in conservation outcomes, while at the same time releasing resources for other uses. People who wish to use resources for conservation purposes are made better off, as are those who would like to use resources to satisfy other desires. Forgoing the opportunity to make net conservation value trades is tantamount to wasting resources.

We have already encountered examples of net conservation trades in earlier chapters. In particular, many uses of areas managed by DOC do not involve the “consumption” or “enjoyment” of many of the conservation outputs provided by those areas.

For example, ski facilities are located in areas managed by DOC primarily because those areas contain the highest mountains in New Zealand. The people using the ski facilities might be only marginally interested in the habitats in the surrounding area – for example, many of them could be almost as happy skiing in the same mountains if they were part of a sustainably managed forestry operation or even a plantation of exotic pines.

People who are interested in conservation outputs might find the presence of skiing facilities in conservation areas in and of itself “damaging” of what they value about those areas. The revenue earned by allowing skiers to use the areas, however, provides significant funds to assist DOC in its conservation activities. The additional conservation activities funded from the fees paid by skiers can more than compensate for any loss in conservation output. Allowing skiers to construct and use facilities in the conservation areas therefore ends up producing a *net* increase in conservation output, even though the *direct* effect on conservation is negative.

Similarly thrill-seeking recreational use of conservation areas is likely to have negative *direct* effects on conservation outputs. Offsetting positive effects from the money income it generates can, however, result in a positive *net* conservation benefit.

A more subtle example may involve setting aside areas for recreational vehicles, or hunting or fishing. While the areas used by these activities could in principle also be used for conservation, their value as conservation properties may be limited because the habitats have already been extensively modified. Allowing activities that are more likely to reduce environmental outputs to occur in areas less valuable for conservation purposes relieves

pressure on the main conservation areas, and thus allows a greater amount of conservation output than might otherwise be possible.

NET CONSERVATION VALUE TRADES IN A MARKET SITUATION

The above examples have all involved trade-offs involving the use of areas managed by DOC. In principle, however, the opportunity for net conservation value trades could arise even if the Department of Conservation did not exist and all conservation activity was purely private.

When a parcel of land is allocated to a particular purpose or form of land title, not all uses of resources are examined. For example, land used for farming or forestry might possess valuable conservation assets, while land allocated to conservation might have a higher social value in some alternative use. In addition, circumstances change, so that land allocated for one purpose may become more suitable for an alternative use at a later date.

As we noted in chapter 2, an advantage of freehold title is that land can be used for many purposes, none of which has to be specified in advance. In fact, freehold title allows land to be used for any purpose *except* certain proscribed uses that would interfere with the rights of others. By contrast, leases restrict land use to activities specified in the lease agreement.

Freehold title gives the owner an incentive to search for new uses that can increase the market value of an asset. By contrast, information about potential new uses of land that are not covered in a lease agreement may reduce the value of a lease authorising current uses. If so, a leaseholder would have an incentive to hide any knowledge gained about such alternative prospects. Leases therefore have a tendency to “freeze” patterns of land use rather than allow them to adapt to new market opportunities.

A potential problem with freehold title is that it may limit activities that are not coextensive with the primary use of the land. This can explain, for example, the rule of eminent domain¹ or mineral exploration and mining

¹ A utility needs land in long narrow strips to construct and maintain wires, pipelines, rail lines, roads and so on, while agricultural, residential and industrial use is more suited to rectangular or square parcels of land. The easements required by utilities also need to form long, relatively straight lines. A utility therefore wants to purchase only the right to use a small strip of each property. Further, each land owner is in a strong position to exploit the utility by denying access to a strip representing a continuation of other strips on neighbouring properties. The government therefore has instituted laws allowing land to be compulsorily resumed for constructing utility infrastructure at a price equal to its value in its previous best use.

rights that do not have the same geographical boundaries as rights to surface resources.²

A further problem is that freehold title to all land of high conservation value would not necessarily provide adequate incentives to seek out a socially appropriate level of land conservation. As explained in chapter 2, a major problem is that property rights to many environmental outputs have not been defined. Since these outputs then have no market price, they are devalued by entrepreneurs. Furthermore, even if all environmental outputs were priced, a portion of conservation benefits are “joint” – one individual’s expenditure or effort to conserve the environment provides gains for all people who have a desire for increased conservation. Consequently, if all conservation land were freehold, and all outputs were priced, individuals would still have an incentive to rely on others to express their market “votes” for joint and indirect services provided by conservation activity, and the true value of conservation may not be revealed in land market transactions.

On the other hand, this does not “prove” that alternative arrangements, such as government monopoly provision of conservation financed through compulsory taxes, would necessarily be better. As we noted in the previous chapter, mechanisms already exist to ensure more of the benefits provided by conservation services are reflected in market prices. Furthermore, there are a number of ways of introducing new market mechanisms, or more decentralised government interventions (such as the voucher scheme for funding conservation activity of value to scientific research), that could enable decentralised markets to perform tolerably well in providing all types of conservation outputs. Certainly, it is not obvious that inefficient centralised resource allocation mechanisms could do better. Thus, we argued that the long-term goal should be to maximise the role of markets and decentralised legal processes in delivering conservation services and regulating resource use. Nevertheless, central government will retain a significant role in providing conservation outputs in the short to medium

² Mineral deposits may not lie entirely in one property or another. A company wishing to prospect for minerals might not wish to purchase an entire property only to gain access to a small part of it. Furthermore, land owners with the right and opportunity to prevent mineral prospecting or mining can be in a strong position to extract payments from the mining company. Most states in Australia allow land owners to be compensated for damage to the value of existing land uses by mineral prospecting or mining, but do not allow the owner to extract payments representing the value of the mineral body. Mineral rights are instead usually allocated on a queuing basis for prospecting, with a requirement to undertake development work for a mining licence.

term, so we also need to consider how centralised resource allocation mechanisms might be made less inefficient.

BARTERING WITHIN A POLITICAL RESOURCE ALLOCATION CONTEXT

Political markets are currently the main way people attempt to obtain the conservation outputs they desire. However, the majority voting rules followed in political decision-making in countries like New Zealand encourage a “winner takes all” attitude. So long as a group has enough members to form a majority it can get what it wants. There is little or no reason to take account of the wishes of a minority. Productive activities are, however, usually characterised by diminishing returns. As output of a particular good or service increases, the costs of obtaining *additional* output of that good or service – the values of the alternative options forgone – also increase. The result is that a “winner takes all” outcome can be very expensive. Allowing even a small increase in a use of resources that is desired by a minority could result in a relatively large gain in output of their desired service. In addition, the cost in terms of the lost outputs favoured by the majority can be small, since the marginal productivity of the resources in that use is so low.

While there could be large social gains from readjusting resource use to accord more with the wishes of a minority, the majority has little incentive to make the adjustment so long as they remain the majority. There is, therefore, a need to design new mechanisms that can achieve net conservation trading benefits. The idea behind net conservation trades is to encourage an environmentalist majority to allow productive usage rights in the conservation estate by providing a *substitute* environmental output that is currently not so well provided – and therefore comes at a high marginal cost. The huge surplus generated by the usage rights in the existing conservation areas would provide the resources to fund the environmental *substitute*.

Such trading occurs naturally in a decentralised market economy and can be replicated to some extent within a centralised system by providing incentives for managers to behave in a “more commercial” way. Resource allocation adjustments need not be restricted to a monetised market framework. As long as environmental stakeholders are able to clearly express their broad objectives in a measurable way (or even provide an ordinal ranking) – for example the area of habitat land available for a particular endangered species, or the stock of fish in a river catchment –

trades can be negotiated within publicly administered institutions and forums and without the need for expressing all values in dollar terms.

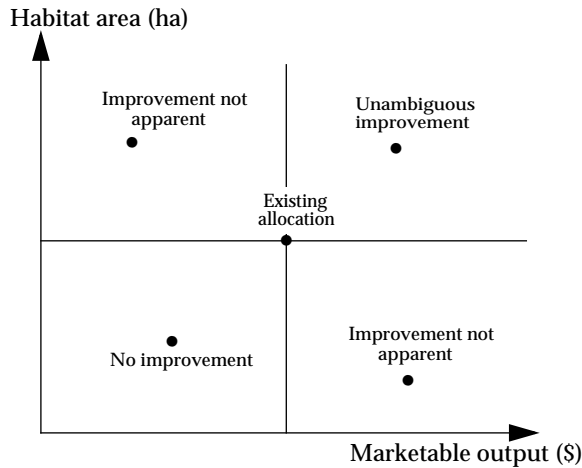


FIGURE 6.1: Conservation trade options

Figure 6.1 illustrates the potential outcomes from a negotiating process involving a monetarily valued productive process (for example, mining) and a non-monetary but measurable conservation value (for example, land reserved for endangered species). All outcomes in the upper right-hand quadrant are preferable to the existing outcome – they are win-win options. If the conservation values could be accurately measured using a common unit of exchange (for example, money), some of the options in the upper left and lower right quadrant *may* be an improvement in resource allocation. However, these are more problematic when there is a lack of exchange valuation information. Options in the lower left-hand quadrant are rejected outright.

Mechanisms for conservation trading would employ something akin to a bartering process – where interested parties pay for the use of conservation assets with actions, or alternative land areas that have higher conservation value. Participants in the trade would seek to improve existing resource allocations through negotiation and the exchange of particular conservation services, land titles and usage rights.

Such negotiation processes can overcome some of the weaknesses of majority voting rules and can produce efficiency enhancing trade-offs. In particular, where single purpose use of conservation areas is very expensive as a result of the value of the alternative uses that are lost, mechanisms need to be found that will allow the alternative uses to proceed while

simultaneously delivering a net increase in conservation output. However, the transaction costs of arranging such trades can be very high. Consequently, it can be difficult to exploit the gains from trade. To reduce the transaction costs of conservation trading, careful attention needs to be paid to constructing standardised processes and procedures and a broad consistent framework that gives clear messages to landholders, land users, potential investors and environmental interest groups.

DEVELOPING A FRAMEWORK FOR NET CONSERVATION TRADES

A number of principles should be observed in developing a framework for net conservation trades. These include:³

- Developing consistent and agreed upon indices for assessing the value of the conservation outputs produced on land managed by DOC, for ranking conservation expenditures and for evaluating the conservation benefit of asset trades.
- Establishing a conservation budget for DOC that reflects community valuations over and above any values reflected in user fees and is transparent and open to public scrutiny.
- Allowing DOC to buy and sell conservation assets and resource usage rights (including the right to sell usage rights within some areas of the New Zealand conservation estate and the right to purchase conservation covenants and new reserves on private land).
- Requiring DOC to maximise the conservation value of its portfolio of assets as a whole through net conservation trades.

Establishing clear principles such as these within the legislation and regulations governing the Department of Conservation would help change incentives within the Department and encourage greater flexibility and accountability in DOC activities.

In evaluating conservation areas it also needs to be recognised that at least some of New Zealand's biodiversity probably benefits from moderately disturbed ecosystems. Some species and communities are adapted to exploiting the niches that arise following disturbances. As a result, exclusive reliance on "lock it up" management practices may actually be detrimental

³ These principles are based on ten principles for a market based approach to conservation policy that were developed by Chisholm and Moran (1993).

to overall biodiversity. A small amount of multiple use of some areas might actually cost very little in lost conservation outputs.

In correspondence with us, Brendan Moyle has also suggested that:

if offsets are going to be used, the use of “brinkmanship” tactics is going to have to be discouraged ... [by] a framework or set of guidelines.

He cited a case involving C.D. Boyd, the New Plymouth District Council and DOC:

The District Council successfully took out an injunction on Boyd’s attempt to clear native bush from his land. Boyd offered some offsets – including adding some of his land to adjacent DOC land. This was not considered acceptable by the other parties. Eventually Boyd got the injunction lifted (1996), went ahead with the clearance and no offset was made.

MULTIPLE LAND USE, SEQUENTIAL LAND USE AND OFFSETS

Net conservation trading would foster a range of approaches to conservation and productive land use other than the “winner takes all” solutions. These include:

- Multiple land use where agricultural, forestry and mining practices can be adjusted to maintain or enhance conservation values *in situ*.
- Sequential land use, where productive land activities with a limited life span (for example, a gold mine) restore the conservation value of the land after the activity is completed.
- Offsets, where a productive activity in one location is used to finance a conservation activity or purchase conservation rights elsewhere.

Multiple land use

It is often thought that land use of one sort necessarily precludes use of the same land for any other purpose. Even within the environmental arena, however, a conservation area can be used simultaneously for scientific research, light recreation and tourism use and to satisfy the demand from the public for species or habitat preservation. Similarly, farms can simultaneously provide conservation services with little or no loss – and perhaps a gain – in their agricultural productivity. For example, farmers could retain native vegetation in riparian margins, stock shelters or windbreaks, or take measures to conserve soil and water resources. Plantation forests can simultaneously provide conservation and recreation

services at little cost by retaining patches of native vegetation along stream margins and access roads.

Conservation areas can also be used to provide services – such as hunting, fishing, traditional harvesting of plants and animals, mining and many more intensive recreational uses – that compromise the provision of conservation services to a greater extent. Even in these cases, however, the additional uses can result in a gain in net conservation values.

Leaver (1997) argues that multiple land use is already occurring in most conservation areas in Australia. Similar management patterns are also found in conservation estates globally. Denying this reality may compromise the conservation outputs that could otherwise be achieved:

Many advocates of the “sacrosanct” approach to park management object to the application of ecologically sustainable development (ESD) principles in national parks on the grounds that national parks are for conservation and not development. This approach denies reality. National parks are exposed to a wide range of development activity that would benefit from the application of ESD principles. I can think of many examples where tourism developments, the provision of visitor services and fire management practices would have been far less harmful to the biodiversity and biophysical values of a national park if ESD principles had been applied rigorously to the development.

Leaver argues that protected areas would produce outcomes of greater social value if they were categorised and managed according to the recommendations of the International Union for the Conservation of Nature (IUCN):

The IUCN developed the categories [of protected areas] on the basis of a mix of primary management objectives as follows:

- strict protection (Ia Strict Nature Reserve and Ib Wilderness Area)
- ecosystem conservation and recreation (II National Park)
- conservation of natural features (III National Monument)
- conservation through active management (IV Habitat/Species Management Area)
- landscape/seascape conservation and recreation (V Protected Landscape/Seascape)
- sustainable use of natural ecosystems (VI Managed Resource Protected Area).

The IUCN system recognises the importance of a full range of protected areas, from those that protect the world’s great natural areas to those that contain modified landscapes of outstanding scenic and cultural importance. This range is encapsulated in the six categories, which equally important, represent a gradation of human intervention. The IUCN represents a fundamental change in the way

land classification and management is perceived and implemented. Protected areas are no longer regarded as islands in a sea of development. The IUCN promotes the idea that protected areas should form an important part of a country's strategy for sustainable management and wise use of resources. The system is non-hierarchical. National parks and wilderness areas are no longer presented as the "crown jewels" and the other classifications of lesser status and protection. Using the IUCN system, a country's most outstanding natural area could be allocated within a multiple use classification which prescribes biodiversity conservation as a primary management objective ... IUCN classifications I to IV are seen by some as being the only classifications available for "real" nature conservation. This is a distortion of the IUCN system and weakens the value of that system in providing a sound basis for protected land classifications.

Whether or not a protected area should be managed *solely* for conservation outputs depends not only on the conservation resources available on that land. It depends also on the availability of *other* resources that could be used for *other* purposes, the value of those alternative possible uses, and the ways in which taking advantage of those other opportunities might (in the absence of compensating payments) compromise the achievement of conservation outcomes.

Sequential land use

In sequential land use, the same area of land is used first for one purpose and then later for a different purpose. The later use might be compromised by the fact that the earlier use has occurred. For example, earlier use could reduce native biodiversity. Even so, the earlier use could leave enough native plants and animals that the land is still valuable for conservation purposes. National Parks around the world contain extensive areas of "regrowth forest". In fact, even in countries such as New Zealand and Australia, so-called wilderness areas have been extensively modified by previous use by indigenous people. In practice, therefore, almost all land used for conservation purposes is a form of sequential land use.

Knowledge, or a legal requirement, that the land has to remain suitable for an alternative purpose also can reduce the benefits obtained from the first form of land use. For example, modern mining licences require that the land be "rehabilitated" after the minerals have been extracted and may also impose constraints on road building, the method of mining, treatment of waste water, control of dust and noise, the control of tailings dams and so on. These requirements could affect how much material is recovered from the deposit, or the costs of mining. Nevertheless, the gains in subsequent

conservation output could more than compensate for the loss in net output from the mining activity.

Fifty-six years of sand mining on the East Coast of Australia provides a good illustration of the potential benefits of sequential land use. Thirty out of 109 former sand-mining locations are now included in National Park and Nature reserves (Allen, Brooks and Jesson, 1990). The experience with rehabilitation of one of these sites is discussed in the case study on Myall Lakes, New South Wales, later in this chapter.

Offsets

Some productive activities will prejudice the long-term conservation value of a site, even if clear guidelines are established for multiple use and even if rehabilitation is carried out. However, it may be possible to negotiate trades that improve the total ecological or biodiversity value of the conservation estate, but still allow a productive activity to reduce the conservation value of a particular locality. Two types of offsets could be envisaged:

- *Land Offsets*: Using funds raised from granting usage rights in the conservation estate to finance offsetting purchases of high conservation value land; and
- *Management Offsets*: Using funds raised from usage rights to fund improved management practices elsewhere in the conservation estate.

Under *land offsets*, fees and other income obtained by allowing alternative uses can be used to extend the area of conserved regions to include new habitats of high conservation value. Some types of natural environments are not well represented in the current conservation areas. There may be private properties with remnants of these habitats that could be suitable for restoration. Income from allowing additional commercial activity in the existing conservation areas could be used to purchase and rehabilitate such private properties to produce a net gain in valued conservation outputs.

Similarly, the island restoration efforts of DOC (discussed in chapter 2) have shown that offshore islands out of the swimming range of introduced mammals are particularly well suited to supplying high quality conservation services in New Zealand. Some suitable islands might also be privately owned at present and additional funding could allow these areas to be purchased and rehabilitated.

Under *management offsets*, additional funds would be used to improve the management of existing conservation areas. For example, additional funds could allow a more extensive pest and weed control program to be instituted. Alternatively, selected parts of some conservation areas could be fenced off

with an electric fence, and feral animals eradicated from within them. This would create a “mainland island”, which could be far more successful at preserving rare and endangered birds than areas such as Mapara where ferals are only partially controlled through baiting and other strategies and reinfestation continually occurs. Finally, preservation of some endangered species might most effectively be carried out *ex situ* in enclosed and closely monitored environments (such as zoos). These activities might also be much more expensive than traditional approaches to conservation, yet yield much higher value conservation output.

The Maruia Society has advocated offset mechanisms through its “net conservation benefit approach” (Salmon, 1993). Guy Salmon of the Society argues that New Zealand’s conservation estate consists principally of lands that early settlers judged unsuitable for agriculture, whereas the rarest habitats are in fertile lowland soils or in coastal areas. He suggests that offsets that enable key habitats on private land to be restored would help achieve the national goal of a representative system of habitat areas.

The *Conservation Act* has no provisions for offsets. However, the *Crown Minerals Act* does allow for offsets or net benefit transactions for mining activities in environmentally sensitive areas. Under the Act, Macraes Mining applied for a gold mining licence in a wildlife reserve and was given the right to mine 542 ha of land in exchange for \$NZ1 million to fund DOC land purchases and other conservation expenses. Salmon believes the trade was widely perceived not to have provided net conservation benefits because:

- the land to be purchased was already effectively protected in private ownership;
- the external windfall gain for DOC was accompanied by an untimely cut in the government’s own budget allocation; and
- the process was not publicly transparent.

Offset mechanisms have also been used extensively in the United States for wetland developments. Under these wetland mitigation schemes, developers are asked to pay the cost of reclaiming wetlands that have ecological value at least equivalent to that being lost. There have, however, been doubts about the effectiveness of these schemes. A 1985 study suggested that only 9 out of 32 projects studied were “successful”. Failures may have resulted from lack of scientific understanding on how to achieve restoration.⁴

⁴ This program was also discussed in chapter 4.

These possible failures, however, suggest that offset mechanisms need to be developed in a broader scientific and budgetary framework where there is a clearer recognition of goals, methodologies and budgetary consequences. Implementing offset mechanisms in the absence of market prices reflective of the true value of different habitats requires a system of ranking conservation expenditures and placing “ecological value” on land units inside and outside the national conservation estate. The assumptions behind the valuation system would need to be transparent and the methodologies employed would need to be objectively verifiable. As discussed in previous chapters, a bureaucratic procedure of assigning “shadow prices” is obviously inferior to a genuine market mechanism. But it is preferable to treating all habitats, no matter how degraded, as equally worthy of “preservation”, which appears to be the current belief among many environmentalists if not the practice of DOC.

Australia has been developing digital systems for classifying ecosystems and assessing the extent to which various ecosystems are already represented in the conservation estate (Thackway and Cresswell, 1995). “Biogeographical regionalisations” (or “bioregionalisations”) map the spatial distribution of various classifications of ecosystems (bioregions). These provide “a useful framework for focusing attention, summarising patterns, aggregating information and allocating resources and priorities in nature conservation” (Thackway and Cresswell, p 1).

Experience with these regionalisations demonstrates that most of the country’s ecosystems are not contained within Australia’s current system of conservation reserves. By contrast, some bioregions have almost 100% representation (for example, Tasmania’s South-West Coast). The rental or lease revenue from allowing small scale but high value productive activities, such as mining, within ecosystems with a high level of representation could finance the purchase of reserves, or conservation covenants on private land in under-represented ecosystems.

Bioregionalisations are mostly being used to justify an increase in *total* protected areas. However, more consideration needs to be given to utilising these tools for offset mechanisms that improve the *balance* of representation.

Within New Zealand, a program for systematically developing national bioregionalisations may prove useful as an interim measure to developing a more market-based approach to conservation. It would need to be made publicly accessible and integrated with land use decision-making.

DOC has programs for identifying habitat types, but to obtain a better measure of true “shadow values” a more uniform approach needs to be

developed using estimation techniques such as *environmental domains*. The National Parks and Reserves Authority initiated the Protected Natural Areas program in 1983. According to Upton (1997), this was:

[A] program of surveys which was supposed to generate a definitive picture of all indigenous habitat, both publicly and privately owned ... Fourteen years later, the program is barely a third complete. What should have taken five years of concentrated effort fell foul, first of departmental restructuring, then tight expenditure constraints. In the battle for funds, crises always win out over long-term investments. In some places, local government has come to the rescue – the Auckland Regional Council has done a superb job on Auckland's doorstep. But in other places the information base languishes.

Lack of information about the structure and distribution of different habitats in New Zealand hinders rational decision-making and encourages *ad hoc* offset arrangements such as those for Macraes Mining that may or may not increase the value of the conservation estate.

NET CONSERVATION TRADES AND MINING

Mineral exploration and mining within ecologically sensitive habitats and the conservation estate has been an area of intense conflict and controversy between environmental groups, mining companies and government. The recent resurgence of interest in gold mining in New Zealand, especially in the Coromandel area, epitomises this controversy.⁵ However, mineral exploration and mining is also one of the major examples of successful multiple and sequential land use involving conservation. The sector also has potential to finance a considerable number of conservation offsets. There are four reasons why mining and mineral exploration is amenable to net conservation trades:

- While local mining impacts can be substantial and visually unattractive, they are generally limited in area.
- Mining has a high value per unit of land area utilised.
- Mining activities are often of limited duration.
- Adjustments such as rehabilitation, or using underground rather than open cut methods, can improve conservation outcomes (albeit at a cost).

⁵ See, for example, the controversy over the tailing dam at Golden Cross Mine owned by Coeur Gold Ltd. This is documented from the viewpoint of an environmental group by the Coromandel Watchdog of Hauraki Inc. (<http://binbro1.bitz.co.nz/watchdog>, August 1997) and is also discussed as a case study later in this chapter.

Relative to many other land uses potentially competing with conservation – including agriculture, forestry, hunting, fishing, traditional harvesting of plants and animals and many more intensive recreational uses – mining, and in particular mineral exploration, can be carried out successfully with very little loss in conservation output.

As Lambert (1997b) points out roughly *one in a thousand* mineral exploration programs leads to a mine. Advances in exploration technology are offset by the fact that the deposits that are easiest to find have usually already been exploited. Even so, exploration activity in almost any area is not wasted, because the more that is known about geological processes, and the geological structures present under the land surface, the easier it is to find minerals elsewhere. Furthermore, even if the deposits found in an area are not sufficient to support a mining operation, changes in mining technology and commodity prices can make them valuable at a later time. Lambert suggests that so much of Australia has been explored for minerals at some time that virtually all land in conservation reserves, or likely to be considered for inclusion in such reserves, already has been subject to some degree of mineral exploration.

These days, much preliminary mineral exploration is conducted with aerial surveys, aerial measurements of the magnetic field density and satellite reconnaissance, with *no* impact on the environment. If the preliminary surveys show promise, soil and rock samples are collected by hand. As Lambert observes, “Even advanced exploration, which involves drilling and related activities, can now be undertaken with minimal, very local and largely temporary impact, for example by using portable drill rigs” transported by helicopter if necessary. He further suggests that:

Because of the costs and other constraints, the proportion of exploration programs conducted in reserves which proceed to the stage of drilling is likely to be considerably less than the BRS estimated overall national average of 1 in 10. A very much lower proportion of exploration programs would be expected to proceed to *extensive* drilling. [emphasis added].

Even mines do not have a large impact on the environment under modern environmental controls and rehabilitation requirements and technologies. Underground and the small open cuts typical of many gold, base metal and uranium mines normally affect less than 4 square km – including roads, plant, spoil dumps and accommodation. On the other hand, coal, bauxite, iron ore, phosphate and mineral sands commonly occur in extensive deposits at or near the surface. These commodities therefore are typically

mined using large-scale open pit operations which can occupy several tens of square kilometres before rehabilitation.

The New Zealand Minerals Industry Association estimates that less than 0.1% of the land area of New Zealand is currently being mined. The annual value of New Zealand mineral output (excluding oil and gas) is about \$900 million, or \$50,000 per ha of disturbed land. Mining can thus be a very significant source of income from a small area of land. Such income can be used to provide a *net* increase in conservation output by being spent on pest and weed eradication, purchase of new high value conservation land and so on.

The public attitude to mining is coloured by past experiences of pollution in mining areas, such as the “moonscape” appearance of the denuded hillsides around Queenstown, Tasmania. Modern mining is, however, conducted under strict environmental controls on water, air, dust and noise pollution and destruction of visual amenity. There are also strong requirements for site rehabilitation at the completion of the project, underwritten by a bond posted at the outset of the project. Before mining commences, the climatology, archaeology, soils, water quality, vegetation, wildlife, insects and fish in the area are studied. The environmental effects of mining are now much less than many other land uses, such as agriculture or forestry, that disturb far greater areas for longer periods of time.

Mining in conservation areas in New Zealand⁶

New Zealand has a diverse minerals geology with a number of small and structurally complex mineral deposits (Chapman, 1994). While New Zealand has an abundant mineral resource endowment, most prospective areas are not well explored, are inaccessible or are difficult to mine (Chapman, 1994). About 70% of the prospective area is within land administered by the Department of Conservation (Jardine and Scobie, 1988). Nevertheless, some regions of New Zealand have yielded considerable mineral wealth, particularly the West Coast of the South Island, Otago and the Coromandel area.

The juxtaposition of New Zealand’s minerals wealth with areas of ecological and conservation significance has generated considerable public debate and legislative initiatives to prohibit mining activity in conservation areas. However, banning mining without complete information is inimical to

⁶ For comparison, an appendix to this chapter discusses the situation with regard to mining in conservation areas in Australia.

both a rational allocation of productive resources and a rational system of conservation reserves and conservation management. This has been recognised in some government policy statements, inquiries and past legislation. For example, in 1988 the then cabinet agreed that:

... it is not possible to assess the relative merits of the (surface) conservation values and the commercial opportunity which may arise from sub surface minerals in advance of a complete prospect.⁷

Consistent with this, the 1991 *Crown Minerals Act* sets up a framework where access to sub surface minerals in public land can be approved by the Minister administering the land on a case by case basis. Such a case by case approach does not prejudice future uses if improved information on ecological or commercial values becomes available.

However, the government's attitude and approach to mining and conservation has become increasingly ambivalent. A DOC Fact Sheet (*DOC at a Glance* in Department of Conservation, 1996a) notes that, in relation to roughly one third the land area of New Zealand where the areas of highest mineral prospectivity are also likely to be concentrated:

since the *Crown Minerals Act* came into force in June 1991, the Minister of Conservation has approved access to conservation land for 2 prospecting applications, 11 explorations and 22 different types of mining including gold, coal and quartz.

In 1990, a *Protected Areas (Prohibition on Mining) Bill* was introduced in Parliament. This was followed by the *Coromandel Hauraki Gulf (Prohibition on Mining) Bill* in 1995. The new push towards permanent exclusion of mining from some conservation areas was reflected in the 1996 Coalition agreement. The agreement explicitly states as a key policy initiative "belief in the principle that mining should not occur on Conservation land".

Both bills were referred to the Parliamentary Planning and Development Committee, which released a set of recommendations and a commentary on the bill in 1996.⁸ The Committee agreed that there was a need for further research to establish whether some particular categories of conservation land are appropriately classified. It rejected some of the areas where bans were proposed and it proposed that low impact activities such as exploration and prospecting be allowed in other proposed areas. Nevertheless, the

⁷ Minutes of Ministerial Committee on Land Allocation: Coromandel Peninsula – Mining 11 October 1988 (POL (88) M 38/6).

⁸ Commentary on the *Protected Areas (Prohibition on Mining) Bill* as reported by the Planning and Development Committee, New Zealand Parliament, 1996.

Committee recommended that a number of categories of conservation land be closed to mining under a *Crown Minerals Amendment Bill* (No. 3).

The proposed *Crown Minerals Amendment Bill* has achieved some balance. In particular, it has recognised the value, and low impact, of exploration, geological research and underground mining. However, the Committee's commentary on the bill fails to provide a consistent and logical basis for assessing the ecological value of the area where mining is to be banned. It also provides no discussion of trading mechanisms which could effectively increase the value of the conservation estate. As it stands the proposed legislation has no provision for adjustments as new information becomes available. The members of the Committee state:

It is our view that there are circumstances where the ecological or recreational value of a particular area is so important that mining is incompatible with the purpose for which the land is held.

This may be true, but it is difficult if not impossible to assess the value of mining in the absence of mineral and geological exploration.⁹ It is also impossible to assess the "ecological or recreational value" of areas in the absence of prices reflecting the value people place on them. At a minimum, a framework for assessing "ecological representativeness" of the proposed proscribed areas is needed. However, the framework also has to allow for adjustments to the portfolio of conservation assets over time by providing incentives to encourage multiple and sequential use where that is likely to yield the greatest total benefit to the New Zealand community.

CASE STUDIES OF NET CONSERVATION TRADES

The case studies highlight some of the problems and potential benefits of allowing productive activities in conservation areas. Table 6.1 lists them and shows which ones illustrate multiple use, sequential use or offset mechanisms.

The key issue we wish to investigate is the nature of the trade-off between conservation outputs and allowing usage rights. In order to make a rational decision about the optimal use of resources in the absence of market prices that reflect "true" value, we need to know how much conservation output is likely to be sacrificed for any increase in productive activity. Most of the case

⁹ A referee mentioned that there appears to have been no economic analyses of the effects of the bill and, in particular, no assessment by Treasury or the Ministry of Commerce. There also does not appear to be any assessment by DOC of the value of the environmental outcomes that would be achieved by passage of the bill.

studies are mining related, although some forestry and water resource examples are also discussed.

TABLE 6.1: Classification of Case Studies of NCV Trades

<i>Case study</i>	<i>Multiple Sequential</i>		<i>Offsets</i>	<i>Comment</i>
	<i>use</i>	<i>use</i>		
Ngati Porou Forests Ltd			✓	Raises Treaty Issues
Buller rimu forests	✓		✓	What is “sustainable”?
Mineral exploration site visit	✓			Shows some problems
Innamincka, SA	✓			New reserve type
Karijini National Park, WA	✓		✓	Good cooperation
Christmas Island	✓		✓	Endemic species
Myall Lakes, NSW		✓		Good sequential example
Henty gold mine, Tasmania	✓	✓		Multiple <i>and</i> sequential
Golden Cross Mine, Waihi		✓	✓	Recent problems
Waiau and Waitaki rivers	✓	✓	✓	Multiple <i>or</i> sequential?

Ngati Porou and forestry

According to a study by Salmon (1993, chapter 5):

In the 1992 Budget, funding was announced for a major tree planting project on the East Coast. This aimed to advance both soil conservation and recreational development needs in an environmentally and economically damaged region ... The [Maruia] Society produced several policy papers ... to ensure that planting was focused on severely eroding land, and was very largely directed away from kanuka stands; while the Ngati Porou land owners were prepared to offer extensive areas of kanuka and native forest for protection.

The Maruia Society was proposing a net conservation value trade. Environmentalists should agree to some kanuka forest being chopped down and replaced by exotic trees in return for some of the funds being spent on planting exotic trees on former, eroding farm land, and for a guarantee that some:

thousands of hectares of tall kanuka forest on Ngati Porou land would have been set aside as reserves, in a region where there are currently no major reserves representative of the characteristic natural vegetation. The reserves would have been fenced, with goats and stock removed, so making possible for the first time the actual regeneration of indigenous species under the kanuka. (Salmon, 1993, p 22).

Presumably because they believed they were in the majority and did not have to compromise:

the other environmental groups rejected this approach: for them, not a single hectare of closed canopy kanuka should be felled under the scheme, regardless of the net conservation gain that could be obtained from a trade-off ... As a result of these groups' opposition, the joint venture between Tasman Forestry and Ngati Porou to plant the tribal lands collapsed early in 1993. Most environmental groups are signatories to the New Zealand Forests Accord, an agreement negotiated between environmental organisations and the forest industries, which Tasman Forestry had pledged to uphold.¹⁰ Some of the [environmental] groups used the power given to them in this way to veto the joint venture.

Salmon makes a case that the value of allowing a small increase in forestry for the Ngati Porou was quite high:

Ngati Porou see themselves as being in a desperate situation. They currently face a 60 percent unemployment rate in their East Coast townships. 160 of their homes face demolition orders on grounds of being unfit for human habitation. Their land is their main economic resource ... In a bid to satisfy environmental interests, Ngati Porou offered to set aside 15,000 ha of reserves of kanuka and native forest on their land. The income forgone by the tribe from not planting this land in commercial species would be significant by the time planted trees reached maturity. By way of comparison, the nearby 11,500 ha Mangatu forest currently employs over 100 people and is probably worth \$60 million.

On the other hand, the value for the environmentalists of retaining the *marginal* kanuka forest in dispute was quite low:

For many of the environmental groups, protection of the regenerating kanuka forest on that land was the over-riding issue. In fact, kanuka and manuka regenerate freely on reverting farmland on the East Coast and in many parts of New Zealand. It takes only 10–12 years for reverting pasture to become 3 metre high kanuka forest. There is more than 75,000 ha of it on the East Coast. It is particularly prevalent on Maori land.

The Press reported on 19 February 1996 that Ngati Porou Whanui Forests Ltd had formed a joint venture with the Hansol Forem Company Ltd, part of the Hansol Group in South Korea, to develop Ngati Porou lands between Tokomaru Bay and Hicks Bay on the East Coast of the North Island. The joint venture will “develop, manage and harvest ... a forestry estate of 10,000 hectares”. Development expenditure of “approximately \$80 million” is expected. Legal ownership of the land will remain with Ngati Porou “but forestry rights for one full crop rotation will be made available to the joint

¹⁰ This is a private arrangement whereby 90% of New Zealand's private forestry companies agreed to end felling of native forests.

venture". The joint venture will be managed by a management company representing both parties.

The Press reported that Ngati Porou leaders see the arrangement as providing employment and income to people "so poor that many cannot even afford to pay rates" and many of whom "are now into their third generation of unemployment". *The Press* also reported that:

The project has aroused heated exchanges with the conservation movement. The Royal Forest and Bird Protection Society says that some of the "scrub" that will be replaced with pine trees is actually kanuka forest. There is an extreme risk of restarting erosion. The scheme also uses a foreign company to circumvent the New Zealand Forests Accord under which local forest companies have agreed not to log native forests. Further, the government's East Coast forestry project subsidises the cutting of the kanuka.

Meanwhile, Ngati Porou has persisted with plans to improve environmental management. For example, the Ministry for the Environment announced that in December 1995 Ngati Porou had been granted \$229,500 (50% of total project cost) from the "Sustainable Management Funding Scheme" for a three year project which aimed to:

create a comprehensive inventory of the Ngati Porou environment, develop hapu environmental management plans addressing environmental management problems, risks and opportunities, and to establish iwi policies with regards to the sustainable management of Ngati Porou environmental resources. (See <http://www.mfe.govt.nz/smf/smffund6.htm#6044>, September 1997a).

Buller rimu forests

In a recent article in *The Independent*, Salmon (1997) discussed another net conservation value trade involving forestry. He was commenting on a halt to logging of native rimu forest by Timberlands West Coast following protests by a group that also issued a "Kawatiri Declaration". While applauding the halt to logging of the Buller forests, Salmon criticises the Kawatiri Declaration for proposing that "all remaining areas of native forest deserve full and immediate protection from logging". Salmon argues that implementation of the Declaration would have several consequences:

First, it means New Zealanders would no longer be able to have, in their own homes,¹¹ the native timbers of their own country. Second, it means the owners of native forest on private land would not be allowed to harvest or fell any area – presumably by a law expropriating their existing legal rights to sustainable use,

¹¹ Presumably people would obtain utility from native timbers in other buildings too.

as well as their Treaty rights.¹² Third, it means any collective benefit¹³ that might come to New Zealanders from wealth and employment creation in sustainable forest management, sawmilling, furniture-making and related industries based on native timber would be forgone. Fourth, it means the sizeable existing demand for timber that has harder, stronger and more decorative properties than radiata pine, and used for furniture-making, panelling, staircases, handcrafts and other specialist uses, would be met by expanding our imports of tropical hardwoods ... destructively logged. Finally, implementation of the Kawatiri Declaration would mean abrogation of the carefully-negotiated West-Coast Accord, a contract binding the Crown to set aside an agreed area of 120,000 ha of forest for the explicit purpose of producing native timber in perpetuity.

To this list, we would add adverse incentive effects. Private property owners would have a greatly reduced incentive to plant, or allow regeneration of, native trees for various purposes (such as controlling erosion) where harvesting for timber is a possible future use of the resulting forest. Furthermore, expropriation of native timber could be taken as a signal that other natural resources will also be similarly expropriated in the future – in which case land owners may decide to pre-empt the decision by immediately eradicating as many native species as possible from their properties.¹⁴

Salmon expands on the application of the sustainability principle in this case:

I and many other conservationists respectfully disagree ... that there is something inherently wrong with a low-impact, sustainable harvest of native trees, confined to very limited areas of forest¹⁵ ... I believe there is an unfortunate regression whenever green movement supporters abandon the sustainability principle in favour of some tribal instinct to arbitrarily declare one species or another to be a

¹² The RMA would constrain the existing rights of private landholders to sustainable use but not necessarily prevent clear-felling, while Treaty rights also would normally allow harvesting on a sustainable basis.

¹³ We would have preferred to emphasise the aggregate of individual benefits rather than referring to a mythical “collective benefit”.

¹⁴ In correspondence with us, Brendan Moyle commented that:

The passage of the *Native Forest Amendment Bill* 1993 was associated with [such] perverse incentive effects. Many private land owners cleared areas of native forests formerly under their protection in anticipation of the Bill. One of the effects of the Bill is to provide excellent legal protection for small areas of forest with little ecological value and little protection for larger areas ... the Bill in effect sets up a fixed cost barrier to harvests (a licence fee). As a result, small areas are not economic to harvest.

¹⁵ Requiring “sustainability” ought to be sufficient. If the logging is required *in addition* to be of lesser impact, or cover a more limited area, than a sustainable yield would require it has gone beyond sustainability.

sacred object¹⁶ – whether it be native beech trees, Kaimanawa horses, or the muttonbirds traditionally harvested by Maori ... if those principles [of sustainability and biodiversity conservation] are understood from an effects-based perspective, as they should be, neither of them requires a blanket ban on native timber production.

Salmon next discusses the potential for net conservation value trades involving offsets, or perhaps multiple use, of resources:

Landcare Research has measured ongoing losses of about 4% every decade in the biomass of South Island forests ... But that worrying decline is mainly being caused by inadequately controlled pests, notably the possum. Logging's contribution is infinitesimal.

Wildlife species are also dying out in New Zealand forests. The kaka has largely died out in the vast areas set aside for the species under the West Coast Accord. The threat to its survival is not logging, but the Conservation Department's failure to control stoats, wasps and possums.

Ironically, it is Timberlands that has pioneered stoat control in beech forests, using proceeds from logging to make its forests a better habitat for kaka than adjoining reserves managed by DOC.¹⁷

The area managed by Timberlands thus represents an example of the benefits that can be obtained from a *management offset*. Since Timberlands apparently retains older trees with holes suitable for use as kaka nesting sites, this may also be an example of *multiple use*.

¹⁶ No doubt Salmon would regard human life as "sacred" in the sense that substantial justification is required to sanction its sacrifice. Beyond that quibble, however, he runs the danger of criticising the motives of the people concerned – by referring to their "tribal instinct" – rather than talking about trade-offs between different things people value for *whatever reason*. This point was also discussed in the context of the Kaimanawa horses controversy in chapter 3. Salmon subsequently expresses a viewpoint more congruent with ours when he says:

In the tradition of religious tolerance in this country, McPherson is entitled to hold to her own particular beliefs. But when she advocates they should become public policy, and be imposed upon others, we need a more compelling rationale than strongly-held minority benefits [*sic* – presumably he meant beliefs].

¹⁷ Experts from DOC have disputed the claims that the kaka are better off on Timberlands land and that Timberlands "pioneered stoat control in beech forests". We are not in a position to adjudicate these competing claims.

An exploration project in a conservation area in New Zealand

A mining exploration project in a conservation area in New Zealand was visited as part of the field work for this report. The project involved drilling and related activities. The drill had been transported to a ridge top, and then taken out again, by helicopter. No new roads were constructed to support the exploration program. Pedestrian access to the drilling site from the road at the base of the hill was by means of pre-existing tracks, except for a small section (about 100 metres) near the drilling site. Extensive parts of the pre-existing tracks were previous water races for an old underground mine that had been in the area about 60 years ago. The old mine was apparently being restored by DOC as a tourist attraction at the time of our visit.

In fact, much of the surrounding area had been extensively altered in the past for agricultural activities as well as by significant mining activity undertaken at a time when little attention was paid to environmental matters. The river at the bottom of the hill retained relics from installations that had been used in previous mining activities.

The forest in the environs of the exploration site (much of the forest visible from the ridge top) was regrowth. The only birds we heard while walking around the area for several hours were fantails. There was also considerable evidence (in the form of carcasses on the roads) of extensive possum infestation of the forests in the region. Weeds and plants such as blackberries and exotic pines were much in evidence.

The mining company had cleared two patches of bush no greater than 10 metres by 10 metres – the drilling site and a location part way up the hill where a pump and diesel fuel had been located. The exploration permit required the company, on completion of the project, to bring in brush by helicopter to cover these clearings and the small additional track. The brush had to be cut from private property. Close to one area that had to be covered, DOC had felled some exotic pines. These trees, which were left to rot where they fell, damaged more bush than the two areas cleared by the company.

The mining company needed to obtain resource consents for the project. These specified strict environmental guidelines that the company had to comply with – in particular with regard to the quality of water discharges.

While the drilling program was in progress, mining company employees were threatened with assault by protesters.¹⁸ The company had to employ an

¹⁸ Protesters fire-bombed vehicles of another mining company operating in the Coromandel region.

on-site guard throughout the project – although this was less expensive than it might have been because the person concerned could also check the equipment to make sure it was functioning correctly.

The major conclusion from this example is that the impositions on the mining company have produced a considerable waste of resources. Apart from the quite appropriate requirements on water quality, the time and financial resources could have been invested in activities that had greater conservation value. The same funds could have been spent on pest or weed eradication, revegetation, land purchase elsewhere that would have been of greater conservation value and so on. Instead of such “win-win” trades, however, resources were simply wasted. The other major point arising from the example is that the real environmental costs of the drilling program in that particular area were negligible. An honest evaluation would have difficulty measuring them.

Innamincka, South Australia

Leaver (1997) presents a case study of the Innamincka area in South Australia between the Simpson Desert and Sturt’s Stony Desert. He first outlines some of the conservation outputs produced in the region:

Downstream of Innamincka, Cooper Creek flows into the Coongie Lakes. These lakes are a huge network of freshwater lakes and swamps, together with the adjacent Diamantina wetlands ... The huge complex of wetlands supports an amazing array of wildlife, particularly birds. The area is listed as a Wetland of International Significance (on the Ramsar Convention) and is vital habitat for migratory birds. Birdsville is not named as an act of perversity ...

Apart from these natural resources, the region also has significant cultural and historical interest:

The proximity of wetland related food and very high quality silcrete tool making resources has clearly supported Aboriginal occupation for aeons. The area is also rich in European history famous for the Burke and Wills misadventure and later as a key link in the pastoral history of the outback and the role of the Australian Inland Mission.

The region is an important pastoral area with Innamincka remaining as “one of the best of the pastoral properties in the Kidman chain of cattle stations”. It is also “sitting over unmeasured riches in oil, gas and coal” with the Gidgealpa and Moomba gas fields (the current source of gas supplies to Adelaide, Sydney and most of the rest of NSW) located about 100 km from Innamincka.

Recreational use of the area has also increased, producing “worsening problems such as vandalism, littering, sand dune erosion, damage to wetlands, wildlife destruction and damage to archaeological sites”. Finally, the area has suffered greatly from feral animals – particularly rabbits.

The mining companies Santos and Delhi Petroleum and the Kidmans pastoral company agreed to implement a management plan for the region that:

- allowed continued access to hydrocarbon resources;
- allowed for the continued operation of a major pastoral enterprise;
- provided a mechanism to manage visitor impact;
- protected the region’s wildlife and cultural assets; and
- arrested the processes causing severe damage – particularly the rabbit damage.

The 1.4 million hectare Innamincka Regional Reserve was proclaimed as the first Regional Reserve in 1988 and its first review was set for 1997. An agreement was signed with the mining companies and a pastoral lease was entered into with Kidmans. About 30% of the Cooper Basin production of hydrocarbons by Santos comes from within the Innamincka Regional Reserve, although all these wells pre-date the formation of the Reserve. However, new petroleum exploration licences have been issued since the Reserve was formed.

As noted in the appendix, the then newly introduced Regional Reserve classification enabled conservation outputs to be maintained and enhanced without the need to buy out existing leaseholders. Visitor use is now also directed within a management plan for the area. A Control Zone was designated within the Innamincka Reserve where management actions would give priority to conservation. The Control Zone was further divided into 12 separate vegetation and terrain types, which account for much of the natural diversity to be found in the Reserve. The management plan has a separate schedule outlining agreed and more stringent conditions covering exploration and production within the Control Zone.

The Kidman pastoral company has found that the Reserve has resulted in a higher administrative burden than a pastoral lease. The company has provided representatives for consultative and management committees. It also has to monitor and report on management activities on a more extensive and frequent basis. The pastoral company has also found that there are more visitors to the area resulting in increased expenditure on road maintenance, and increased vandalism and theft, while all gates had to be replaced by

stock grids. On the other hand, it is not clear that the Regional Reserve status *caused* the increase in visitor numbers – it may have occurred anyway.

Karijini National Park, Western Australia

Stoddart and Batini (1997) examine cooperation between Hammersley Iron and the Western Australian Department of Conservation and Land Management (CALM) to manage land in and around the Karijini National Park in the Hammersley Ranges in the North West of Western Australia. Hammersley Iron operates the open cut Marandoo mine and associated rail line, which bisect the Park, undertakes mineral exploration in the Park, and manages three pastoral stations abutting the Park.

Pastoralism began in the area in the middle of the nineteenth century and shortly thereafter overstocking degraded the land. Apparently most pastoralists in the area are now involved in active restoration efforts, if not individually then through the Land Conservation District Committee program. The Park includes a former pastoral lease within its boundaries.

Western Australia has a process for dealing with exploration and mining leases in National Parks. It is based on a memorandum of understanding between several government departments. It involves an environmental assessment followed by the consent of both Houses of the Western Australian Parliament.

The National Park was initially based on preserving the spectacular gorges in the ranges. It now covers over 606,000 ha (6,060 square km).

Hammersley Iron and CALM signed a memorandum of understanding (MOU) in 1995. The MOU aimed to:

- add to the area being managed for conservation output at no cost to CALM;
- add to the knowledge base on fire, ferals, vegetation and so on to better inform management decisions;
- demonstrate that land can be managed to simultaneously produce both marketable and conservation outputs; and
- provide conservation outputs valued by the Hammersley Iron workers, their families and others in the region.

The MOU is based on a genuine trade between the two parties. They both expect to benefit from it. Neither party is prevented from withdrawing at any time, and there are no penalties for breach of any provisions in the MOU.

Within Park boundaries, the primary focus of management is to produce conservation outputs, although recreational, cultural, mining and pastoral

outputs are also produced in some areas. Pastoral output is predominant on the adjacent properties, although conservation is raised in importance close to the Park boundaries. Throughout the entire area (more than 1 million ha), management recognises that the subordinate as well as the dominant goals should be evaluated with decisions taken to increase *total* output value where possible.

The central focus of management thus far has been control of cross-border effects related to fire, feral animals, weeds and animal movements, the distribution of watering points and improvement and relocation of fences. There have also been some cooperative and complementary research programs. Hammersley has also funded outside research on agricultural, environmental and mining issues relevant to the region. Once new pastoral management techniques have been refined, the partners intend to demonstrate them to local pastoralists. Local workers have also been trained in prescribed burning and fire suppression techniques and there are plans to train them in Park management. A walking track has also been constructed on Mt. Bruce in the Park and takes hikers to a point overlooking the Marandoo mine where there is signage explaining the relationship between the Park and the mine.

Christmas Island

McKay (1997) examines phosphate mining on Christmas Island. Mining for phosphate on Christmas Island began in 1887 and provided a steady supply of phosphate to Australian and New Zealand farmers for a century.

After ceasing in late 1987, mining resumed in late 1990 following a takeover of the firm by employees and the identification of new markets in South East Asia. The renewed operations are based on reclamation of stockpiled phosphate together with some mining of *in situ* ore. The new operations are being conducted under a regime that includes a schedule of relinquishment milestones and requirements to re-establish rainforest on some areas rather than leave them to regenerate naturally. These requirements are part of the mining lease. McKay observes:

The schedule includes 20 locations/fields in four areas on the Island, where on present information, the development and environment priorities [of the Commonwealth of Australia] can be met without impairing [the] commercial position [of] Phosphate Resources Ltd (PRL). A schedule of this type, however, cannot be cast in stone and is to be reviewed every two years. It may be varied as agreed between the Commonwealth and PRL.

The Christmas Island National Park was declared in 1980, extended in 1986 and 1989, and is administered by Parks Australia. The major conservation concern on the Island is the survival of Abbott's booby, since Christmas Island is the sole remaining breeding place for the bird. McKay comments:

Following consultations with Parks Australia and PRL, BRS has scheduled relinquishment of areas in the central part of the Island as a matter of priority. This is to occur progressively over the next few years and will permit reforestation of old mining fields and rehabilitation of damaged habitat adjacent to Abbott's booby nesting sites.

The Park also protects many endemic plants and animals including many species of land crabs. McKay comments that "tourist information promotes the Island's tropical rainforest, large suite of endemic plants and animals, coral reefs and spectacular landscapes".

PRL is supporting Parks Australia's rainforest rehabilitation program on the Island through a levy on phosphate production. At the same time, resources from the continuing mining operations, together with financial support from Australian taxpayers, are being channelled into developing tourism and related industries. These have included development of small scale wilderness lodges in previously mined areas, a light rail public transport system linking urban and tourist areas and the airport along the alignment of the now demolished mine railway, and further residential and urban tourism development.

Phosphate mining on Christmas Island continues to play a major role in the Island's economy. It is being used to move the Island toward a new tourism industry while simultaneously enhancing conservation outputs.

Myall Lakes, NSW

For 56 years, from 1934 to 1990, the 1700 km of Australia's coastline between Port Kembla in New South Wales and Gladstone in Queensland was mined for mineral sands. A recent survey revealed that of the 109 locations where 215 separate operations took place an extensive range of land uses are now found on the former sand mining sites:

Thirty of the sites are now included in eight National Parks and seven Nature Reserves and 61 sites are used for recreation purposes. The range of land uses now in place from most to least common include recreation, urban, Vacant Crown Land, conservation, agriculture and tourism, infrastructure and extraction, Aboriginal Land Grants and forestry, defence, and water supply. (Allen, Brooks, and Jesson, 1990, p 159).

The success of sequential land use in these areas indicates that the community can gain substantial benefit from using resources under controls and regulations sufficiently stringent to ensure future uses are not compromised.

Sand mining has operated since the turn of the century, with gold being the first mineral extracted. In the early years, mining was confined to the rich black seams on the beaches. Little environmental rehabilitation was required. The sand was simply scraped up off the beach and sorted for the gold. The remaining black sand, which contained heavy minerals, was then discarded and left on the beach.

New mining technology, and the increased demand for welding rods in World War II and the Korean War, made the extraction of rutile (used to coat welding rods) economic. Successive improvements in mining technology enabled the same areas to be mined several times. Even though mining spread to the frontal dunes and the immediate areas behind, environmental rehabilitation remained non-existent or rudimentary at best.

More efficient mining techniques that were developed in the 1960s resulted in larger mining plants and allowed miners to move from the frontal dune areas to adjacent woodland and scrub. These developments occurred as community concern about conservation increased. Rehabilitation requirements were made more stringent, although the emphasis was on stabilising land rather than ecosystem regeneration:

The New South Wales Soil Conservation Service was instrumental in developing these early practices and some of the more progressive companies were leading the way in establishing plant nurseries to raise native plants for regeneration of frontal mine dunes. (Lewis, 1997, p 28).

Conflict between sand mining and recreation was almost inevitable due to the location of the mineral sand deposits along the east coast of Australia. One third of the population lives along the coastal area from Wollongong to Rockhampton, which also contains the country's most popular tourist areas:

Certain geological processes have placed the deposits with the world's highest grades of rutile and zircon in the coastal sand masses along that part of Australia's coastline that now has the densest population. (Allen, Brooks, and Jesson, 1990, p 160).

The resulting conflict between mining and conservation occurred before a suitable regulatory framework had been developed to control mining and ensure mined areas were rehabilitated. The result is that substantial mineral deposits are now locked away in conservation areas.

The Myall Lakes area, located in central coastal New South Wales, is an excellent example of sequential land use and the rehabilitation of land previously used for sand mining. The Myall Lakes National Park now encompasses previously mined areas and provides a classic example of sequential land use. Mineral Deposits Ltd (now BHP Titanium Minerals Pty Ltd) operated the area as a major mineral sand mine.

Substantial deposits of rutile, zircon and monazite were found in the high sand dunes in 1961. However, mining of the Myall Lakes area did not occur for some time.

The proposed mining activity was the first in Australia to be preceded by a substantial environmental impact statement (EIS), which was prepared between 1972 and 1973. The EIS listed several areas of potential impacts of mining on landscape values, flora and fauna. In preparing the EIS, researchers found that frequent fires, fishermen and campers had inflicted significant damage on the vegetation and wildlife in the northern dune areas, making them relatively more suitable for mining. The southern dune area was found to be in a much better condition with denser and more diverse vegetation.

In 1973, there was an extensive Public Inquiry into the proposed mine. Mining operations were to be conducted under strict conditions, and when completed a substantial rehabilitation program was to be undertaken. For environmental reasons, the company also was not permitted to mine half of the deposits it had leases over.

Mining commenced, at Bridge Hill Ridge, in 1974 and the first rehabilitation of the area was monitored in 1977. Despite extensive planning and engineering knowledge, the Bridge Hill Ridge mine presented unique problems to the company. This was mainly due to the scale of the proposed rehabilitation program. In particular, it proved difficult to reconstruct the 100 m high sand dunes. The mined sand continually slipped back into the dredge pools. The company developed a new technique to remove water from the newly constructed dune so that it would remain stable. Apart from this new technique for high dune restoration, most of the previously used rehabilitation processes and techniques worked with at most minor modifications:

The object of the program was to recreate the dry sclerophyll forest on the mined dune, similar to that which existed before mining. Most of the techniques that had been developed at other mining operations could be confidently transferred to this new situation, for example methods of seed collection and the raising and planting of new nursery stock for planting out. (Lewis, 1997, p 30).

The company also had to develop a new process to handle topsoil. Previously, topsoil had been stored in a big pile next to the dune. The large scale of the Myall Lakes project required the soil to be stored for a longer time, causing it to lose nutrients:

The solution was to pick up soil ahead of the operation by scraper-loader, carry the soil around the operation and spread it on the newly formed tailings. This technique ensured that the valuable attributes of the topsoil – organic matter, plant nutrients, micro-organisms, seeds – suffered minimal deterioration. This topsoil handling technique has since become accepted practice at other mine sites in Australia. (Lewis, 1997, p 30).

Other problems were encountered, and had to be overcome, as work proceeded. For example, the wind damaged new young growth on the former mine areas:

Temporary plastic mesh was erected on the newly planted areas to protect young growth in the first one to two years of rehabilitation.

Other problems were the spread of weed species in the early years of rehabilitation. As the soil aged, however, nutrients declined to pre-mining levels and most of the weeds began to die out. Some weeds, including bitou bush and lantana, thrived in the sandy soil and could only be controlled by hand pulling or spraying until the native plants became more established.

The mined areas began to be included in the Myall Lakes National Park in 1980. Mining stopped in 1983, but rehabilitation work continued. As Lewis (1997, p 28) remarks, the Myall Lakes mining operation was noteworthy for a number of reasons:

- It was a major operation involving the movement of over 12 million tonnes of mineral sand per year.
- It was the first major mining project in Australia for which an environmental impact study was prepared.
- The proposal attracted widespread opposition at the time, with predictions of disaster from some quarters.
- The mined and rehabilitated land is now part of the Myall Lakes National Park.

The company that operated the mine, Mineral Deposits Ltd, received high commendations from the New South Wales government in the inaugural Awards for Environmental Excellence in the New South Wales Mining Industry in 1990 for rehabilitation of mine sites over a number of years.

Following rehabilitation, the area was extensively monitored to assess the progress of the rehabilitation, to determine if other rehabilitation work was

required and to assist in determining when the mined areas were sufficiently developed for the mining leases to be relinquished. The monitoring is conducted along transects that cover 2% of the total mined area. Monitoring commenced in 1977, after mining of the first section had been completed. In 1993, the *oldest* section of rehabilitation was considered to be satisfactory and the company was released from its commitment to rehabilitate that section of land. Some areas are, however, still being monitored to this day:

The rehabilitation areas vary in age from 21 to 13 years. Data from these transects have revealed that the four main tree species are at or greater than pre-mining densities and are developing satisfactorily. The shrub and ground cover species have developed as expected in response to the open nature of vegetation, with a preponderance of pioneering species in the early years. The understorey layer shows a maturing in the older sections. (Lewis, 1997, p 31).

The inter-departmental authority established to monitor the rehabilitation set a number of criteria that had to be met before the company could be relieved of its responsibilities. These included:

- a composition of over- and understorey vegetation similar to the pre-mining forest;
- evidence that non indigenous and exotic species are under control; and
- a forest structure that blends into the surrounding landscape.

The oldest sections now resemble young forest ... these oldest sections have been accepted by the government for relinquishment. They are still immature forest and have some years to go before reaching a state of mature forest similar to that before mining. However, they were judged to be self-sustaining and requiring no further inputs into their development. In 1996 monitoring work was carried out in the youngest sections, constituting approximately 25% of the area mined and rehabilitated. (Lewis, 1997, p 31).

These days, a number of tourism operators have begun to use the formerly mined Myall Lakes area to promote eco-tourism and farm style accommodation and activities. The web site of one of the private operators in the area, "Forest Lodge", promises:

A variety of spectacular trails will take you into the magnificent rainforest valleys, through the dense eucalyptus forests (one of which contains the "GRANDIS", the tallest tree in New South Wales) or to the top of mountains with breathtaking views extending to the famous Myall Lakes and the Pacific Ocean. (<http://www.travelbank.net/auschost/nswfarms/forest/fl-uniq.htm>, August, 1997).

Through sequential land use, the mineral sands industry has generated considerable wealth without causing lasting environmental damage. These

economic benefits would have been forgone if the government had not permitted previous mining efforts.

In return for the transient occupation of what was mostly areas of Vacant Crown Land the industry has generated almost \$12 billion (mid 1990) of export income for Australia. The industry had also employed a substantial work force and contributed in a large part to the now developed infrastructure in many formerly remote areas, particularly along the north coast of New South Wales. (Allen, Brooks, and Jesson, 1990, p 170).

Land use for mining in these areas has been demonstrated to be sustainable, and former mining sites can be reclaimed and returned to conditions similar to, and in some cases better than, those prevailing before mining commenced. Resources of economic value to the community were extracted while landscape, biological diversity, faunal habitat and other resources of aesthetic or recreational value could be recreated after mining had finished. It is expected that several decades will elapse before the young developing forest will approach full maturity. However, the presence of many species of lichen, fungi and ground orchids, together with evidence of activities of ground fauna in the area, show that a dynamic forest ecosystem is developing.

The Myall Lakes sand mining development is an example of industry being able to respond to land use concerns and rehabilitation challenges:

The fact that former mineral sands mining areas are now included within eight National Parks and seven Nature Reserves, and that two of these areas are listed on the Register of the National Estate, is further recognition of the success of rehabilitation programs conducted by the industry. (Allen, Brooks, and Jesson, 1990, p 170).

It is of course essential that a high level of expertise be available and careful attention be paid to each phase of the rehabilitation process. Mining and conservation can co-exist with the proper management, environmental controls and monitoring programs. Substantial economic returns can be generated from sand mining as a short-term land use, after which the land can be returned to other forms of land use ranging from conservation to intense forms of development.

There are approximately 20 million tonnes of zircon and rutile valued at \$A15.6 billion (mid 1990 values) remaining on the east coast of Australia. These represent approximately 3 times the value of minerals already extracted and do not include the values from downstream processing of the minerals.

Total alienated resources amount to 8 million tonnes of zircon and rutile valued at \$A6.2 billion (mid 1990 prices). These alienated areas are situated mainly in National Parks – notably on Moreton and Fraser Islands and the Cooloola sand mass north from Noosa, which are all in Queensland. However, in New South Wales:

substantial resources are alienated within seven conservation areas, namely Broadwater, Bundjalung, Yuraylung, Hat head, Crowdy Bay and Myall Lakes National Park and Limeburners Creek Nature Reserve. These areas were all subject to the 1977 Coastal Mineral Sands Mining Policy proclamation of the New South Wales government. (Allen, Brooks, and Jesson, 1990, p 169).

Mineral sand mining along the east coast of Australia continued from early mining efforts in the late 19th century to capital intensive and high technology mining in the 1980s. Over this time, the industry developed techniques to mine more efficiently, and developed a wealth of knowledge in sound environmental management and reclamation before rehabilitation became government policy. This knowledge has given the industry the ability to respond to environmental challenges.

Henty Gold Mine, Tasmania

Goldfields (Tasmania) Ltd officially opened the Henty Gold Mine, situated approximately 30 km north of Queenstown, Tasmania, on 2 July 1996 (Hayter, 1997). It is the first gold mine to be opened in the state since the last century. The project anticipates producing 90,000 ounces of gold a year for 4.5 years, employing 70 full-time personnel and 30 full-time contractors. This small, high-grade mine has been referred to as “the mine under the rainforest” because of the many steps that have been taken to ensure environmental outputs in the region are maintained, and even enhanced.

The discovery of the Henty gold deposit followed 30 years of exploration activity in the region. The ore body now being mined is 300–500 m below the surface and was discovered while investigating a shallow resource that was not, by itself, commercial. The shallow deposit consists of about 23,000 tonnes at 36 grams gold per tonne, the deep resource 506,000 tonnes at 26.9 grams gold per tonne.

The deep resource is accessed by a 402 metre shaft, 3.2 metres in diameter. The gold processing plant is located approximately one kilometre from the mine. The mine and processing facilities use approximately 14 ha that had been disturbed by previous users, along with an additional 9 ha. The headframe and winder, which normally would have been above ground,

were placed underground to reduce the visual impact of the mine and the surface area that had to be disturbed.

Parts of the Henty Valley had previously been used for mining, forestry and the construction of hydro-electric dams and associated facilities (constructed by the Tasmanian Hydro-electric Commission – HEC). Mineral exploration began in 1891, focused on copper, and a number of small mines operated intermittently until 1903. The forestry was based on King Billy pine, although other rainforest trees were also logged. Some people still use the valley to exercise rights conferred by craft wood permits issued by Forestry Tasmania and fishing licences issued by the Inland Fisheries Commission. A number of mining firms also have active exploration programs within the Henty Valley.

The value of the conservation assets in the Henty River valley is highlighted by the fact that Tasmania's South West Conservation Area comes within 3 km of the eastern boundary of the mining lease. The South West Tasmania National Heritage Listing also extends close to the lease boundary. The Mount Read area on the western side of the lease gained recognition for botanical values in the early 1980s – including a Huon Pine reputed to be many thousands of years old. A portion of Mount Read was nominated as a Recommended Area for Protection at that time. Goldfields proactively commissioned a government botanist to survey the Mount Read area in 1991. The mine land use Permit contained stringent requirements to protect the Mount Read area from fire and disturbance.

All employees and contractors working at the mine undergo extensive environmental education programs. Transport companies are also required to comply with special provisions to limit spills and ensure operators are aware of the clean up procedures. Drainage on the site has been planned to capture and treat any water contaminated by spills. Storage facilities have been centralised and kept to a minimum. Recyclable materials generated on site are collected by companies associated with Saint Vincent de Paul. Non-recyclable land fill wastes are deposited off-site to a Tasmanian government licensed disposal facility 200 km north of the lease area. Bulk reagent containers (for cyanide) are reused.

Rock waste from the mine that is likely to form acid is disposed of underground. Similarly, about 50% of the treated leach residue from the processing plant is used underground as a type of "cement" fill. The remaining leach residue is pumped as a slurry to tailings ponds about 4 km south of the plant.

Other waste rock from the mine is being deposited in HEC quarries that had been used to produce dam construction material. Potentially acid-forming rock is placed at the bottom of the quarries to be covered by non-acid forming rock and peat prior to revegetation. The backfilling of these quarries will enable the re-establishment of the original contours of the land. Peat for rehabilitation of the backfilled quarries and other mine areas was salvaged prior to the flooding of the lakes constructed by the HEC. The mining company has established a seed bank, and seedlings of local rainforest species, to be used in the revegetation process. The company is also undertaking a feral plant and animal eradication process and is planning to transform the mine office complex into a wilderness accommodation facility. These features of the mine development all represent net conservation or recreation outputs that would not have been available without the mine.

Water management is the primary environmental issue at the mine, in part because the average annual rainfall at the mine site is 3.5 metres. Baseline water quality and invertebrate studies in the river have been undertaken on a monthly basis since 1991. The effects of seasonal changes in variations in flow levels were recorded. Once operations began, monitoring frequency was increased to a weekly basis, or a daily basis during special events. Water flow, temperature, pH, conductivity and dissolved oxygen are measured in the field while chloride, coliforms, faecal coliforms, cyanide, oil and grease, sulphate, suspended solids, aluminium, arsenic, mercury, cadmium, calcium, copper, chromium, nickel, lead, zinc, iron and manganese are measured in the on-site laboratory. All water monitoring results are reported to the Tasmanian government monthly. To October 1996, assessments had not found any change in water quality below the project, although a slight shift in invertebrate species composition has been observed directly below the treated mine water discharge point.

Contouring works ensure all waters from the site are directed to a storm water surge pond via two main discharge points, which have traps to capture oil and grease and coarse sediment. Drains prevent water from running onto the site from surrounding areas. Water collected by the storm water pond is pumped into the line carrying water from the mine. After moving through settling ponds, the water is treated using a combination of chemical and passive methods. Some treated water at this point is used as an input into the process plant. Remaining water flows onto a 1 ha passive water treatment system consisting of an artificial wetland filter, aerating drop structures and settling ponds. Additional water is then recycled to dilute the process plant waters flowing from the leach residue ponds, so that only a small percentage

of treated mine water passes through a final small section of wetland before entering the Henty River. The discharge into the river is monitored at five second intervals. Unless a programmed change in water quality is encountered, five minute averaged values for pH, conductivity, flow, temperature and dissolved oxygen are reported and loaded into a computer database that can be extensively queried to produce tabular, graphical or statistical outputs.

All process plant waters, together with the detoxified tailings slurry, are discharged into leach residue ponds. The location and contouring around the leach ponds ensures that water flowing from them enters the artificial HEC Henty Canal rather than the river. The water discharged into the canal is also monitored to ensure compliance with government-imposed standards. There is a trade-off between ensuring lower cyanide concentration versus lower chloride and sulphate contaminate concentrations.

Golden Cross Mine, Waihi

The Golden Cross Mine at Waihi was also visited as part of the field work for this project. Like the Henty mine, Golden Cross is situated adjacent to a conservation area. It also uses a cyanide process to extract the minerals (silver and gold) from the ore. This study again illustrates the technological advances that have reduced the environmental impact of mining operations. It also illustrates, however, that environmental risks still remain with many mining operations. We first discuss the environmental measures taken at Golden Cross. We then discuss the problems encountered at Golden Cross and what may be learned from them.

Gold was first discovered in the Golden Cross area in 1892, but an extensive mining operation was not started until after 1893 because of the need to bring in equipment and materials, including a ten stamp battery, a cyanide plant and kilns. In those days, cyanide and other waste products were simply dumped in the Waitekauri stream.

The operations were sold and extended in 1895, and about this time Golden Cross township formed, consisting of a community of about 400 people with several shops, a school and a hotel. The mine closed in 1904, then operated again from 1906–1917.

The new open pit mine at Golden Cross opened in 1990. An underground mine was also started in 1991. It has about 11 km of tunnels and produces about 55% of the gold at the site. The decision to re-open Golden Cross was made in 1981, but it took ten years and over \$100 million in studies and new facilities before the new mine produced its first gold and silver bar

(75% silver, 25% gold).¹⁹ Golden Cross has about 200 full-time employees and also employs many casual and contract workers.

While both the Golden Cross Mine and the Henty Mine use cyanide to treat ore, Golden Cross have invented a process to recycle cyanide back into the ore processing circuit to minimise cyanide discharges into the tailings pond. The pH of the tailings is reduced to 7 (neutral) to cause the cyanide to be released as a gas. The gas is redirected to re-absorption towers where the pH is raised again to above 10, at which point the cyanide goes back into solution and is recycled back to the mill.

The Golden Cross Mine is the first in the world to use a cyanide recycling process. The process recovers up to 90% of the process cyanide. It also reduces the pH of the tailings liquid to a more acceptable level. Tailings dams for mines of this type that do not use the recycling process would be expected to contain on the order of 150–220 g/m³ of weak acid dissociable (WAD) cyanide and have a pH of 10–10.8. However, the liquid in the Golden Cross dam currently has only 12 g/m³ WAD cyanide and a pH of 8.4, which is much closer to the pH of 7.5 in the Waitekauri stream. Lime is added to the tailings dam to increase the pH and make the heavy minerals insoluble in water. The lime also assists with making the dam structure stronger over time by forming a type of “cement” as the tailings gradually settle and consolidate.

The mining operations at Golden Cross were planned to disturb less than 100 ha of surface land. The open pit is about 35 ha in size, and at the completion of mining probably will be allowed to fill as a lake. Rock from the pit that is not ore has been used to build the tailings dam. It was originally proposed that the tailings pond would become a wetland at the end of the mining operations – although subsequent developments discussed below will require a revision in the mine closure plans. We saw water birds swimming on the tailings dam the day we visited. At mine closure, it also was proposed to replace topsoil in areas other than the lake and wetlands and plant native vegetation.

As with the Henty Mine, water quality is a major environmental concern with the Golden Cross Mine. The rainfall at Golden Cross is also about 3 metres per year, and contouring and drains have been constructed to ensure off-site water flows around the mine site and directly into the Waitekauri

¹⁹ While the output from the mine is predominantly silver by volume, the gold is more valuable, so the mine is usually referred to as a "gold mine".

stream. All storm water falling on the site is drained into sedimentation ponds, with the water then treated and discharged to the stream.

Process waters from the tailings pond are also treated through an advanced water treatment plant before being discharged into the Waitekauri stream. Modern water treatment technologies are so good that sewage can be treated to drinking water standard. We were told by the people at Golden Cross that they sometimes have to monitor the volume of water discharges to ensure the water in the river is not too pure for the aquatic wildlife.

The water treatment plant at Golden Cross has a sophisticated computer control system that checks operations continuously, and an alarm and paging system to alert staff to any problems. The “device” we liked, however, was the collection of fish tanks. In a variant on the old canary down the mine routine, the water is piped through fish tanks in the office before it is released into the river. Rainbow trout in the tanks would turn belly-up if the water quality deteriorated.

Like Goldfields at Henty, Coeur Gold New Zealand Ltd, the operators at Golden Cross, have also undertaken some mitigating environmental rehabilitation. They have fenced about 5 km of banks on the Waitekauri stream downstream from the mine. The fences exclude stock from planted native trees. The project is aimed at restoring the riparian zone. The company has also constructed a walking track in the adjacent conservation area and erected information boards explaining the mining operations. (The boards have actually been erected a number of times since they keep getting removed by protesters.)

Despite these plans aimed at minimising adverse environmental impacts, the Golden Cross Mine has become quite controversial. Coeur Gold advised Environment Waikato and the Hauraki District Council in late December 1995 that a land slip had occurred beneath the tailings dam. While the dam was designed to withstand the “maximum credible earthquake” of magnitude 7.2, no-one knew about the geological problem that caused the sub-surface land slip.

Coeur Gold obtained a geological report on the landslide in January 1996. It found a weak, wet sheared layer of rocks lying from 20m to 100m beneath the down-slope of the tailings dam which:

appear to be creeping down slope in an episodic – stick-slip fashion ... Some inclinometers were installed when ground cracking was first observed in mid to late 1995, and more have recently [been] or are currently being installed. Their short monitoring history indicates movement rates of up to 1.8 mm/day for several days after very heavy rainfall with movements decreasing to zero to 0.5 mm/day during dry periods. Apparent movements of two Survey trig points of

0.3 and 2 m, indicate that these movements may have been occurring for at least the last 4 years.

The assessment of a number of experts engaged by Coeur Gold or the Waikato Regional Council was that the major risks associated with the slip were environmental damage to aquatic life. The Council found that:

A catastrophic failure could result in acute effects on aquatic life in the Waitekauri and Ohinemuri Rivers. A moderate dam failure could result in acute effects in the Waitekauri River and chronic effects in the Ohinemuri River. Floods risk would be restricted to the Waitekauri Valley and would be minor in relation to the potential effects of cyanide, heavy metal and sediment pollution on aquatic life.

“Chronic” criteria are set to protect aquatic life in the longer term and should not be exceeded by a rolling four day mean. “Acute” criteria are levels which, if aquatic life are to be protected, contaminants should never exceed.

A consultant who prepared a report for the Waikato Regional Council noted that “Cyanide in the tailings dam effluent is likely to cause the public the greatest concern in the event of uncontrolled discharge.” She went on to note, however, that the problem was likely to be mitigated by the fact that the cyanide recycling process reduced the quantity of WAD cyanide in the tailings, while cyanide is naturally degraded by processes which occur both in the tailings dam liquid and in the stream and river waters:

Natural chemical and biological processes which can degrade cyanide in a normal freshwater environment include volatilisation (loss of the gas HCN) and complexation with iron, as well as hydrolysis and biological oxidation to form organic acids and ammonia (NH₃). If high levels of cyanide are present and conditions favour rapid biological oxidation, the production of ammonia may give rise to secondary issues such as ammonia toxicity and, if further oxidised to nitrate, raised nutrient levels. Cyanide can also be removed by adsorption onto organic matter clays and feldspars. It is the rate of these processes, balanced against the cyanide flux which will determine the magnitude of the problem.

The similarity in the pH level of the tailings dam and the Waitekauri stream was another mitigating factor. If the acidity levels had been more different, a discharge of tailings material into the stream would precipitate out more heavy metals. The consultants all observed that the mechanisms in place to capture and treat water on the mine site would mean that minor leaks from the tailings dam could in fact be accommodated without any adverse environmental effects on the stream. It was not anticipated, however, that the water treatment procedures would remain in place after the mine was closed.

All the consultants agreed that the landslide could be arrested or reduced to minimal levels by removing water from the layers of rock where the

slippage was concentrated and by loading material onto the “toe” of the slip. The consultants also expressed the opinion that “the consolidation of the tailings over time will produce a stable, low permeability soil mass where an uncontrolled release of tailings prompted by ground movement or seismic activity would cease to be a credible risk”. Coeur Gold subsequently:

- installed drains to reduce the water entering the site in heavy rainfall;
- inserted a number of drainage holes into the rocks in the shear zone;
- loaded additional material around the toe of the slip as suggested;
- built a rock buttress downstream of the dam to reduce peak flows if a failure did occur;
- reduced the free water in the impoundment to “beach tailings against the dam” and reduce its permeability; and
- upgraded the water treatment plant to reduce copper levels in the tailings by a factor of four.

Coeur Gold spent over \$27 million on the landslide problem and apparently plans to spend another \$20 million in the next few years (although it received an insurance payment of about \$14.6 million to cover some of the cost).

The Waikato Regional Council expressed the opinion that the stabilisation measures were likely to restore the original design safety factor for the dam in the short-term, but it was more uncertain how effective they would be in the long-term.²⁰ The Council recommended that relocation of the tailings should be considered as a longer-term measure. An article in the *Waihi Leader* on 22 July 1997 reported, however, that a consultant had recommended against moving the tailings to a new dam further down the valley. Transporting tailings to a new site would itself involve environmental risks.

An article in the *National Business Review* on 24 October 1997 noted that Coeur Gold has decided to close the mine in December 1997, partly because they do not wish to add any more tailings to the dam. The open pit will be partly filled and revegetated, the underground mine will be flooded and closed off and the tailings dam will be partially capped. Coeur will monitor the site for five years and pledges that “remedial measures will continue for as long as required for the environment and public safety”. A spokesman for Environment Waikato said that the main concern after closure was acid

²⁰ It would seem to us, however, that the likely long-term effects of a leak of tailings into the stream could not be too great. After all, the earlier mines in the area simply released cyanide and other contaminants directly into the streams – and the areas are now considered to have substantial natural assets.

drainage from the dam. Coeur Gold and the regional council are working on ways of limiting the possibility.

This example illustrates that even a mining project where many precautions have been taken to avoid environmental damage can experience unforeseen problems that result in unacceptable environmental risks. In particular, no-one who knew about the landslide problem would propose to site the tailings dam at Golden Cross in its current position.

Nevertheless, knowledge about controlling the environmental effects of mining continues to grow. Each new experience alerts subsequent firms to new situations they need to examine before designing mining and treatment facilities. For example, an article in the *New Zealand Herald* on 30 May 1997 noted that at an international conference of mining engineers there had been "intense interest in the Waitekauri mine by people from 10 or 12 countries". In addition, knowledge of new treatment technologies is continually reducing the environmental risks associated with mining. For example, the cyanide recycling process invented at Golden Cross has substantially reduced some environmental risks associated with mining heavy metals.

Finally, other land uses including farming, forestry and even recreational use²¹ also involve risks – including to human life as well as environmental

²¹ For example, on the night of 31 July 1997 there was a landslide at the ski village of Thredbo in the Australian Alps. The landslide demolished two ski lodges and killed 12 people. Sutherland and Bita (1997) reported that:

The coronial inquiry into the Thredbo landslide tragedy will investigate key concerns surrounding a retaining wall built by the [New South Wales] National Parks and Wildlife Service (NPWS) on the Alpine Way above the slip site. Engineers have questioned whether a 2m high concrete wall built earlier this year on the high side of the road adjacent to the slip diverted water down the slope, contributing to last week's landslide ... there is some confusion over whether drainage pipes were laid behind the wall ... the NPWS said it built the wall using its own staff or contractors ... University of Melbourne geology department head Ian Plimer, who has visited the site, said the wall would have pushed the water down the hill ... Professor Plimer [also] claims willow trees 50 m from the slip site were poisoned by the NPWS last summer. "Those trees are now no longer extracting large amounts of water from the soil and the second thing is that those trees are now no longer bolting the soil on to the rocks," Professor Plimer said. ... Geotechnical engineer Brian Maddock, who worked on the Carrinya site 12 years ago, said something has destabilised "fill" put at that site 30 years ago. "Something's happened in the last 12 months or 18 months that's increased the amount of water available above Carrinya Lodges," said Mr Maddock.

Unlike the Thredbo incident, the Golden Cross landslide has not yet resulted in any loss of life. The Thredbo incident may also show that the NPWS is not immune from engineering mistakes that can lead to landslips, and that recreational use of conservation areas can be dangerous. No doubt the engineering safety regulations the NPWS imposes on its own operations do not approach the controls it would place on a mining company operating in the same terrain.

pollution. The relevant question is not whether there are risks associated with an activity but whether the expected returns are worth the risks that are incurred.

Water resources

When land was allocated to DOC in 1987, the potential value for hydro electric generation was not assessed. Since the most suitable sites for hydro electric generation are in mountainous areas, the result has been a potential source of conflict particularly between the Electricity Corporation of New Zealand (ECNZ), the main electricity generator in New Zealand, and DOC. Indeed, conflict between electricity generation and conservation predates the formation of DOC. As the ECNZ web site observes:

Manapouri is New Zealand's largest hydro station, and currently provides around 14 per cent of ECNZ's generation. Manapouri sparked significant controversy, becoming one of the biggest environmental issues in New Zealand's history when it was first built. (<http://www.ecnz.co.nz/business.html>, August 1997).

As a corporatised entity, ECNZ has to renegotiate water rights for its operations under the RMA. It began a process of public consultation on rights to take water from Lake Manapouri to operate the Manapouri Power Station in 1990. Resource consents under the RMA allowing the station to operate for 35 years were eventually granted in December 1996. ECNZ eventually obtained support for its application from DOC, Ministry for the Environment, local iwi and the local Fish and Game Council. In return for their support, it offered these various groups a number of conditions that ECNZ would abide by:

These conditions included a minimum flow provision down the lower Waiiau River. We also established a number of trusts for mitigation works. For example, the Waiiau Fisheries and Wildlife Habitat Enhancement Trust will provide habitat enhancement to mitigate effects of ECNZ's operations on the lower Waiiau river. More than 1,000 hectares of new wetlands and many hundreds of kilometres of restored habitat in river tributaries will be provided for, and hundreds of thousands of native trees will be planted as part of this project.

ECNZ is implementing an extensive monitoring program to ensure the effectiveness of the measures put in place to avoid, remedy or mitigate adverse effects of the station's operation. (<http://www.ecnz.co.nz/business.html>, August 1997).

A similar example is discussed in the Ministry for the Environment (1995a, p 31). In this case, ECNZ was seeking water rights for its Waitaki Power

Project, which generates about one-third of New Zealand's electricity. A working party, headed by the Waitaki Catchment Commission, was established to examine ECNZ's application. Other groups involved in the negotiations included the New Zealand Salmon Anglers Association, Fish and Game Councils, Federated Farmers, Ministry of Agriculture and Fisheries, Ministry for the Environment and DOC. The salmon anglers had already complained that low river flows had adversely affected the annual salmon spawning run, while the farmers wanted more water for irrigation. The main conservation interest is that the catchment for the project is the main breeding area for the black stilt, an endangered bird.²²

The working party discussed their different objectives, identified options and jointly hired experts to examine and report on various issues. As Hendry (1994, p 50) records:

Scientific data and terms of reference for the research were designed to be acceptable to all concerned. The proposal and its effects were known to all parties and each party had the opportunity to suggest possible solutions to the problems.

The Ministry for the Environment (1995) observed that the outcome again involved ECNZ providing the other parties with other resources in return for their support of continued ECNZ operations (effectively a set of net trades):

ECNZ retained the existing minimum flow and obtained adequate storage in Lakes Pukaki and Ohau. Although wading bird habitat along the Tekapo River was not recovered, the habitat along the Ahuriri River was enhanced – the endangered black stilt may well have been saved. The Acclimatisation Society (now the Fish and Game Council) secured a modified flow regime and a comprehensive, ECNZ-funded study into the effects of flow fluctuations on the fishery. The farmers seeking irrigation water received a more comprehensive flow information system, and a commitment from the corporation to fund work on intake structures needed by operational flow fluctuations. Canoeists obtained special releases of water through a river bed enhanced for canoeing.

Hendry (1994, p 50) claims that:

The negotiations in the Waitaki Valley were successful, largely due to the commitment of the parties involved. In particular, the personnel of the DOC conservancy had a major influence allowing an amicable solution.

²² A biologist we spoke to in New Zealand suggested that the bird may have been endangered partly for "natural" reasons. He suggested that there was evidence that the female black stilt preferred to mate with a pied stilt, with the resulting offspring being pied. In this case, there is some doubt about whether habitat destruction or "natural causes" are the main source of the endangered status of the bird. We have not been able to verify these claims.

He also summarised (p 51) the key elements in the conservation aspect of the settlement as an agreement between ECNZ and DOC to establish a seven year program, at a cost of \$406,000 per year, to fund the black stilt breeding program, control weeds on the Ahuriri River and provide additional scientific expertise to DOC.

These two examples raise a number of issues. First, the outcomes involve all parties making concessions and departing from their preferred position. This is usually characteristic of market, but not of political, decisions. In a market where all resource uses are priced, the final use of resources has to produce greater value than any alternative if it is to go ahead. Final users therefore have to take account of the value of the opportunities forgone. Since resource uses usually are characterised by diminishing returns, the least cost solution typically will involve a mix of uses. Political decisions are, by contrast, typically associated with all or nothing outcomes. The party “with the numbers” gets everything it wants.

The second issue raised by these two cases is that, even though satisfactory compromises were arrived at, a suitable framework for negotiations and a great deal of negotiating time were required. There is also an indication that particular individuals may have played a crucial role in arriving at a satisfactory outcome. Another case study discussed below emphasises this conclusion. By contrast, market processes with clearly defined property rights involve much lower transactions costs.

Finally, in these two examples, the RMA required other parties to negotiate with DOC to deliver conservation outputs before they could get what they wanted. There is nothing wrong with this in principle. However, the question it raises is why doesn't DOC have to go through similar negotiations with other potential users when it makes resource allocation decisions involving areas under its stewardship? Just as the maximum value use of resources in these cases involved trading off other values in order to enhance conservation outputs, so also the maximum value solution for use of at least some areas managed by DOC is likely to involve reducing conservation outputs in order to increase other uses. Since DOC is exempt from the sustainable management provisions of the RMA, however, it does not have to go through a similar process to demonstrate that it is providing maximum value to the people of New Zealand for the resources under its control.

Hendry (1994, pp 52–55) discusses another case of ECNZ attempting to negotiate water rights which had a less satisfactory outcome than the above two cases. Flow levels in the Wanganui River significantly affect the

generating capacity of ECNZ's North Island hydro generating stations. Up to 10% of the North Island's hydro generation capacity and 3.5% of the nation's electrical generation depends on water diverted from the head waters of the Wanganui River. In March 1988, the Wanganui Catchment Board fixed new minimum flow levels for the Wanganui River that reduced the production capacity of the affected power stations by 20%. The net economic cost of the loss of generating capacity to the New Zealand public was \$72 million.

ECNZ lost an appeal against the decision of the catchment board partly because DOC intervened to argue that the minimum water flow should be set at an even higher level. DOC had an interest in the matter because:

DOC is the largest single land owner in the Wanganui catchment area and under the 1987 *Conservation Act* and the 1950 *Harbours Act*, DOC controls the navigation of the river from its tidal reaches to Whakapapa Island. Two national parks, the Wanganui and Tongariro, plus a number of scenic reserves flank the river. As guardian of these protected areas, the Department has a special interest in the river flowing through the landscape. Additionally, under the 1953 *Wildlife Act* and the 1983 *Fisheries Act* DOC has responsibilities to protect the native wildlife and manage for game, birds and fresh water fisheries. (Hendry, 1994, p 53).

The minimum flows that applied *before* the catchment board decision was made had, however, prevailed for a number of years without destroying the conservation outputs of interest to DOC. It was not incumbent upon DOC to demonstrate that the conservation outputs it sought to protect were of greater value than the forgone electricity output.

Furthermore, DOC achieved a gain in conservation outputs without having to pay any compensation to electricity consumers. Since it has no responsibility to consider, let alone value, alternative uses of resources, DOC can advocate positions that represent a net diminution in the *total* (including conservation) value of all outputs.

If DOC had to compensate other resource users for the value of their lost opportunities, it would also be forced to place a value on the conservation output it has gained. Would the higher minimum flows in the Wanganui River gained in this instance have been the way DOC would have *chosen* to spend \$72 million (45% of its annual expenditure) on conservation? When it does not have to face the cost of its decisions, DOC is not forced to weigh up alternative ways of achieving conservation goals. It is not forced to ask the question of how society might get the best conservation output for an expenditure of \$72 million. Instead, it is encouraged to treat all costs which do not result in expenditure by DOC as if they are not costs at all. This is

hardly likely to result in New Zealand achieving a given level of conservation output at the minimum *social* cost.

CONCLUDING REMARKS

A major obstacle to taking advantage of net conservation value trades involving conservation areas is that the value of alternative uses of resources is not allowed to contribute to increased conservation outputs. As a result, managers of conservation areas have little incentive to consider alternative uses of resources even if the result is likely to be a substantial gain in net conservation output in addition to substantial conventional economic outputs.

Similarly, on land under the control of parties *other than* DOC, the Department again has little incentive to consider non-conservation uses since it does not have to compensate owners for the value of any opportunities that are forgone. DOC therefore has an incentive to advocate the maximum attainable conservation output.

DOC also has little incentive to weigh the conservation value of alternative areas or activities against each other. It does not have an incentive to achieve a given level of conservation services at the least social cost for the New Zealand community. As we have seen in many countries and many contexts, political decision-making processes do not encourage a search for efficiency.

However, there are many ways of achieving more efficient conservation outcomes. In some areas, much of the available conservation output can be achieved without abandoning all other uses of resources. Similarly, other uses can often be allowed for a short time, on a controlled basis, and in a small part of the conservation area, without irretrievable damage to the ability of the area to produce maximum conservation outputs in the future. Even where alternative uses of resources have a permanent, detrimental *direct* effect on conservation outputs, allowing the alternative activities to proceed may provide substantial benefits if funds can be siphoned off and allocated to conservation activities – for example, better management of tourism and recreation or improved control of weeds or feral animals. The result can be a *net* increase in conservation output in addition to a community benefit from the non-conservation use of resources.

APPENDIX – MINING IN CONSERVATION AREAS IN AUSTRALIA

There has been a growing trend in Australia to recognise the value of multiple and sequential resource use, particularly with regard to mining. An increasing number of Australian states have legislated to allow mineral exploration and mining in some conservation areas under strict environmental controls and guidelines.²³

South Australia

In South Australia, the state government announced a decision in 1986 to:

foster multiple land use concepts and to ensure that no land is alienated from exploration without careful consideration of the sub-surface mineral or petroleum potential, relevant economic factors and the existing and potential sub-surface rights.

The decision led to an amendment of the *National Parks and Wildlife Act* to allow the creation of a new reserve category, the Regional Reserve, that embodied multiple land use principles. Specifically, the Regional Reserve amendment to the South Australian *National Parks and Wildlife Act* enabled the proclamation of:

any specified Crown Land for the purpose of conserving any wildlife or the natural or historic features of that land whilst, at the same time, permitting the utilisation of the natural resources of that land.²⁴

The Act states that each Regional Reserve has to be reviewed at intervals of not more than 10 years to assess both the impact of resource utilisation on conservation outputs, and the economic benefit derived from such resource use.

A Regional Reserve is managed and administered according to a Reserve Management Plan prepared by the Department of Environment and Natural Resources in conjunction with the Department for Mines and Energy and any leaseholders. The Act allows zones to be established within a Regional Reserve with different management priorities applying in each zone.

The lower environmental risks associated with mining *exploration* as opposed to *production* are reflected in the Act. An exploration lease within a Regional Reserve can be granted by the Minister administering the *Mining*

²³ The discussion of current practices in Australia is taken from Minerals Council of Australia (1996).

²⁴ South Australia *National Parks and Wildlife Act 1972*, reprint No 5, 15 January, 1994.

Act after *consultation* with the Minister for the Environment. A production lease, on the other hand, cannot be granted before the Minister administering the *Mining Act* obtains the *approval* of the Minister for the Environment. The major difference this makes in practice is that the *National Parks and Wildlife Act* contains stronger provisions relating to environmental protection and operating constraints than does the *Mining Act*. The Regional Reserve classification therefore ensures that all mining within such reserves satisfies the stronger conditions applying under the *National Parks and Wildlife Act*.

The total area under the Regional Reserve classification is now 106,271 square km (about 40% of the area of New Zealand). All of these reserves, except for Chowilla (part of the Bookmark Biosphere Reserve discussed in chapter 5) have active mining or petroleum exploration licences, but no new mining developments have occurred in any of them since they were designated as Regional Reserves.

Apart from the Regional Reserves, mining is also allowed (subject to conditions imposed by the Minister) on about 55% of the remaining area allocated for conservation purposes in South Australia. The classification of a conservation area with regard to authority to prospect and mine can also be changed through a resolution approved by both houses of the South Australian Parliament. The Minister for the Environment still has to approve any exploration or mining lease in a conservation area that has been jointly proclaimed for conservation and mineral exploration or mining.

Some mining companies have stated that the Regional Reserve concept is “a sound compromise” between exploration and conservation, but the workability of the Act will not really be tested until a company applies for a mining licence. Some companies have expressed concern over the duplications involved in the approval process, which must satisfy the *Mining Act*, the *National Parks and Wildlife Act* and the *Planning Act* (which also applies in some reserves). Surely this problem could be handled by a new approvals process which simply applies the most stringent requirement from any of the three acts.

Conservationists have opposed the Regional Reserve concept – particularly on the grounds that they want greater opportunity for “public involvement” in management decisions and clearly designated areas where conservation is the sole land use. However, the Regional Reserve concept has allowed greater conservation output to be produced from areas that were previously not being managed with that purpose explicitly in mind. The funds to “buy out” these alternative resource users would simply not have been provided given the relative value of the conservation and alternative

outputs. The other resource users have also provided additional staff and money income to support management and conservation activities and manage the recreational and tourist use of the areas.

The Minerals Council of Australia (1996, p 14) claims that the National Parks and Wildlife Service spends very little money on the Regional Reserves. The Minerals Council argues that the relative lack of funding might result from a policy of using visitor numbers as a criterion for determining the allocation of funds. We would argue that visitor numbers should be a relevant criterion for allocating funds to conservation areas, since visits are an important output. Perhaps the National Parks and Wildlife Service could also institute a contingent valuation or other survey type of technique to judge the indirect or non-use conservation value of different conservation areas. The mining industry has suggested that greater funds could be obtained for Regional Reserves if some mining or pastoral royalties were returned to the areas where the leases apply. Needless to say, this proposal was supported by the Departments of Environment and Natural Resources and Mines and Energy but opposed by the Treasury.

Queensland

Queensland is the only other Australian state with legislation permitting reservation of land to protect conservation values while allowing mining to be the predominant use. The history of these reserves dates back to 1977, when a category of Departmental and Official Purpose Reserve (D&OP Reserve) was used for two areas of conservation interest on Cape York Peninsula where the Department of Mines wanted to allow exploration and possibly mining to occur (Willmott, 1997). The use of the classification expanded modestly over the following ten years.

The hybrid classification encouraged the Department of Mines and the National Parks and Wildlife Service to develop a working relationship. In particular, they developed procedures for agreeing on management plans for such areas.

Following the introduction of the *Nature Conservation Act 1992*, the D&OP Reserves were transferred into the category of Resources Reserves. The Act introduced several classifications for conservation areas including:

- National Parks (scientific, non-scientific, Aboriginal land, Torres Strait Islander land)
- Conservation Parks
- Resources Reserves

- Nature Refuges
- Coordinated Conservation Area
- Wilderness Area
- World Heritage Management Area
- International Agreement Area.

The first three categories all applied to land owned by the state. The last five applied to private land.

Resources Reserves have as management objectives the protection of cultural and natural resources, the controlled use of those resources (excluding commercial forestry) and maintenance of the area “predominantly in its natural state” (Minerals Council of Australia, 1996, p 19, Willmott, 1997, p 20). The Department of Mines and Energy and the Department of Environment were designated as joint trustees of the Resources Reserves. The Department of Environment manages and finances nature conservation, recreation and grazing (if any) issues using staff from other parks. The Department of Mines and Energy administers exploration and mining, again using visiting Field and Environmental Officers. The category of Resources Reserve is seen to correspond with Class VI of the IUCN Protected Area Management Categories (discussed above).

Draft management plans or guidelines have been formulated for each Resources Reserve. These documents usually set out the background to the gazettal of the reserve, the purpose of the reserve, the priorities of the different objectives and the existing constraints on management. Conservation is usually the highest priority, which, as Willmott (1997, p 20) argues:

is logical as a reserve is not required to allow access for exploration and mining (this can occur as a matter of course on private, leasehold and such other state land). However, it is made clear that the term “conservation” means protection of the general integrity of the environmental systems and not the preservation of all individual plants and animals within them.

The documents also detail how exploration and mining will be managed so as to protect the conservation assets in the Reserve. The management guidelines are reviewed every five years, or when significant new resource information becomes available.

Conditions applying to exploration or mining vary somewhat from one Reserve to another, but semi-standard core conditions have been developed. An initial consent permits “non-disturbing activities” such as:

- airborne surveys;
- use of existing trafficable tracks;
- use of off-track four wheel drive vehicles without track construction; and
- geological mapping, hand sampling and non-disturbing geophysical investigations.

Further consent is required before constructing tracks, trenches, drill pads or camps and before consent is given the operator needs to detail the work that will be done to minimise and rectify disturbance. Mining activity can only proceed after an Environmental Impact Statement (EIS) has been prepared. Apart from the usual matters relating to water pollution, noise, dust and so on, the EIS has to assess the regional and state significance of the mineral deposit and compare its value with the value of the environmental assets that may be put at risk.

The Department of Mines and Energy has suggested that Resources Reserves are most appropriate for areas with conservation value that are also:

- areas of active exploration, or where past exploration, mining or geological prospectivity indicates that further exploration can be expected;
- theoretically favourable for mineralisation but not yet explored;
- known to contain low-grade, at present uneconomic, mineralisation that may become economic in the future;
- known to contain minerals for which there are no current markets;
- favourable for small-scale mining (such as gem fossicking by tourists); and
- known to contain major mineralisation that could be mined without affecting the entire reserve and where satisfactory rehabilitation is likely to be possible.

Willmott (1997, pp 21–23) notes that about 35 Resources Reserves have been declared. Most of them are small and together they cover about 3,300 square km. Most Resources Reserves also adjoin National Parks “as a result of concerns of mineral potential when the parks were being considered”.

Mining companies have expressed some concern with the added administrative burdens associated with operating in Resources Reserves. The Departments are, however, addressing these concerns. There has also been some delay in preparing management plans and guidelines for Reserves. The Department of Environment is also assessing the experience

with rehabilitation. Part of each Reserve is declared as a “reference area”, where exploration and mining will not be allowed, so there can be a control to enable disturbance and rehabilitation to be assessed. Mining industry bodies have stressed to their members that the industry as a whole will suffer if environmental performance of companies operating in Resources Reserves is not exemplary.

Apart from Resources Reserves, the *Nature Conservation Act* stipulates that mineral exploration or mining cannot occur in a National Park or Conservation Park. It may or may not be permitted in Nature Refuges, Coordinated Conservation Areas and the remaining categories (where there have been no gazettals to date) depending on conservation and non-conservation resources present. Petroleum exploration and production is allowed in all categories under conditions imposed by the Department of the Environment.

Unlike the Regional Reserves in South Australia, the Resources Reserves in Queensland tend to be small in area and are often adjacent to other conservation areas. In addition to continued operation of previous leases, new exploration and mining leases have been granted in Resource Reserves since 1992.

Tasmania

The majority of land reserved under the Tasmanian *National Parks and Wildlife Act 1970* is unavailable for exploration or mining. Some State Reserves are available for mining and exploration if a mining tenement covered the area when the reserve was gazetted, or mining or exploration is permitted in a reserve management plan which has passed both Houses of Parliament. Mining is generally excluded in Game Reserves and land reserved under the *Aboriginal Relics Act* or the *Crown Lands Act* but can occur in Conservation Areas unless it is specifically prohibited.

However, the *Mining (Strategic Prospectivity Zones) Act 1993* classified areas of land as “having high potential for mineralisation and attempts to ensure continuation of mining rights (where applicable)” (Minerals Council of Australia, 1996, p 21). Seven Strategic Prospectivity Zones (SPZ) were declared, covering 37% of the state, and covering unallocated Crown land, land reserved under the *Crown Lands Act*, state forests, Hydro-Electricity Commission land, conservation areas and freehold land. Crown Land within a SPZ cannot change status or be sold without the approval of Parliament if the change in status would constrain the operation of the *Mining Act* (or its predecessor). Further, if the status is changed, compensation is payable to the

holder of any exploration or mining lease or licence revoked by the status change (although the lease will expire if the change in status is delayed).

In addition, the Public Land Use Commission (PLUC) was established in 1991 as an independent body to recommend on the use of public land in Tasmania. The PLUC released final recommendations in 1995. The Tasmanian government said, however, that action on its recommendations would be delayed until the Regional Forest Agreement (RFA) process had been completed. An RFA was signed between the Tasmanian and Commonwealth governments on 8 November 1997.

The PLUC recommended that the more than 120 existing classifications of public land under various Acts should be reduced to 13 categories. The recommended system accorded with the IUCN specifications, so is therefore non-hierarchical and covers a range of reservations from multiple use reserves to areas focused solely on producing conservation and limited recreational outputs. The PLUC also suggested that revocation of a classification could occur following a resolution of both Houses of Parliament.

Two of the categories recommended by the PLUC have sustainable use of resources and conservation as dual management objectives. The *regional resource* category specifies that the area has high mineral prospectivity and should be managed for minerals exploration and development whilst providing for conservation of natural or cultural values. The *conservation area* category specifies that the area should be managed to conserve its natural and cultural value while permitting sustainable use of natural resources. It was suggested that the regional reserve category should apply to all unallocated Crown land in a Strategic Prospectivity Zone with a single area of predominantly natural vegetation of at least 500 ha in extent.

The PLUC also recommended that the *Mining Act* (or a new *Minerals Resources Development Act*) should apply to a range of other categories including nature recreation areas, cultural landscapes and public reserves. This recommendation may be interpreted as a lack of prohibition on mining activities rather than an encouragement of mining development.

Victoria

Land can be classified as exempt from mining, restricted, or available for mining. Land classified under the *National Parks Act* which is exempt from mining includes:

- Reference Areas;
- National Parks;
- State Parks;
- Wilderness Areas;
- Aboriginal Places;
- Archaeological Areas; and
- other lands exempted by the Minister.

There are provisions, however, allowing the continuation of pre-existing exploration or mining operations within National, State and Wilderness Parks.

Land where mining activities have *restricted* access includes regional parks, coastal and marine parks, flora and fauna reserves, natural feature reserves, and historic areas. The restrictions require consent from the Minister for Conservation and Land Management prior to any mining or exploration activities in these areas.

Finally, an area reserved under the *Crown Land (Reserves) Act* is available for multiple land use, including mining, unless the alternative uses are explicitly excepted.

New South Wales

A new classification that would have allowed multiple land use, including mining, of land managed under the *National Parks and Wildlife Act* was considered in the early 1990s. The current Labor state government has since suspended all such discussion. The *National Parks and Wildlife Act* of 1974 prohibits mining and exploration in:

- National Parks;
- Historic Sites;
- Nature Reserves;
- State Game Reserves;
- Karst Conservation Reserves; and
- Aboriginal Areas.

The prohibition does not apply to existing interests at the time of reservation. Continuation of existing interests may, however, require consent and additional restrictions that have to be complied with. The Act permits the Minister for the Environment to allow mineral prospecting to be performed on behalf of the government in reserved lands normally prohibited to

mining, although the permission is open to veto by *either* House of Parliament.

Mining is not prohibited in a State Recreation Area. The Act does not, however, promote multiple resource use in these areas. Any mining activity in these areas also requires the consent of the Minister for the Environment.

Western Australia

The government announced a policy allowing mineral exploration in three of the state's largest National Parks in 1990. The policy later resulted in the excision of land and the subsequent development of the Marandoo mine in Karijini National Park in 1994 (discussed above).

In early 1993, the new coalition government announced minerals exploration would be allowed in all National Parks and conservation areas in accordance with the *Mining Act* of 1978. This act requires exploration to be *approved* by the Minister for the Environment and the Minister for Mines. Mining activity in other conservation reserves requires the *advice* of the Minister of the Environment. Some applications for exploration under the policy have been refused on the grounds that the government was not convinced that potential environmental problems could be handled properly.

Mining in protected areas (as opposed to exploration) requires an environmental assessment by the Environmental Protection Authority and subsequent approval by state parliament.

The *Conservation and Land Management Act* in Western Australia also contains provisions for specifying reserves as multiple use. This provision is increasingly being used for conservation reserves in areas of known mineralisation. The areas are managed for recreation, wildlife conservation and historical features, while recognising the potential for mineral development.

A policy to allow petroleum exploration in marine reserves was announced in 1994. These areas now permit tourism, commercial fishing and potential resource development.

Northern Territory

The *Territory Parks and Wildlife Conservation Act* of 1988 allows exploration, recovery and processing of minerals, coal and petroleum in National Parks, reserves and wilderness zones subject to conditions relating to environmental damage. Damage resulting from activity is also subject to financial penalties. Exploration and mining in protected areas also requires

agreement from the Conservation Commission as well as the Department of Minerals and Energy.

7. THE STRUCTURE AND PERFORMANCE OF DOC

When we discussed the formation of DOC in chapter 1, we observed that there was an intellectual environment at the time that emphasised the importance of “separation of functions” in government departments. Many individuals in New Zealand had given a great deal of thought to how government entities could be organised to ensure they delivered value to their customers, the citizens.

Part of the motivation for this examination was the tendency of the then Labour government to corporatise some previously government-owned trading enterprises rather than privatise them as was being done in the United Kingdom at that time. Where the Thatcher government privatised the electricity industry, for example, the New Zealand government corporatised the corresponding entities.

This policy environment is likely to raise questions in the minds of any thinking government official. What is the effect of different ownership structures on outcomes? Why have some ownership structures tended to dominate in some types of activities more than in others? What has changed in the last part of the twentieth century to make government ownership appear as a less desirable institution than it once did? If corporatisation is an alternative institutional structure to both private ownership and a government department, what are the advantages and disadvantages of corporatisation relative to the other two?

Attempting to answer all of these questions would take us far beyond the scope of the present study. We briefly discussed some of the relevant arguments in chapter 2 and appendix 2 to that chapter. We shall not repeat them here. The point we now wish to emphasise, however, is that the idea behind separating the functions of government departments is related to the motivation for corporatising or privatising former government-owned trading enterprises.

The owners of a firm, or the politicians overseeing a public entity, need to monitor the performance of managers. When the objectives of the enterprise are vague and difficult to measure, managerial performance is very difficult to monitor. Managers will be able to indulge their own preferences and deviate from the wishes of the monitor. The result will be that less of the output desired by the monitor will be achieved for a given expenditure of

funds, or equivalently, to achieve a given desired output, the owner will need to spend more.

One response to this in the past has been to restrict the decision-making autonomy of managers. This approach has other costs, however, since it is impossible to design a decision-making framework that will achieve the best use of employees and other resources in all circumstances.

Thus, when a government trading enterprise is corporatised, the firm is reconstituted along commercial lines with a board of directors who are responsible for achieving more transparent and focused objectives. Subject to satisfying these narrow objectives, managers are actually given more decision-making autonomy. Political directives have to be explicit and open to public scrutiny. Managerial rewards are closely related to achievement of the stated objectives. Managers need to be able to sack employees who do not perform.

When these ideas were translated to the non-trading elements of New Zealand's public sector, the result was the *State Sector Act 1988* and the *Public Finance Act 1989*. James (1996, p 12) summarises the features of these Acts as follows:

Under the *State Sector Act*, all appointees to the top positions in government departments and ministries are on term contracts. Department heads, now known as Chief Executives (CEs), have greater decision-making autonomy than before, including the power to hire and fire departmental personnel. The State Services Commission selects departmental CEs, negotiates collective employment contracts on behalf of the CEs, and generally advises the government on human resource issues.

The *Public Finance Act* achieves a number of goals. It transfers responsibility for each department's financial operations from the Treasury to departmental CEs, each of whom maintains a departmental account which handles all receipts and bills. Ministers contract with CEs annually for the provision of "outputs" (specific and measurable tasks) rather than the "outcomes" (policy objectives) that the outputs are designed to achieve. The agreements are tabled in Parliament. CEs have wide discretion in fulfilling the terms of their agreements; they may produce goods and services in-house or out-source them, and are not required to buy inputs from other government agencies. Their pay levels depend partly on the efficiency of their departments.

The most innovative provision of the *Public Finance Act* requires government to move from cash accounting to accrual accounting, based on Generally Accepted Accounting Practice for purposes of budgeting and management. Unlike cash accounting, accrual accounting takes account of the value of receivables (amounts due but unpaid), of payables (amounts owed but unpaid), of government assets, and of non-cash liabilities such as unfunded pension

liabilities. Accrual accounting thus facilitates a more comprehensive assessment than does cash accounting of the state's true financial position.¹

Finally, the *Public Finance Act* instituted a capital charge system. Twice a year each department must pay Treasury a capital levy based on the total value of department assets and the average interest rate on long-term government debt. This charge is designed to encourage departmental CEs to economise on their use of assets.

In short, these Acts provided for the transformation of the public sector from centralised control of finances, staff and other inputs to devolved arrangements where managers are responsible for the mix and magnitude of inputs, have incentives to be productive and are held accountable for results. The basis of the accountability regime is a focus on outputs. Ministers purchase outputs, while departments are paid a negotiated price to deliver those outputs.

These reforms have been very successful. According to Schick (1996), as a result of these reforms many government departments in New Zealand are:

... no longer the organisational cocoons many once were. They are not sheltered by special rules, stable career patterns, incremental budgets and ambiguous performance standards. They increasingly resemble business organisations. Change is on-going, managers routinely monitor results against plans and they are more responsive to external conditions and customer interests.

REFORM OF THE STRUCTURE OF DOC

Many government departments were restructured when the *State Sector and Public Finance Acts* were introduced. The 1987 Treasury Brief, *Government Management*, provided the basis for these restructurings, and urged that policy advice and service delivery be assigned to separate entities. The rationale was that this separation would give Ministers less biased and more varied advice. That is, it would overcome the concern that opportunistic service providers may capture policy makers (including the Minister) by selectively feeding them information. However, the brief also warned against too distinct a separation of the policy advice function that may lead to "ivory tower isolation". The brief somewhat tentatively recommended "a considered approach which addresses particular agency structures on a case by case basis in the light of resource constraints and current priorities". The

¹ It is also more difficult for the manager to manipulate – for example, by shifting payments through time to use up budgeted funds before the end of the financial year.

outcome was that in most departments, policy advice, funding of operations and delivery of services were separated.

In other departments, however, including DOC, policy advice, funding and service provision remain tied together as in the old model of government departments. Thus, Hendry (1994, p 34) notes:

DOC was not subject to the same organisational criteria as other government departments. The Department retained the ability to both develop policy and manage it.² This dual role was contrary to the Department's initial purpose and one that contradicted contemporary thinking and the principles on which the state sector reforms were based.

The 1987 *Conservation Act* charges the Minister to both "manage" for conservation purposes the resources within the DOC estate, as well as "advocate" and "promote" conservation values.

Hendry goes on to argue that the coupling of policy and service provision within DOC has created problems:

The dual objectives of the legislation, and the failure to separate the role of policy development from management, has created problems for DOC that were synonymous with pre-reform type government departments. These problems include:

Output efficiency: While substantial moves have been made within DOC to improve efficiency and outputs, the administrative model under which the Department operates is restricting its ability to achieve the type and degree of efficiency attained in other government departments.

Separation of functions: Separation of functions ensures accountability, reduces potential for conflicts and encourages balanced decision-making processes. By the very nature of the political process, politicians will always be

² A referee suggested that Hendry is not correct and that policy functions in relation to conservation matters in fact lie with the Ministry for the Environment. However, one of the functions of the Department specified in the *Conservation Act* is that it "advise the Minister on matters relating to any of [its other] functions or to conservation generally". The first "output class" nominated by DOC is "policy advice and Ministerial servicing". The Department has a "Conservation Policy Division" that is concerned with offering "strategic advice and policy analysis" to the government. Furthermore, DOC has a page on its web site (<http://www.doc.govt.nz/policies/>, October 1997) that suggests it sees policy advice as an important part of its functions. Finally, Fact Sheets prepared by DOC (in Department of Conservation, 1996a) state that the New Zealand Conservation Authority (NZCA) and the Conservation Boards advise DOC on policy issues among other functions. Why would the NZCA and the Conservation Boards have policy advising roles in reporting to DOC if the Department was not involved in developing policy advice for the government?

under pressure from various interest groups ... In general, the closer ministers are to the operational aspects of implementing policy, the more open they are to pressure from lobby groups.

Multiple objective legislation: The dual objective legislation under which DOC operates provides a formal loss of accountability and creates conflicts of purpose and direction. This is because fulfilling one objective tends to provide an excuse for failure to perform another. The conflicts arising from this dual objective make it extremely difficult for DOC to juggle competing demands on its resources and places DOC in an unenviable position. For DOC these problems are compounded by legislation that does not require the Minister to consider alternative land uses.

The combined effect of these three factors means that the evaluation of the best use of resources occurs on no known criteria. Additionally, pricing decisions, and decisions relating to resource use and allocation made by DOC, are frequently unrelated to costs. This provides hidden and often unpredictable subsidies to some activities, and erratic and confused signals to others.

DOC has not had to prioritise and put values on decisions relating to resource use. The only terms of reference for making decisions are founded on subjective values of conservation, and there is no way to assess the opportunity cost of using some resources, or a fraction of the estate, for different activities. In this system, industry fails to gain access to resources and conservationists cannot be sure that decisions made by the Department will result in the best outcome for conservation.

Schick (1996) also cited the possibility of these problems in general terms but warned that “decoupling does not necessarily separate policy and operations”. He further stated that “service providing units tend to grow their own policy capacity after they have been split off from the department”. However, the possibility of this occurring would be lessened where the service providing units are large in number, relatively small in size and decentralised. In particular, if the various conservation areas were managed as independent units with separate accounting and reporting responsibilities, the possibility of multiple policy advising agencies developing would be greatly reduced. In any case, even if there is some duplication in policy advising functions, the result need not be wasteful. Greater competition in the provision of policy and advice lessens the prospects of biased advice and enhances the prospects of alternative views being considered by the government and the community.

Schick (1996) commented that reform of New Zealand’s state sector must be continuous. Mistakes are inevitable, not least because New Zealand is at the frontier in many areas of government reform and often will not have the opportunity to learn from others. After a decade in operation, it appears that

the integrated operations of DOC (that is the policy, advocacy and management roles) have been given long enough to prove themselves. The disappointing progress in some of its core activities (particularly providing service to visitors, but also pest control and perhaps even species preservation), together with inadequate consideration of the alternative value of the resources it is controlling, suggests that it is time for a substantial reform of DOC operations. Functions need to be separated, and the associated conflicts of interest eliminated.

To these considerations, we would add the requirement that reforms should be made that move New Zealand closer to the long-term goal of increasing efficiency of resource use in conservation areas. In particular, greater encouragement for, and reliance upon, competition and private sector provision of conservation services would reduce costs and improve customer service.

In summary, the government's role in conservation ought to be restructured along modern lines. In particular, the Department of Conservation should be reformed by:

- separating service provision from funding, with more funding for conservation coming through user fees, net conservation value trades of resources and direct grants to scientific researchers;
- encouraging greater competition between conservation areas by making local managers compete for funds by providing services of value to users (including scientists in addition to tourists);
- allowing private owners to compete for conservation funds provided through the central government;
- making all operators in conservation areas legally liable for damages;
- removing the advocacy function from DOC and relying much more on regional councils and other decentralised bodies, including the newly competitive conservation areas, to help enforce the RMA;
- separating policy advice from the service functions; and
- restricting the current Department to a regulatory and funding role for activities that are primarily producing conservation outputs of a joint and diffuse nature and therefore which cannot be readily reflected in market prices under current institutional arrangements.

The independent policy development body could be responsible for developing market mechanisms to encourage greater private provision of conservation services. Such a body could also oversee funding of conservation outputs of a public good nature. It may also play a role in

ensuring competitive neutrality between public and private suppliers of conservation services. Its over-riding objective would be to ensure that policy is consistent with maximising the benefits that current and future generations of New Zealand residents obtain from the available natural resources – that is, with the sustainable development goals underlying the RMA. The result would be improved allocation of the full complement of resources available to the people of New Zealand including:

- proper consideration of all uses of resources, including the value of the “non-conservation outputs forgone” in the output bundle produced by conservation area managers;
- optimal use of private conservation initiatives; and
- maximum conservation value for a given sacrifice of alternative outputs that are also valued by the people of New Zealand.

The suggested restructuring of the central government’s role in environmental management, and in particular the harmonisation of the *Conservation Act* and the RMA, would appear to suggest that the proposed policy development body could become part of the Ministry for the Environment. Some people we spoke to in New Zealand suggested that the Ministry for the Environment also suffers from “a widely held view that it is not performing well at the moment”. We certainly do not mean to suggest that the RMA, or the Ministry for the Environment’s administration of that act, is beyond criticism. Furthermore, the New Zealand reform of public administration has demonstrated that there are benefits from encouraging competition between agencies providing policy advice to government. A thorough investigation of those issues is simply beyond the scope of this study. In the absence of such a detailed examination, however, we remain uncertain as to whether the proposed policy making body should be part of the Ministry for the Environment or remain separate from it.

Our suggested reforms would go well beyond the current review of DOC administration of existing functions. In a number of press releases in April and May 1997, the Department outlined some of the changes that have been instituted as a result of the review of its operations undertaken by a management consulting firm:³

Director General Bill Mansfield said today the changes would increase Regional Conservators’ responsibilities for operational management in their conservancies

³ See, for example, the documents available on the DOC web site (<http://www.doc.govt.nz/pressrel/>, October 1997).

and create new positions known as area managers. The proposals being considered also include a reduction in the number of conservancies in the North Island. The changes are designed to strengthen the Department's capacity to implement new quality systems and improve the efficiency of its work.

Similarly, in another press release on 27 May 1997 the Department stated:

The Department of Conservation has moved into the biggest phase of its restructuring with decisions on the basic structures to be applied in conservancies and field offices across the country.

More than 1200 staff work at this level. It is not expected that there will be a reduction in the number of staff but there are likely to be some redundancies as up to 50 positions are relocated to be closer to the field.

In announcing the changes, Director General Bill Mansfield said they strengthen line management within the Department to ensure conservation work is done to a high quality and managers and staff are accountable.

To do this conservators will have more involvement in managing operations. Area managers will report directly to conservators, rather than through operations managers as at present.

The area offices will be strengthened to manage all field operations and to ensure that more resources are located closer to the field work.

The philosophy underlying the restructuring process was outlined in a paper presented to a Royal Forest and Bird Protection Society Forum in December 1996, by the former Director-General of Conservation, Bill Mansfield:⁴

When you now ask as the theme of this forum, whether the current departmental restructuring is "Integrated Conservation Management or a recipe for disintegration?" I want to assure you emphatically that the vision remains unchanged, and that if anything, the present restructuring is to ensure that disintegration does not occur because of a failure to achieve consistently good performance.

The present restructuring is *not the result of a review of the Department's functions*, or its integrated conservation mission. Consistent with my role under the State Sector Act, I am the driver of this internal process, not the government, the Treasury, the State Services Commission, the Business Round Table, the Public Service Association or anybody else. What I have asked to be reviewed is the effectiveness of the Department in delivering those functions, with a view to improving, not removing delivery ...

I have therefore taken advice from management consultants *whose task is not to advise on the outcomes or functions laid down in the legislation*, but rather to bring

⁴ The paper is available on the DOC internet site (<http://www.doc.govt.nz/issues/bmcb190.htm>, October 1997). The emphasis of statements in the quote is ours.

their experience of organisational performance to bear on the question of the Department (and not any other organisation) delivering those functions ...

Our suggested reforms focus directly on the outcomes, the goals of the Department and the functions laid down in the legislation. The emphasis in the recent reforms on greater decentralisation of the Department is consistent with the direction of reform we are suggesting, but we are arguing for much greater separation of *functions* in addition to geographical separation, and much greater *competition* in the delivery of conservation services, not just greater administrative freedom.

In undertaking such a radical reform, all DOC functions and activities, and resources under DOC management, should be comprehensively reviewed to ensure resources are used to provide maximum value (in the widest sense) to the people of New Zealand. In particular, the government should also consider reclassifying land currently managed by DOC according to IUCN categories. There are presently around 50 classes of conservation land in New Zealand. This has produced an unworkable system of determining the classification and use of parcels of land. The number of land classes could possibly be reduced to around 5, thereby streamlining the allocation process yet not diluting the safeguards that ensure environmental sustainability.

Allocating environmental resources

Separating *policy advice* from the *operational responsibility* of the Department is particularly important for ensuring a thorough evaluation of alternative land uses. As stated by Hendry (1994) in the quotation above, the evaluation of the best use of resources currently “occurs on no known criteria”. What is required is a formal and transparent process for assessing uses for land under DOC control, and one that incorporates economic principles of opportunity costs of alternative uses.

If resource allocation decisions were made in a more decentralised way, local managers would have incentives to trade off alternative uses. Regulation of such trades could be implemented through decentralised legal processes occurring within the framework of the RMA and the environment courts.

The Ministry for the Environment (1995b) sets out mechanisms that can be used to determine the use of environmental resources. The paper suggests allocating rights and duties in deciding which living systems are allowed to sustain themselves and which are altered to achieve other purposes. The paper makes the point that:

the pursuit of sustainability does not mean an absence of change, it means interacting with other living systems in a way that enables those systems to continue functioning. This is different to seeking to maintain the capacity of a system solely to perform a particular task or provide a particular resource. A healthy system will sustain a flow of resources to be used by people. The determination of the potential resource flows available requires a characterisation of the system and its patterns of relationships with other systems.

Thus, the preferred allocation process explicitly acknowledges that all resource uses, including conservation, effectively involve managing change. All natural systems can be managed to yield a sustained flow of outputs desired by people. The relevant question is not whether something of value to people *can* be provided. Rather, the key question involves characterising the trade-offs involved in producing different outputs and thus the most desirable *mix* of outputs to be produced from each set of resources. Management should rarely if ever be aimed at producing a single output or a single state of a living system, since multiple use will generally yield greater value.

The MFE report explicitly acknowledges that decisions that affect living systems concern the allocation of rights and duties between individuals and communities and interactions of people with living systems. Thus, while emphasising “ecological integrity” as an important output from the management of resources, this “living systems” approach still demands the consideration by the community of alternative uses of resources.

While by no means devaluing conservation outputs, such an approach may lead to more valuable uses of resources for current New Zealand residents by maximising “net conservation values”. So long as resource use occurs within a “sustainable use” framework, such mechanisms could also improve the welfare of future generations of New Zealand residents.

A capital charge for DOC

One of the reforms to the State Sector involves levying a charge on the net worth (assets minus liabilities) of departments and some Crown entities. When the charge is first assessed, department operating budgets are also increased so the designation of a capital charge has no immediate effect on departmental cash flows. If the department subsequently reduces the amount of capital it uses, however, the resulting gain in net income can be used for other purposes.

Capital charges were meant to be applied to assets valued in financial statements, such as buildings, information technology equipment and cash appropriated for depreciation or held as working capital. The purpose of the

charges is to signal that capital is not costless and should be managed on the same basis as other inputs to production.

Imposing capital charges also supports the concept of competitive neutrality between the public and private sector, and thus aids efficiency where the two sectors compete in product markets. The policy thus also assists managers to better judge whether tasks should be contracted out rather than produced in-house.

We support the application of the capital charge and commend New Zealand for being a leader in applying such private sector practices to the state sector. However, we believe that the concept can be taken one step further to make it even more consistent with private sector practices. In particular, the value of land managed by a department on behalf of the Crown should also be included in the asset base of the department *and be subject to the capital charge*. Land as much as other items of capital should be managed efficiently by government departments. Such a change may, however, have a significant impact on DOC, which is responsible for managing a large and valuable parcel of land.

One option for applying such a charge to DOC land would simply be to allocate a fixed charge (maybe the standard charge of around 11.5%) to the nominal value of the land. This would be consistent with the treatment of other asset classes. Since it would value all land equally, however, it would not achieve the desired goal of encouraging the Department to balance out the value of alternative uses.

A more useful approach would be to allow other parties that may want to use the conservation estate to bid a price for doing so. That becomes the “market value” of the land for capital charge purposes. DOC would get a new budget line representing payment of “rent” for the capital item and a new cost (equal to the rent). If it sells the capital and replaces it with “lower rent” capital, it has a gain in operating income. The presumption would be that until someone proposes an alternative use, the land has zero “opportunity cost” – or highest value under an alternative use – and no capital charge would apply.

The idea behind the reform would be to drive efficiency in the use of land by government departments. For example, it would give DOC the right incentives to balance out the costs and benefits of conservation relative to other resource uses. Conservation could take place on land that is suitable for other purposes. If the conservation value is not great enough to offset the other use values, however, DOC would have an incentive to “cash out” that land and buy other less valuable land instead.

Separating advocacy from operations

It is not uncommon at present for some parts of DOC to be working constructively with members of the community (such as farmers and industry) while another part of DOC is opposing the same parties in the Environment Court. The adversarial role interferes with attempts to build better community relations and achieve desirable outcomes through cooperation and consent.

To overcome this problem, it would be desirable to separate the advocacy function of DOC from its operational function.⁵ This would allow DOC and the community to develop confidence in each other's intentions and operating procedures. Confidence would in turn allow negotiators to reveal sensitive information and form lasting agreements and partnerships that could be very effective for achieving conservation and other goals. A more enduring relationship encourages a more frank discussion of ideas and intentions and reveals new approaches that might prove more satisfactory for all concerned.

A referee also pointed out that it is most unsatisfactory that:

DOC and not the regional councils is responsible for managing the coastal water and sea bed. There is no valid reason for not giving that function to the regional councils under the RMA as is done for inland waters and lakes. Split jurisdictions at the high tide line give rise to much useless argument.

Another major problem with the current advocacy role for DOC is that it is affected by the vague and unworkable goal of "intrinsic value". How can DOC argue that a particular resource use will have adverse consequences for conservation when there is no objective measure of the value of those outputs? The essence of sustainable use is a balancing of the values provided by alternative uses of resources. In order to do this, a court needs to have a way of measuring and comparing the different values.

Separating government departments into smaller units can be costly if it forgoes economies of scale or scope (for example in corporate management). However, the offsetting benefits in more efficient use of resources could more than compensate for any increased administrative burdens.

⁵ It has been pointed out to us that DOC is not alone among government departments in performing an advocacy role under the RMA. Other departments "such as Forestry, Fisheries and Commerce also have, and extensively exercise, an advocacy function". Our criticism of DOC performing this role is not, however, based on a contention that its position is unique. Rather, we are concerned with the conflicts that arise as a result.

Importance of leadership

Reforms to New Zealand's state sector have given unprecedented control to the Chief Executive (CE) or, in DOC's case, the Director-General. Under a philosophy of "let the managers manage", the CE often has considerable influence over the direction of the department, the manner in which it operates and the outputs it produces. For example, the *State Sector Act* empowers the CE to recruit senior and middle managers, use appropriated funds and organise operations to produce agreed outputs, determine the composition of inputs and report on outputs and outcomes. Of course, the CE remains responsible to the relevant Minister, is bound by legislation and is made accountable through various mechanisms, including the achievement of output-based targets.

Schick (1996) states that:

The New Zealand reforms are utterly dependent on robust, entrepreneurial, risk-taking managers. At every turn, the reforms are built on the expectation that empowered managers will take initiative in revamping operations, reallocating resources and pointing the organisation in new directions. ... Without strong management, New Zealand departments would be about the same after reform as they were before, but with high transaction costs⁶ and greater risk to government.

Conceivably, the independence enjoyed by the CE could reduce the need for extensive restructuring of DOC along the lines suggested above. For example, the new Director-General of DOC may be more favourably disposed to systematic evaluation of alternative uses of resources under DOC management and to strict separation of the advocacy, policy advice and management roles of DOC.

However, given the legislative directives for DOC, the lobby groups it so closely associates with and the culture of the organisation, we suspect it would be very difficult for a CE to alter the *modus operandi* of DOC under the current structure.

⁶ Transaction costs were defined in chapter 2 as the costs of defining, enforcing and transferring property rights. The term is also used more generally to cover the costs of other types of "transactions" or "exchanges" or "transfers" of information. Schick is here referring to the costs of monitoring and motivating employees and transferring information and resources within a government department.

Coordinating environmental management across organisations

Current government management of environmental policy was outlined in chapter 1. We noted that there is a quite complicated interaction of agencies that guide, oversee and complement the activities of DOC – although the organisations are not separated along functional lines.

The main outcome of the current structure is an overlap of organisations involved in quite similar activities – particularly broad conservation policy. While this has provided avenues for broad public input into conservation issues, and competing sources of advice to governments, it has also acted to maintain the status quo. In particular, there has been little provision for input by individuals and organisations with alternative viewpoints regarding the use of resources managed by DOC.

MEASURING THE PERFORMANCE OF DOC

We intended to undertake a detailed benchmarking exercise as part of this study. Our initial aim had been to compare DOC performance at an aggregated level with similar organisations operating in Australia. We also had intended to compare the performance of individual conservancies within DOC. The aim would be to assist the development of reforms that could help reduce costs and increase efficiency in other ways.

Again we emphasise that such reform is not our first best approach to providing improved conservation strategies for New Zealand. Our preferred approach involves greater reliance on competition and private sector provision of conservation services, and associated radical reforms to the structure and functions of DOC. We nevertheless viewed our brief as asking for suggestions for a range of reforms of varying degrees of radicalness and with different time horizons. Thus, we also outline in the remainder of this chapter ways of using benchmarking techniques to improve the operations of the Department of Conservation *as it is currently structured*.

These ideas are put forward only as suggestions. We would expect them to be extensively modified in the light of experience. In addition, while our suggestions are tailored to the current structure of DOC, many of them may also be of interest to private entrepreneurs, or regional managers in a more decentralised department, who are competing to supply conservation services.

As was reported in a number of New Zealand newspapers in February 1997, we wrote to DOC in October 1996, offering to benchmark DOC operations. We informed DOC that Tasman had recruited a number of

former employees of the Industry Commission and the Bureau of Industry Economics in Canberra who had “extensive experience benchmarking public sector enterprises”. We said that

We would be very keen to make that experience available to the Department of Conservation in New Zealand as part of our consultancy for the New Zealand Business Roundtable. We believe that this would add considerably to the value of the exercise for the people of New Zealand. The only cost to the Department of Conservation would be the time some people in your organisation would have to devote to providing us with relevant data and other information. We would also keep these people fully involved with the exercise to ensure that the analytical tools we develop can be maintained without further consulting input.

The then Director-General of DOC responded that the benchmarking exercise would not provide valid or useful results in view of the Department’s restructuring. While he appreciated our offer, he said it came “at an inappropriate time for us”. He further stated that:

An extensive study of historical data will not provide the basis for benchmarking the department’s performance under the new structure and systems currently being introduced.

Thus, DOC declined to provide detailed information about their activities.

In response to the reply from the then Director-General we wrote a further letter explaining:

Benchmarking was originally developed to provide useful broad indicators of the relative efficiency of organisations engaged in similar lines of business. It also can be used to compare different divisions within an organisation. When used in this way, benchmarking can be a powerful tool to assist management in identifying more successful modes of operation that can be disseminated throughout the organisation.

The application of these techniques to the Department of Conservation would depend partly on the available data. We would expect, however, to focus on statistics such as:

- areas managed in different regions,
- estimates of populations of endangered species,
- terrain and extent of weed and pest activity,
- numbers of visitors, and accessibility,
- numbers of employees,
- other operating expenditures,
- capital expenditures,
- expenditures on weed and pest control,

- administrative staff,
- accidents, and
- revenues.

While we would expect our analysis to generate controversy and be subject to much debate, we believe that only by engaging in such an analysis and debate can the Department hope to achieve the greatest output using its available resources.

We added:

We are aware, of course, that your time is extremely valuable, as is that of your staff. We asked for your cooperation in the expectation, however, that the Department would be anxious to engage in any activity which, while requiring no commitment of financial resources from the Department, nevertheless is likely to assist accountability and public discussion of the Department's activities.

Our view is that a study of recent DOC performance (using historical data) would have been very timely as it could provide benchmarks to be used to assess the effectiveness of the new structure and systems. These benchmarks would be relevant, given that the main activities of DOC have not changed as a result of the restructuring. Furthermore, if the benchmark analysis had revealed deficiencies in the previous management or structure of DOC, an ideal time to learn about those defects would have been when the Department was undergoing a major restructuring. Any reforms revealed to be desirable would have been easier to implement at that time.

We made another unsuccessful attempt to engage DOC after its restructuring exercise was completed in mid-1997. In recent correspondence, we have been informed that the Department intends to undertake a benchmarking exercise in 1998. We encourage the Department to persevere with this intention. It will not be easy, but we believe it has the potential to provide substantial benefits.

It is our understanding that DOC has a management information system capable of providing detailed information for performance appraisal purposes. For example, the system includes detailed regional level costings as well as information on individual projects. We were unable to view details of this system.

DOC did provide us with some performance data. These mainly comprised core public documents such as DOC annual reports and *Conservation Action: DOC Achievements and Plans*. These documents contain the major performance measures that DOC reports to Parliament and the State Services Commission as part of the accountability process.

The measures are supposed to reveal the quantity, quality, timeliness and cost of core DOC outputs. While this is a very sound *conceptual framework* for

measuring the performance of an organisation, the measures actually reported by DOC cannot be used very extensively in a benchmarking exercise. This is mainly because they do not generally encompass data on the physical quantity of inputs required to produce outputs. Another defect is that the measures do not reveal the cost of producing specific units of output (although they do have broad revenue and expense data by output class). Later in the chapter, we provide more information on the performance measures generally reported by DOC.

Efficiency and effectiveness measures of conservation activities, especially those relating to the management and operation of parks, have been developed in organisations similar to DOC, for example the Department of Natural Resources and Environment in Victoria. Benchmarking exercises have also been undertaken by the Australian New Zealand Environment and Conservation Council (ANZECC) Standing Committee on Conservation.

While such measures exist, they are generally in the developmental stage. There is not yet an established core of detailed efficiency and effectiveness measures used by conservation authorities worldwide.

One reason for this is that it is very difficult to develop measures that accurately reflect the performance of these organisations, given the diversity of tasks they undertake (including conservation, tourism, education, visitor services, advocating for conservation on private property) and the subjective trade-offs involved in producing many of these outputs (such as conservation versus tourism). Further, the differing operating conditions faced by different organisations (such as climate, geography, ecosystems) make it difficult to attribute reasons for differences in performance.

Nevertheless, there is merit in developing efficiency and effectiveness measures. The lesson from other applications is simply that the researcher needs to be very careful in drawing conclusions from any performance measurement or benchmarking exercises. Such exercises should be viewed as indicating discrepancies in performance either between entities or over time that warrant further investigation. We discuss the potential usefulness of performance benchmarking activities in more detail later in this chapter.

A corollary of the lack of an existing literature on performance measures for conservation activities is that conservation is not monitored as effectively as many other areas of government (such as education and health). In line with the evolution of the management of New Zealand's system of public administration we would expect that the government, as purchaser, would expect improved monitoring of DOC activities over time.

After discussing the broad usefulness of, and approach to, performance benchmarking, we shall briefly consider the type of indicators we have collected from DOC before investigating more appropriate indicators and data reported elsewhere. The chapter concludes with an outline of possible measures that could be considered for a benchmarking exercise within DOC.

Usefulness and nature of performance benchmarking

The provision of conservation services in New Zealand is dominated by DOC, which is generally not directly subject to competitive pressures. The development of performance benchmarks offers a way of introducing so-called “yardstick competition” to DOC’s activities by comparing actual performance internally and against international counterparts. These measures can be used by DOC management and the government to identify areas where there is potential to improve performance. The regular use and reporting of such measures could also increase the accountability of DOC to the government.

The objective of performance benchmarking is not simply to form a report card and grade people, but to help facilitate a program to improve efficiency. The philosophy behind benchmarking is well summarised by the Innovation Network (1997, p 2) as follows:

As a change management tool, benchmarking broadens the horizons of your management and employees by helping them realise that “there can be a better way”. The successful benchmarker sheds the “not invented here” syndrome by ridding itself of such notions as “We can’t learn anything from others”, “We’re as good as you can get”, “There is no one outstanding”, or “We’re unique and can’t be compared to anyone else”. Instead, a philosophy emerges characterised by attitudes like “We’ll borrow shamelessly”, “We can learn something from anyone”, and “We don’t have all the answers”. It forces people to talk openly and honestly with their counterparts.

However, performance benchmarking of DOC activities is very complex. It needs to focus on measures associated with inputs, processes, outputs and outcomes. *Input measures* relate to the resources employed by the enterprise – labour, materials, land, services, equipment and buildings. *Process measures* relate to the way the service is provided and include measures of quality. *Outputs* are the services actually delivered by the enterprise, or the effect the enterprise has on the services delivered by others. Some analysts have extended this to also include potential or “supply-side” output, which includes the capacity to provide services. *Outcome* or *effectiveness measures*

relate to the extent to which the enterprise's operations contribute to meeting broadly defined policy or social goals.

When comparing DOC and similar agencies internationally, or even when comparing different DOC conservancies, measures need to be adjusted for influences beyond management's control such as different climates, geography or ecosystems. One needs to compare like with like. This could be achieved by comparing units of organisations that conduct similar functions under similar conditions. Alternatively, performance measures can be adjusted for "operating environment" characteristics beyond the control of management.

Notwithstanding the intention to adjust for differing operating conditions, this is difficult to do in practice. Thus, it is always important to be very careful in drawing conclusions from any performance measurement or benchmarking exercise. One approach is to focus on explaining reasons for exceptional performance (good or bad). These outliers are a pointer to where it *might* be worth spending more time investigating what is going on – not "proof" of efficiency or inefficiency. Thus, broad benchmarking comparison of outputs can be refined to the process level to locate reasons for differences in performance and ways of overcoming performance shortfalls.

Considerations in choosing performance measures and forms of comparison

As noted by Lawrence (1997), the principal criteria for choosing a set of performance measures are that they be comprehensible, comprehensive, useable and timely. In turn, for a set of measures to be comprehensible the intended audience must find them easy to understand and interpret. They also need to be relatively few in number. Yet, to be comprehensive, they must cover most of an entity's operations. Timeliness is required to provide feedback as close to the event as possible. For measures to be useable they need to be easy to calculate.

Performance measures can generally be divided into three broad categories: accounting, non-financial and economic indicators. Accounting ratios are typically classified as: operating ratios, leverage and liquidity ratios. Non-financial measures are usually tailored to the enterprise and its industry but typically cover efficiency, effectiveness, and service quality. Non-financial efficiency measures usually consist of either simple partial productivity ratios, such as labour productivity, or technical or engineering measures of system performance. Partial productivity measures are widely used as they are simple to calculate. However, they should be interpreted

with caution since most production processes involve interactions between the effects of different inputs – for example, the productivity of unskilled labour inputs depends on the amount of skilled labour or capital.

Economic measures usually comprise total factor productivity (TFP) and the economic rate of return on investments (ERR).

TFP measures total output relative to all inputs used. More specifically, the TFP index measures the impact of all the factors affecting growth in output *other than* changes in input levels. In order to calculate the TFP index, one needs to assume a particular functional relationship for the way inputs are combined to produce outputs. However, there are relatively flexible functional forms available for this purpose that allow a wide range of production processes to be represented without too great a fear of distorting reality.⁷

The ERR is defined as the ratio of economic income to the opening market value of the enterprise's assets. Economic income is defined as the enterprise's cash flow (earnings before interest and tax plus accounting depreciation) plus the change in the market value of the enterprise's assets during the year. The ERR provides the best means of comparing government enterprise performance with that of the private sector. However, in practice it is often very difficult to accurately assess changes in the market value of government enterprises' assets. The lack of a market for many of the assets in question often means that valuations are determined on an accounting rather than economic basis. For example, historical or written down replacement costs are used rather than market value as indicated by sales of similar capital assets or through stock exchange valuations of equities or bond market valuations of debt.⁸

The forms of external and internal comparison most commonly used are targets and time series. Target setting can suffer because of its subjective nature, which may not correlate with the potential for optimal efficiency improvements. Time-series comparisons of performance within an enterprise provide a useful indication of changes in performance but do not allow performance to be compared across enterprises. Comparisons between

⁷ A researcher needs to keep this fact in mind, however, and allow for the possibility that a particularly "anomalous" TFP measure could actually reveal that a different functional representation of the production process might, in that particular case, be desirable. Thus, a low TFP may not necessarily indicate "inefficiency" in production.

⁸ The related issue of likely differences in efficiency between corporatised publicly owned and privately owned firms is discussed in chapter 2.

comparable business units within an enterprise form an important basis of so-called “yardstick competition” but still do not indicate achievable best practice.

External comparison of an organisation’s performance with that of its peers, both domestically and internationally, provides the best basis for comparison. It highlights where the organisation stands in regard to international best practice and indicates those operations most amenable to improved performance. Combined time-series and cross-section (or “panel”) data provide the fullest possible picture by showing not only how the organisation compares with others at each moment but also how performance has changed through time.

Performance measures inevitably evolve through time. As experience is gained in forming and using measures, the enterprise can refine them to meet its requirements. Enterprises may start off with relatively simple measures and progress to more sophisticated measures as experience is gained and better quality data become available. Indeed, a major benefit of a formal benchmarking program is that it provides managers with an incentive to collect data and present them in a way that is comprehensible to others inside and outside the organisation. As additional data are collected, new performance measures become feasible.

Main performance measures reported by DOC

As mentioned earlier, the main indicators of DOC performance the government uses for accountability and resourcing purposes are presented in its annual reports (for example, DOC, [1996b]) and, in somewhat more detail, in *Conservation Action: Department of Conservation Achievement and Plans* (DOC, undated).

Typically, there are nine output classes against which DOC is judged. In 1996, there was a special category relating to the Cave Creek tragedy (Table 7.1). The annual reports present multiple physical output measures within these output classes and data on revenue and expenses for the current year (actual and estimate) and the previous year (actual). The *Conservation Action* report presents data for the current year and projections for the next year.

These measures are useful in that they describe the key activities undertaken by the Department and place pressure on DOC to meet specific targets agreed with the government. There is also a link to financial data via the reporting of total revenue and expenditure by output class. Quality measures are not reported in much detail in the annual report (DOC, 1996b)

but have slightly more coverage in the *Conservation Action Report* (DOC, undated).

TABLE 7.1: Output classes and associated measures included in DOC reporting to government, 1996

<i>Output class</i>	<i>Typical measures reported</i>
Policy advice and Ministerial servicing	Number of draft replies to Ministerial correspondence
Implementation of legal protection	Number of legal protection agreements
Statutory planning and RMA coastal responsibilities	Regional policy plans and consent applications assessed
Management services: conservation estate	Number of animal and plant pest control projects
Management services: protected species, island habitats	Number of recovery programs for plants and animals
Manage statutory actions, leases, licences, concessions	Number of concessions managed
Provide recreational opportunities: access, facilities, services	Number of huts, shelters managed Number of roads, bridges inspected
Management of visitor and public information services	Number of displays, newsletters, events
Conservation management strategies and servicing of statutory bodies	Number of management plans under way
Commission of Inquiry into Cave Creek	Performance against deadlines

Source: Department of Conservation's annual report (DOC, 1996b).

However, it is questionable whether the measures are truly outputs. Many of them would appear to be more in the nature of inputs than outputs. For example, animal and pest control projects are undertaken to reduce animal and plant pests – the reduction in target species is the required output, the number of programs undertaken is an input used to achieve the required output. The Department is managing resources on behalf of the people of New Zealand, who are its ultimate “customers”. There needs to be more of a focus on what the actions taken by DOC *achieve* for these customers rather than simply an enumeration of actions taken. This issue is discussed in more detail below, where we suggest alternative measures of outputs.

We also would recommend that DOC publicly reports measures that indicate the *efficiency* of its operations. This could be achieved by dividing

many of the output measures reported in the annual report by the physical or financial resources required to achieve them. For example, the cost *per* reply to ministerial correspondence and the number of replies *per* officer. An outline of possible efficiency measures for DOC is provided in the final section of the chapter.

In general, DOC does well against the measures set for it. This may be because:

- it is effective in undertaking many of the tasks it is set;
- the targets are not too onerous; or
- a combination of the above.

Again, the problem is that we cannot tell which of the above holds from the information provided. Anecdotal evidence is that DOC is efficient “on the ground” – that is they are cost-effective in undertaking the tasks they have decided to do. They apparently also contract out quite extensively. Well specified efficiency measures, benchmarked internally and against international counterparts, would help to ascertain whether DOC is an efficient and effective organisation and whether the targets are appropriate.

Relevant performance measures reported by other organisations

DOC should critically examine the performance measurement activities of similar organisations in other countries to:

- review its own performance measures for effectiveness; and
- make its measures readily comparable with other organisations.

As mentioned earlier, performance measurement in conservation organisations is lagging other government and business sectors worldwide. However, we have been able to find good examples of performance measures reported by other government conservation agencies and related organisations, particularly those in Australia. We report measures from the following sources:

- Australian New Zealand Environment and Conservation Council (ANZECC) Standing Committee on Conservation; and
- the Victorian Department of Natural Resources and Environment.

ANZECC Benchmarking and Best Practice Program

ANZECC is a strategic partnership of national park management agencies from all states and territories of Australia and from New Zealand. One

element of the Council's operation is a National Parks Benchmarking Best Practice Program. The stated aims of this program are to:

- develop a better understanding of other agencies and the outside world;
- develop improvement targets;
- facilitate improved productivity and performance;
- stimulate change and a culture of continuous improvement; and
- stimulate the development of a forward-looking organisation.

Stage 1 of the benchmarking program was a profiling exercise amongst the member organisations against four parameters – generating six indicators:

- total recurrent cost per visitor;
- total recurrent cost per hectare;
- percentage user pays to total recurrent cost;
- percentage total labour cost to total recurrent cost;
- total number of effective full-time staff; and
- distribution of staff by occupational category.

Information was sought from all ANZECC member agencies by questionnaire. Responses were received from all agencies *except* DOC. Tabulations and graphs were produced to clearly show the relative performance of each organisation against each measure. The information was interpreted with caution. The point was made that the information should only be used as a guide but may be of value to establish agency performance targets and provide an indication of trends in agency performance over time.

We would recommend that DOC become more involved in the benchmarking activities undertaken by ANZECC.⁹ This would help DOC to achieve many of the aims outlined above. The government, as purchaser, also should encourage DOC to become more involved in the ANZECC Benchmarking and Best Practice Program.

⁹ We have been informed that DOC is an active member of ANZECC in other respects. For example, the visitor structure standards developed by DOC are used as best practice among members. Indeed, when one of the authors recently visited a conservation area in Tasmania he was told that structures were being upgraded “to match the standards developed in New Zealand following the Cave Creek tragedy”.

Measures used by the Victorian Department of Natural Resources and Environment

The Victorian Department of Natural Resources and Environment (DNRE) has undertaken a number of benchmarking exercises to compare its performance both internally and against other similar organisations. These exercises have been undertaken both independently and as part of the ANZECC work program. It should be possible for DOC to report data in a similar format to that used in Victoria and thus to compare its performance against aspects of the Victorian Parks Service.

An internal benchmarking exercise undertaken by the Department in 1996 compared the performance of 37 separate Victorian districts in undertaking National Park activities (Department of Conservation and Natural Resources, 1996). The main indicators are outlined in Table 7.2. The data are not reported as they have not been publicly released. However, the data may be made available to DOC, in some form, to allow performance comparisons. DOC should be able to calculate the indicators in Table 7.2, gauge broad trends against international operations and identify outliers within its own operations. An analysis of this information would most likely identify areas where resources should be reallocated.

TABLE 7.2: Internal benchmarking of Victorian National Parks, 1996

<i>Indicator</i>
Total recurrent base budget per hectare
Conservation and protection budget per park hectare
Total recurrent base budget per visitor day
Visitor use budget per visitor day
No. of rangers per 100 000 visitor days
Patrol days per 100 000 visitor days
Overtime and allowances in total recurrent base budget (%)
Labour cost in total recurrent base budget (%)
Projected revenue per \$100 visitor use budget

Source: Department of Conservation and Natural Resources, Victoria (unpublished).

Melbourne Parks and Waterways (1996) also undertook a relevant performance monitoring exercise before it was amalgamated into Parks Victoria. The results are presented in Table 7.3. Again this provides a

potentially useful set of comparative data that DOC may be able to benchmark itself against.

TABLE 7.3: Melbourne Parks and Waterways performance indicators

<i>Indicator</i>	<i>1995–96</i>
Non-financial indicators	
Total park visits (million)	5.3
Customer satisfaction with park visits	79
Community satisfaction with park management	81
Percentage of natural/semi-natural areas under “active conservation management”	25%
Percentage of parks and waterways meeting customer guarantee for environmental management	To be developed
Financial Indicators	
Total cost per hectare open to the public	\$4,043
Total cost per hectare owned or managed	\$2,970
Total cost per visit	\$2.92
User-pays to total revenue	6%
Employee Indicators	
Employees on performance plans (%)	100
Total sick days per employee per annum	3.2
Lost time injuries per employee (days)	0.02
Days lost in industrial disputation (days)	0

Source: Melbourne Parks and Waterways, *Corporate Plan 1996/97–1998/99*.

Outline of possible performance benchmarks for DOC

Given the measures outlined above and other indicators we have considered in undertaking this research, we have compiled a broad list of indicators that could be used for internal and international performance comparisons of DOC activities.

Park and reserve management

Key characteristics relating to each park or reserve:

- Expenditure (\$m) (categorised into ordinary time and overtime labour, equipment, program type – such as pest control, visitor services, and so on);

- Revenue (\$m) (categorised into visitor fees, parking fees, franchise fees, mining exploration fees, and so on);
- Number of hectares;
- Proportion of regional land area (for example, proportion of Northland land area);
- Habitat types in area (such as forest area, grassland, wetland) and proportion of national inventory of habitats of that type;
- Visitor days (m) – overseas versus domestic if available;
- Total staff – also the category breakdown for staff; and
- Measures of significant staff activities such as patrols, scientific work and pest eradication.

These indicators have been selected to provide a broad profile of the conservation organisation being investigated. They include the profiling variables used by the Victorian Department of Natural Resources and the Environment (1996). They allow for the calculation of financial and non-financial indicators as outlined below. While this is quite a comprehensive set of indicators, the number of indicators used in any benchmarking exercise could be altered depending on data availability and the purposes of the specific exercises.

General financial indicators

- Expenditure and revenue (\$m) – as detailed above;
- Operating ratio – revenue as a proportion of operating expenditure;
- Net expenditure, that is, expenditure minus revenue from user fees;
- Proportion of head office staff to total staff;
- Expenditure per hectare owned/managed;
- Expenditure per hectare opened to public;
- Net expenditure per hectare;
- Staff per million hectares;
- Expenditure per staff member; and
- Net expenditure per staff member.

These data will provide a good indication of the relative cost recovery of conservation organisations, the level of costs and components of staff costs in total costs. These data should be readily available and thus conducive to comparison across different conservation authorities. These are “first order” benchmarks that may highlight outliers that warrant further investigation.

Tourism-related indicators

- Visitor days (m) – overseas versus domestic if available;
- Visitors per hectare per year;
- Visitors per day per staff member;
- Cost per visitor;
- Revenue per visitor;
- Levels, patterns and trends of visitor use, demographic profiles;
- Satisfaction of visitors (which, of course, requires “Parks Satisfaction Indexes” to be constructed);
- Inventory of tourism facilities (information centres, publications, guiding services, signs, maps, weather advice, registration of hikers, tracks, huts, toilets, camp grounds, water supplies, roads, bridges, viewing platforms, search and rescue);
- Condition of tourism facilities (physical or customer rating);
- Cost of tourism facilities – capital and maintenance;
- Expenditure on marketing and education; and
- Effectiveness of marketing and education.

Of particular importance here are the profiles of park visitors and the customer satisfaction indicators. These are being used extensively in many conservation (and other service) organisations throughout the world. The information we have received suggests that DOC needs to enhance its collection of information from park visitors to aid marketing exercises and review resource allocation priorities. For example, data could be collected on the origin of visitors and used in travel costs studies to provide an indication of visitors' valuation of conservation.

Costs of undertaking particular tasks

Unit costs for standard tasks such as:

- walking track maintenance;
- road maintenance;
- fencing;
- spraying for weeds;
- eradicating possums, rabbits, mustelids;
- maintaining camping grounds (per hectare);

- fire control; and
- corporate overheads.

A more detailed benchmarking exercise could focus on key tasks that are undertaken by a number of conservation organisations. By choosing a set of similar, standardised activities it is possible to obtain meaningful indications of the relative cost, efficiency and effectiveness of key conservation tasks. The tasks outlined above are central to most organisations managing state or national parks, including DOC. It would be necessary to further specify the details of many of these tasks to ensure that like was being compared with like. For example, one would need to take steps to ensure that walking tracks and roads were of similar composition and standards, or that fences were being built with similar materials and design specifications. This type of exercise could also be repeated over time within an organisation to gauge trends in costs and efficiency and possibly to compare in-house and contracted activities.

Conservation-related indicators – on and off parks and reserves

These indicators would attempt to produce quantitative measures of the conservation services provided by DOC – such as endangered species management, wildlife research, ensuring desirable biodiversity, eradicating pests and weeds, and fire risk control. They could include:

- changes in the condition of the biological and physical features of parks (that is, information on the existence of flora and fauna species in parks, the overall condition of these species and data on pest plants and animals);
- community satisfaction with management of conservation assets;
- percentage of natural area under “active conservation management”; and
- extent to which parks and reserves meet IUCN criteria as “protected areas”.

To measure the conservation of biological diversity,¹⁰ measures such as the following could be collected:

- Ecosystem type by age class or successional stage;

¹⁰ Customer valuation measures suggested under other sub-headings above should also be used to relate these biological measures to the other economic variables.

- Ecosystem type by protected area categories as defined by IUCN or other classification systems;
- Number of park-dependent species;
- Status (threatened, rare, vulnerable, endangered, or extinct) of park-dependent species at risk of not maintaining viable breeding populations, as determined by scientific assessment;
- Genetic diversity – number of park-dependent species that occupy a small portion of their former range;
- Population levels of representative species from diverse habitats monitored across their range; and
- Measure of the extent to which bioregions¹¹ are represented in the parks and reserves system.

Reporting accurate and meaningful conservation indicators that allow for comparison between different organisations and regions is extremely difficult. Data are often not available or are expensive to obtain and the characteristics of individual ecosystems are often very different. However, with the above range of indicators in mind, it may be possible to at least make a start on benchmarking conservation outcomes. Once measures have been collected, comparison of changes in their value over time for the one park or region may provide very useful information. While some of these measures are no doubt collected by individual scientists or park managers, there is an advantage in systematising the procedure. Measures from different parks or regions may then be more easily compared, while senior managers will find measures easier to interpret when they are all provided in a similar format or calculated in a similar way.

Restoration and conservation of historic resources

- Number and type of historic assets conserved;
- Number and type of historic assets restored;
- Cost of restoration and conservation of historic resources;
- Revenue from restoration and conservation of historic resources;
- Staff undertaking restoration and conservation of historic resources; and
- Customer satisfaction with restoration and conservation of historic resources.

¹¹ These were also discussed in chapter 6.

These indicators could provide a profile of the cost and labour productivity of undertaking restoration and conservation of historic resources. Any anomalous areas of performance would become evident and could be subject to further investigation. This would represent a first step in benchmarking an area that historically has not been subject to such investigation in most countries.

Employee indicators

- Percentage of staff on performance plans;
- Sick days per employee;
- Lost time due to incidents;
- Time lost due to industrial stoppages; and
- Response to employee attitudes surveys.

Most organisational benchmarking studies include an analysis of employee performance including the type of variables outlined above (for example, the Victorian Department of Natural Resources and the Environment [1996]). Thus, it should be possible to compare DOC performance with that of other conservation organisations and even with organisations operating in other industries. Based on conversations we had in New Zealand, we would expect DOC to perform quite well when evaluated according to most of these indicators.

Calculated measures

As we indicated above, collecting these various types of statistics is only part of the benchmarking exercise. Once the “raw data” have been collected, they can be used to calculate various ratios, productivity measures and so on. Again, these measures need to be calculated and reported on a consistent basis if they are going to be useful in assisting management to improve the performance of the organisation.

CONCLUDING REMARKS

DOC would not provide access to information that would allow us to accurately gauge its efficiency. However, irrespective of its “technical efficiency” in undertaking its current tasks there is extensive qualitative evidence of “allocative” inefficiency – resources under the control of DOC are not being allocated to their most highly valued uses. Parts of the DOC estate producing highly valued conservation outputs are often not receiving sufficient attention due to expenditure of scarce DOC resources on land only

capable of producing conservation outputs of much lower value. In other cases, land that is being utilised for conservation is more highly valued in other uses (such as mining or forestry).

This problem has been exacerbated by the lack of an independent mechanism to ensure an appropriate allocation of DOC land between conservation and other uses. Reclassifying land and appropriately compensating DOC would lead to “net conservation benefit” by increasing the total amount of resources available to DOC and simultaneously directing its efforts towards areas of higher conservation value.¹²

Extending the capital charge for DOC to include a charge for the “opportunity value” of the resources under its control – that is, the value, if any, that those resources would have in their next best *alternative* use – also would encourage DOC to make a more rational trade-off between conservation and other uses. An increase in the value of alternative uses should raise the capital charge (*and budget*) for DOC.

In spite of the successful reform of most of the New Zealand state sector over the last decade, DOC has remained an “integrated” department – combining the functions of policy advice, advocacy, purchasing and providing conservation services and regulating private operators using conservation areas. After a decade of continuing with the old integrated model, with no obvious signs of improvement in performance, we believe it is time that DOC fully embraced the new model of government operations. The Department needs to be radically restructured to remove conflicts of interest and produce a range of organisations with narrower and more transparent objectives. In particular, the new policy development body should ensure that conservation policy is consistent with the sustainable development objectives of the RMA.

A reclassification of land managed by DOC should also be considered, with attention paid to those areas that might be more efficiently managed by private operators. Land remaining under public ownership should be classified according to IUCN categories and have the capital charge extended to apply to it.

Whether or not such radical reforms are proceeded with, we believe that DOC should extend the public reporting of its performance. For example, its annual reports should include indicators of efficiency and effectiveness, not just raw inputs and outputs. These indicators should be used by management to influence resource allocation decisions. DOC could also

¹² This issue is discussed more extensively in chapter 6.

benefit from benchmarking its activities internally and against similar activities elsewhere. One avenue for this would be to become much more involved in the Benchmarking and Best Practice Program of ANZECC.

8. MAORI DEVELOPMENT AND CONSERVATION POLICY

Private conservation and multiple resource use have particularly strong potential to contribute towards Maori economic development. As is recognised by the Department of Conservation, DOC administered land is often the only Crown land available for settlement of Waitangi Treaty claims. Use of such land to settle Waitangi claims can be entirely appropriate and compatible with achievement of conservation goals. It can also provide an excellent basis for contributing far more effectively to Maori development than the commonly advocated alternative policies of anti-discrimination legislation and special welfare programs available only to Maori people. In order to see why this is so, we need to carefully analyse the key issues for Maori development, and the limitations or inappropriateness of the alternative policies.

MAORI ECONOMIC DEVELOPMENT

In New Zealand, as in all the settler societies of Australasia and the Americas, the indigenous people experience significantly poorer average social outcomes – lower life expectancies, poorer health, lower income, lower educational attainment, higher unemployment – than the descendants of the European settlers and other later arrivals.

Yet, in many ways, New Zealand already represents a more effective melding of its indigenous peoples and other citizens than does any other settler society. In no other settler society do many members of the majority identify themselves by a word taken from the indigenous language. In no other settler society is the indigenous language an official language. In no other settler society is a treaty with the indigenous people treated as a foundation document of the society with continuing (albeit revived) force. In no other settler society has direct indigenous participation in political life been an accepted fact for so long.

This relative success is no accident. Of all the indigenous peoples who became minorities in their own land, none attempted to deal with the interaction with more technologically developed societies as vigorously as did the Maori. Possession of a common language and culture, and of institutional structures forged by the stresses of tribal war and previous ecological disaster, led to the use of a wide range of strategies to deal with the challenge of the new arrivals. Maori adopted European weapons,

participated in the global trading system (such as through whaling and establishing shipping companies), engaged in manufacturing activities (such as building flour mills in the top half of the North Island), were actively involved in mining in the Coromandel in 1852 and embraced literacy.¹

The Kingitanga or Waikato based “king movement” was an attempt to build a nascent nation-state – or at least a political entity able to deal with the invaders. In the late nineteenth century, the kotahitanga movements attempted to create a Maori parliament. The *Treaty of Waitangi* represented the political recognition and manifestation of the vigour of the Maori response to the European challenge (no doubt helped by the fact that the Maori greatly outnumbered European settlers at the time).

However, the Maori attempts to adapt to the challenge of the settlers were not able to ensure effective equal footing between Maori and pakeha. The impact of new diseases on an epidemiologically isolated population had a devastating effect, particularly on the fertility of Maori women (Crosby, 1993, p 232). A declining Maori population, coupled with the rapid build-up in the European population and consequent pressure to develop political and judicial practices to facilitate alienation of Maori land, also weakened the Maori position.

In particular, Maori people were significantly disadvantaged by the use of Crown pre-emption to make the Crown the monopoly acquirer of Maori land. The Crown right of first refusal in alienation of Maori land set out in Article 2 of the English-language version of the Treaty:

... but the Chiefs of United Tribes and the individual Chiefs yield to Her Majesty the exclusive right of Pre-emption over such lands as the proprietors thereof may be disposed to alienate at such prices as may be agreed upon between the respective Proprietors and persons appointed by Her Majesty to treat with them in that behalf

was always inherently unlikely to operate to the advantage of Maori. Indeed, the Maori version of the same provision:

Otiia ko nga Rangatira o te wakaminenga me nga Rangaitira katoa atu ka tuku ki te Kuini te hokonga o era wahi wenua e pai ai te tangata nona te Wenua – ki te ritenga o te utu e wakaritea ai e ratou ko te kai hoko e meatia nei e te Kuini hei kai hoko mona.

with the corresponding modern English language translation:

¹ Governor Grey estimated the literacy rate amongst Maori was higher than in England at the time. (Crosby, [1986], 1993, pp 217–268. All page references are to the 1993 edition.)

But on the other hand the Chiefs of the Confederation and all the Chiefs will sell land to the Queen at a price agreed to by the person owning it and by the person buying it (the latter being) appointed by the Queen as her purchase agent. (New Zealand Government Online, 1997).

does not seem to have quite the same implication of privileged Crown position.

Nevertheless, we would argue that the economic development opportunities for Maori societies, as originally constituted were limited by their institutional structures. In particular, their inalienable communal² property rights structure was not the most efficacious basis for participating in commercial society.

A culture based on decentralised decision-making mechanisms is able to exploit much more diverse sources of information and harness the powerful engine of individual incentives to promote greater technological development. Technological development in turn enables the society to use a much wider range of resources, and marshal resources more effectively, both in interactions between cultures and in the ability to fulfil the preferences of its own members. The settlers' ability to use much of the available resources more efficiently was also an easy justification for dispossession.

Maori defeats in the New Zealand Wars expressed the practical inequality between the cultures. What the *Treaty of Waitangi* had stated to be an agreement between equals became a very unequal relationship, with European culture, expressed in law, setting the norms of New Zealand society.³ A culture disrupted by displacement, regional defeats, population loss through disease,⁴ and alien legal and other political institutions provided a less than ideal base from which to deal with the challenges of the modern world.

² By "communal" property, we mean a form of joint ownership where individuals cannot make unilateral decisions regarding their ownership stake or share and the rights and responsibilities of each owner are not explicitly delineated. Joint stock companies, where shareholders can dispose of their shares independently and rights and responsibilities are well-defined, do not represent communal property.

³ See, for example, Mikaere (1997) for an interesting discussion of the effects of the application of British marriage and adoption law to Maori society.

⁴ The indigenous population of Oceania is estimated to have fallen from 3.5 million in 1522 to 2.0 million in 1939. (McNeill, [1977] 1989, p 318. All page references are to the 1989 edition.)

The role of culture in material well-being

Culture matters: our cultural heritage and the skills we acquire and use are fundamental to how we interact with the world. The former in particular can so permeate our consciousness that we can be quite unaware of its importance or distinctive content. Nor can it be assumed that merely living in the same society, or even the same community, automatically involves a shared culture.

For the purposes of this analysis, “culture” is defined as *transmission from one generation to the next, via teaching and imitation, of knowledge, values and other factors that influence behaviour.*⁵ It provides a deep structure through which we view the world and ourselves. It moulds preferences into identifiable, common patterns while also delimiting the opportunities and choices that are open to individuals. It constitutes a set of formal and informal constraints, a way of structuring our relations with others in a world of limited information and computational ability (North, 1996, p 36).

Incorporated in a culture are informal institutions such as families, kin and clan structures, friendship networks and so forth. Societies can also develop formal institutions of both a state and non-state variety.

Culture, and its attendant institutional structures, is important for providing individuals with opportunities to exploit their abilities and transmit the skills, values, attitudes and aspirations that are vital to economic development. Throughout this study, we have emphasised the important *economic consequences* of property rights, markets and the rule of law. The economic disparity between cultures which do not develop formal institutions of property and markets, and an accompanying independent legal system, and those where such formal institutions are a dominant element in social life, is particularly wide. In all societies, economic development has both required, and produced, substantial cultural adaptation.

It is impossible to understand the Maori situation without understanding the scale, and implications, of cultural dislocation and the difficulties in using a culture adapted to one set of circumstances to deal with profoundly different circumstances. Maori culture displayed a far greater capacity to adapt to the European challenge within settler societies than other indigenous cultures. Nineteenth century Maori society produced formal justice and military institutions, religious orders and banking. Yet Maori

⁵ Boyd and Richardson (1985, p 2) quoted and used in North ([1990], 1996, p 37. All page references are to the 1996 edition).

societies evolved to operate according to the wants, needs and circumstances of a mixed hunter-gatherer and agricultural existence in an isolated archipelago.⁶ Even a culture as comparatively adaptable as Maori culture cannot bridge that gap effortlessly.

Moving from one “mental map” to another, and learning the associated skills and knowledge, is hardly an easy or automatic process. People in all societies (including those in Europe) have found it to be a long and difficult process. In modern times, public policy has often hindered the process. For example, much nineteenth century public policy in New Zealand, in seeking to satisfy settler demands for access to resources at low prices, actively undermined Maori society. Even when the intentions have been beneficial, policy often has not generally assisted the process.⁷

The implication of this analysis is that improving the situation of Maori is not primarily about government-inspired anti-discrimination action, even though they have suffered from significant discriminatory action in the past. In one sense, it is about rectifying their vulnerability to discrimination. However, the problems of indigenous peoples in settler societies are not simply a matter of discrimination. Nor is the solution to be found in targeted welfare payments. These approaches need to be examined in more detail, however, in order to tease out their limitations.

AN ANALYSIS OF ANTI-DISCRIMINATION AND WELFARE POLICY RESPONSES

It is sometimes suggested that the simple operation of market forces makes serious discrimination unsustainable – that profit seeking firms will not fail to use labour or supply consumers where gains can be made by doing so. Discrimination can be viewed as a form of (male, white, Protestant, etc.) cartel. Like all cartels, there is a financial incentive to break it. Indeed, in the case of both apartheid South Africa and the American South in the era of “Jim Crow”, massive state and other action, including violence, was required to

⁶ The degree of indigenous success and harmony with their environment is, however, often exaggerated: the Maori extinction of the moa and other large animals – and its catastrophic consequences – gives New Zealand less reason to be prone to such naive sentimentalism than elsewhere. See Edgerton (1992), Flannery (1994) and Crosby, (1993).

⁷ For a discussion of the failures of public policy regarding indigenous Australians see Warby (1997).

enforce discrimination despite significant levels of discriminatory attitudes in the dominant group.

Cartel behaviour in the form of discrimination is made easier, however, when general beliefs support it or circumstances (for example living in a small town) make enforcement easy – in particular, the limited number of suppliers in a small town make relief from discriminatory behaviour via competitive pressure significantly less likely.^{8,9} Furthermore, people economise in their allocation of time and mental effort to choosing employees, suppliers and so on, using habits, routines and prejudices as rough guides. The latter in particular are not likely to be picked up randomly, but “piggy-back” on common judgments. Experienced changes in circumstances are far more likely to engender calculation than the continuation of familiar circumstances. Hence, there clearly is such a thing as social inertia. Expectation of discrimination may also reduce incentives for minority groups to invest in education and training. Such under-investment would serve to perpetuate a situation where the perceived gains from hiring the “outgroup” remain low.¹⁰

Discriminatory behaviour therefore can persist even when gains exist to be captured by hiring “outgroup” staff if pressure to realise those gains is low: the more “invisible” such gains are to prevailing attitudes, the higher the pressure to realise gains has to be before they will be acted upon. If there are what economists call “principal-agent” problems – where decisions made by “agents” on behalf of “principals” may not reflect the preferences of the principals¹¹ – the pressure on the decision-makers to realise such gains may be very low. This can explain why discrimination can persist more in

⁸ This is something enforcement of anti-discrimination policy should reflect – for example, by use of networks of local conciliators as the primary intermediary before court action – but generally doesn’t.

⁹ Hence, one can also explain the tendency of “outgroups”, such as homosexuals, to congregate in large cities, where it is much easier to achieve critical “social mass” as a shield against discriminatory pressures.

¹⁰ This provides an argument for anti-discrimination action by government. However, it is much less clear that affirmative action is justified, since over-compensation for discrimination can also discourage appropriate effort while the effective devaluing of education and employment attainments of members of the “assisted” group is likely to have continuing negative effects.

¹¹ These are discussed in chapter 2 in the context of controlling managerial behaviour in public and private enterprises.

government employment, or monopolistic or highly regulated markets, than in highly competitive ones.

Divining what is discrimination, and what is not, is not necessarily a simple matter. Members of “outgroups” initially may be less productive, due to lower education, skills and experience. Unless they have compensating features (such as the strong family networks of Chinese communities), they may also represent higher credit risks. Information flows, for example about business reputation, may be much stronger within rather than between groups. There may be significant information costs – such as differing use of language and social cues – in transacting with members of other groups. Disadvantage arising out of, for example, poor quality local public schools, can affect the level of skills, making members of a group disproportionately less competitive in the labour market. What looks like discrimination may be sensible, even fair, market behaviour – albeit based on unfair, or at least unequal, prior discrimination.

To complicate matters further, during periods of transition away from endemic discrimination there are cohort effects. Taking the example of gender, if one assumes that the idea that women would have full careers similar to men became widespread by, say, 1975, then the distribution of positions typically involving long lead times (such as senior management) currently occupied by people over 45 is going to reflect the career assumptions of 1965 or 1955, not those of 1995. As the post-1975 cohort moves through the work force, the distribution of positions can be expected to change accordingly. Average gender incomes will also be affected. Separating cohort effects from discrimination is also not always an easy matter, though it is often not done at all, particularly in public commentary (Rimmer, 1995, pp 16–23).

The political context of anti-discrimination and welfare policy responses

Confidence in the capacity of government to intervene successfully in economic processes has clearly receded somewhat in more recent times, particularly in the light of the failures of the command economies. Even so, confidence in the capacity of government to intervene in *social* processes remains high. The growth in government expenditure in OECD countries since 1960 has been dominated by growth in transfer payments. A recent IMF study (Tanzi and Schuknecht, 1995) has found that growth in government expenditure since 1960, unlike earlier expenditure growth which was largely

directed to physical and social infrastructure, has not been associated with improvements in social indicators.

The distinguishing feature of government is the operation of legal coercion (in New Zealand, within the constraints of a parliamentary democracy). Confidence in the efficacy of interventionist welfare policy therefore amounts to confidence that legal coercion can be relied upon to improve social processes, and induce better social outcomes, for a group regarded as poorly treated by the general society. One might reasonably ask, what evidence is there for this proposition? The argument is that society is seriously flawed, but political action can correct this. But is this political action somehow freestanding? Or will it also reflect underlying social norms and processes? Does it have other failings and inefficiencies?

Failures of Welfare Policy (I): US Inner Cities

An example of the dubious reliability of the remote application of legal coercion as a social mechanism is provided by inner-city America. Many policies intended to help have had perverse consequences, while many other policies have had unintended negative effects:

- minimum wage laws price young, inexperienced, poorly skilled or otherwise marginal workers out of the labour force;
- rent control regimes discourage – or even penalise – private provision and maintenance of dwellings;
- family income support and taxation mechanisms reduce the incentives for – or even penalise – family formation or maintenance;
- drug control laws create the possibility of massive illicit income, leading to accrual of wealth poorly protected by property rights;
- ineffectual policing has numerous consequences – people are not encouraged to accumulate physical or human wealth or invest in lasting relationships; family structures are put under pressure; business expenses are increased, reducing employment opportunities and raising prices;
- welfare housing policies tend to concentrate social pathologies;
- high local taxes encourage income, capital and employment flight; and
- provision of poor public services, particularly public education, reduces employment opportunities, wealth and amenity.

US inner cities are more pervaded by government action than any other part of US society: policies largely decided upon elsewhere. The relative weakness of civil society is both cause and effect, with poor social outcomes prompting policy intervention leading to a displacement of voluntary action in an interactive and destructive spiral.

As discussed in chapter 2, four realms of state action can be distinguished. In the first two, government provides basic rules and ensures provision of desirable services which either would not be provided or would be seriously under-provided otherwise – the rule-making and enforcing and public good-

funding operations of the state. The legal coercion powers of the state are clearly essential for rule making and enforcing and may be of substantial assistance for ensuring provision of public goods.

The third realm concerns the operation of public utilities. In particular, natural monopolies¹² carry a risk of an unacceptable concentration or inappropriate use of private power, leading to inefficient provision and monopoly profits. One solution may be industry-specific regulation. Another may be a public role in system planning and setting market rules.¹³

The democratic/public interest aspirations of the state, its rule-making role, and, paradoxically, its lack of commercial focus can make it a preferable wielder of monopoly power, though there is clearly a trade-off with the inefficiencies of public ownership and dangers of state power.

The fourth realm of state action covers areas where the state is claimed to simply do significantly better in replacing or significantly altering *social* processes. Here, much reliance is being placed on the democratic/public interest aspirations of the state. Yet how likely is it that the state, the wielder of legal coercion, would be, significantly and systematically, over decades, more moral than the surrounding society? And there are significant costs to the wielding of legal coercion.

Ordinary commercial and charitable exchanges involve trades both parties wish to take place. Since the exchange is (at least *ex-ante*) voluntary, the enforcement costs are far lower and the resources exchanged are much more likely to satisfy the preferences of the transactors.

By contrast, government transfer payments represent a centrally directed coercive transfer of income from one set of citizens to another. This results in them being a costly form of exchange.

Transfers need to be funded by taxes that are costly to raise because of compliance, administrative and activity-displacing costs. Taxes impose penalties on undertaking some activity that has no connection with the benefits being received. It is rational, therefore, for people to do all they can to avoid taxes, including avoiding or reducing participation in taxed activities. Taxes, by raising costs and lowering incomes, also render many

¹² These are firms characterised by declining average costs of production so that one provider can always undercut potential competitors (see chapter 2 for further discussion).

¹³ Public ownership may be the best option when the level of information required to regulate a private monopoly is high, the operating costs are relatively low so there is less concern about public sector inefficiencies and there is a danger of commercial alliances reducing competition in connected private markets.

Failure of Welfare Policy (II): Some Results

United States Results

The failures of welfare policy are particularly well documented in the United States. For example, in 1968 and in 1980, 13% of the US population was classified as poor despite a quadrupling of expenditure on social welfare. In 1954, black males had a labour force participation rate only slightly lower than white males. By 1976, black male labour force participation was 7.7 percentage points lower than for white males. In 1950, 17% of black births were to single mothers, by 1980 48% were. Yet, in 1980, government health expenditure was 6 times, public assistance 13 times, education expenditure 24 times, social insurance 27 times and housing 129 times the 1950 figures. Experiments in Seattle and Denver with income maintenance also provided evidence of deleterious effects from income transfers. Work effort declined in families receiving income maintenance: most strikingly young males who never became heads of households reduced their hours of work by 43%. Family break-up accelerated – dissolution of marriages was 33% higher among whites and 42% higher among blacks receiving income maintenance than non-recipients.^a

Australian Results

An example of perverse effects is provided by the effect of family income assistance in Australia on the unemployment rate among couples with 4 or more children. In August 1985, unemployment rates showed very little difference by family size. By August 1995, the unemployment rate for couples with 4 or more children was almost 10%, compared to about 4% for couples with no children or less than 4 children, despite the overall unemployment rates being about the same in August 1985 and August 1995. The much more generous family income assistance available by August 1995 depressing the incentive to seek work (by raising income not connected to work and raising effective tax rates through the assistance phase-out provisions) must be the prime suspect for an otherwise surprising result. That the unemployment rate for single parent families had climbed from 12 to 18%, and the number of single parent families had increased 40% over the period, is similarly hard to explain without reference to the structure of income support.^b

New Zealand Results

In the 30 years to 1986, the work force participation of Maori men was higher than the New Zealand average, mainly reflecting the younger age structure of the Maori population and a tendency to enter the work force at a younger age (that is, lower life expectancy and lower educational attainment). Since the mid-1980s, there has been a marked decline from a participation rate of 82.0% in 1987 to 69.3% in 1994. In March 1995, the labour force participation rate for pakeha men was 65.6% but only 60.8% for Maori. In 1981, 85.9% of Pacific Islands men were in the labour force. By 1991, 64.5% were. While male participation rates fell generally, the falls were far higher for Maori and Pacific Islands men. However, in that time, the occupations held by Maori and Pacific Islanders became more like those of pakeha, not less. The problem was not some general ethnic disadvantage, but response to particular incentives.^c

a. Green (1996, pp 70–72), b. Kryger (1995), c. Green (1996, pp 80–81)

potential economic transactions non-viable. The total *extra* cost of taxes may be at least 28 cents for the last dollar of taxes collected.¹⁴ Thus, for tax-funded expenditure to be a net social gain, it has to be very effectively spent.

Effective spending in turn requires good information about what is valued. Yet political mechanisms are poor ways of generating and using information about preferences and effects. In particular, the key decision-makers are typically far removed, and insulated, from the effects of their decisions.

It is hard to see how, as is sometimes suggested, the process of coercive transfer or direction of resources is somehow uniquely bonding or socially developing.

In fact, coercive transfers of resources typically involve narrower levels of social action and interaction than other alternatives. For example, work provides all sorts of ancillary skills and benefits welfare dependency does not. This is hardly surprising, since private action is *action*, the inter-acting of autonomous decision-makers; the stuff of which a vibrant civil society is made. It is not a one-way process of dependence. Far from having a monopoly of the social and the public, government is often a second best form of both. The lack of evidence of lasting social benefits from transfer payments is not surprising.

The concept of race

What is the proper role of “race” as a concept in law and policy? If one takes the view that “race” is a concept with no ethical value, with no useful scientific or causal explanation value (apart from belief by some people that it matters), then the only useful role for the concept of “race” in law and policy is to bar discrimination on racial grounds.

It is true that Maori have disproportionately poor social outcomes. But, the thesis of this analysis is that the explanation is not racial – it is in no sense genetic – but comes from a mixture of the legacy of past discrimination and problems of *cultural* adaptation. Apart from the barring of discrimination, the concept of race has no useful role to play in improving those conditions.

On the contrary, by characterising the issue as one of race and racism, and by using accusations of racism to police public debate, attention is drawn away from real causes and issues. Focusing on race and racism dangerously and destructively simplifies what are much more complex and fluid matters of cultural identity. People of mixed race should feel able to easily identify

¹⁴ See chapter 2 for further discussion.

with all their heritage, not be subject to policy or other social incentives to embrace one part while denying another.¹⁵

If race really does not matter, then there is no need to have it as policy or legal category. Nor have attempts to provide a legal definition of race been a happy experience (Howard, 1997). Indeed, the difficulties in defining “race” are very good evidence for the emptiness of the concept. The definition of “race” used in Australian policy, and accepted by the High Court as defining race for the purposes of the race power of the Australian Constitution (Section 51 [xxvi]):

An Aboriginal or Torres Strait Islander is a person of Aboriginal or Torres Strait Islander descent who identifies as an Aboriginal or Torres Strait Islander and is accepted as such by the community in which he (she) lives.¹⁶

is a three-part definition encompassing descent, identification and acceptance – in other words, parentage and the attitude of oneself and those lived amongst.

But that is a perfectly reasonable definition of *cultural* membership. Culture is primarily transmitted by family: so descent matters. It is basic to how one views the world: so identification matters. It is created and maintained from social interactions: so acceptance by other members of the culture matters. “How Aboriginal (or Maori) is person x?” is properly construed as a question about family, and therefore cultural, background.

When we talk about Maori we are talking about members of, or descendants of members of, people possessing a certain shared *culture*. Maori culture, like other indigenous cultures, has also become diluted by intermingling, foreign influences, war, death, loss of knowledge as well as withdrawal from the patterns of life which nurtured and maintained it.

The variety of definitions, and delay in coming to a widely agreed definition, itself indicates the complexity and fluidity of identity in this regard. In particular, it indicates the incompleteness of such identification:

¹⁵ The difficulty of mixed-race people in social situations where race is treated as important is well known. One wonders if some of the popular resentment at well-known indigenous people with significant European ancestry is not resentment at the denial of things shared, or a feeling of dishonesty. If matters were thought of in cultural, rather than racial, terms, the question of appearance would become much less important.

¹⁶ See the publications, Australian Bureau of Statistics (ABS), *Census 86: Data Quality – Aboriginal and Torres Strait Islander Counts*, Cat. No. 2602.0, Canberra, 29 September 1989, p 2 and ABS & CAEPR, *National Aboriginal and Torres Strait Islander Survey 1994: Employment Outcomes for Indigenous Australians*, Canberra, 30 May 1996, p 115.

cultural identity can be mixed, and is far from a complete identification of any individual.

Nor has the experience of the policy attitude of “we must ban discrimination but we must have racially based policies” been a happy one where it has been tried. If race is made the basis of policy, then the saliency of race is inevitably increased. If the goal is to have a society where people are not judged or treated on the basis of their race – which it surely should be – then the law and the state should not do so either, no matter how benign the intention. Either the principle of action is that race does not matter or it is not. It cannot usefully be “it is not, except when it is”. One is simply not being consistent in the application of the principle that people not be judged or treated on the basis of their race. One is not acting to abolish race as a category that (misguided) people believe to be functional.

There are issues distinctive to people who identify themselves as being Maori. But they are issues of *culture*; of beliefs, of social and human capital. They are not racial and it is not useful to characterise them in those terms. Indeed, it is positively harmful to do so. Transfers to Maori of Crown land in the course of settlement of Treaty claims do not, properly understood, represent allocation on a *racial* basis, but the *restitution of, or compensation for, property improperly alienated* from particular kin groups.

Anti-discrimination law

Anti-discrimination legislation seeks to bar restrictions from public life (broadly defined) on the basis of specifically enumerated shared characteristics. It restricts the autonomy of some actors (those who would so discriminate) in order to increase the opportunities of other actors (those who would be discriminated against).

There is an immediate difficulty in that we differentiate and discriminate in our behaviour constantly. Discrimination is essential to any serious concept of friendship or family. We differentiate between sellers in our ordinary shopping. However, that is discrimination in favour of particular individuals for reasons which are utterly tied to their individuality. Anti-discrimination legislation seeks to bar discrimination on the grounds of *general* characteristics that are declared to be irrelevant as a basis for judgment and should be ignored (except in so far as some specific exceptions may be allowed). Anti-discrimination legislation can thus be consistent with individualism where it is restricted to protecting individuals from deliberate exclusion or unfair treatment.

Epstein (1995, 1996a) criticises anti-discrimination law as part of making a powerful and general case for vastly greater simplicity in law, based primarily on confidence in the ability of people to make decisions about their own circumstances (and the beneficial information and incentive effects of doing so). His criticism of separate anti-discrimination law in particular is based on the proposition that interaction with strangers should be handled by tort law, while contract law should handle arrangements made on the basis of consensual agreements between parties.

A case for retention of anti-discrimination law might be based, however, on the fact that people who have suffered from past discrimination may have very limited human and social capital making them susceptible to specific types of torts or “unconscionable contracts” that may not be adequately covered by existing tort or contract law. Perhaps this concern could be handled within the framework Epstein is proposing by introducing new types of torts or unconscionable contracts.

Specific anti-discrimination statutes may also be warranted in situations, such as small towns, where greatly reduced competitive pressures may lead to a *de facto* monopoly supplier or demander for many goods or services, perhaps by facilitating the formation of cartels. In this context, anti-discrimination statutes could be seen as a special case of anti-trust law.

We agree with Epstein, however, that it is not possible to provide either efficient or equitable rule-differentiation by group, as distinct from activity. Group membership is simply not sufficiently pervasive or of identical form for such an approach to operate to continuing beneficial effect. Group differentiated treatment must be unfair, generate poor incentives and give rise to resentment – on the basis of actual unfairness. It is generally harmful to social harmony.

It is also clear, as Epstein argues, that deregulation of markets tends to disproportionately help those subject to discrimination or with limited social or human capital. The lower cost of transactions¹⁷ – deregulation particularly reduces the advantage of those more able to afford the services of lawyers and accountants so necessary in a regulated economy – makes entry to

¹⁷ Transaction costs were discussed in chapter 2, where they were defined as the costs of defining, enforcing and transferring property rights. While we normally think of property rights as an explicit legal title, they can also be implicit. People can have the right to undertake certain activities by default until someone else successfully prosecutes them for infringing on some other defined right recognised to have precedence. In more regulated markets, transactions are usually more expensive since legal and other expertise is required to ensure regulations are complied with.

markets easier, breaking down cartel arrangements. In the United States, the far greater effect of deregulation in making trucking more integrated than the preceding *Civil Rights Act* is a powerful example (Epstein, 1995, p 176). Another is the dramatic fall in Maori unemployment (from 28% in 1991 to 18% in 1996)¹⁸ after the passage of the *Employment Contracts Act*.

Epstein is also correct in pointing out that government discrimination is far more harmful than private discrimination, precisely because it lacks alternatives: it is imposed universally (Epstein, 1995, p 178). Aboriginal policy in Australia provides striking examples of this: indigenous Australians have actually suffered far more from the effects of government discrimination (usually allegedly for their benefit) than from private discrimination (Warby, 1997).

Furthermore, government actions are not well suited to achieving individualistic outcomes precisely because governments cannot be allowed to discriminate, in the sense of treating different people differently where it is *appropriate* to do so. Government must treat people as members of legally defined classes. Formalism, not individualism, is the basis of government action.¹⁹

In summary, while we agree with Epstein that there are dangers in expanding the government role in these matters, we can see several levels at which laws specifically aimed at tackling discrimination and disadvantage may need to operate. They may have to:

- stop explicitly discriminatory behaviour, either through statute or development of common law remedies, where there is reason to believe normal competitive pressures will not be adequate; and, in the process,
- sensitise people to issues of fair treatment – the dissemination of information in addition to the existence of legal remedies has a role here.

Once discrimination is no longer acceptable behaviour, and is not legally supported, there is a lag before past effects can be eliminated.

On the other hand, and particularly in a reasonably competitive market economy, there are also natural social pressures to ameliorate the effects. If a policy requires continually escalating enforcement effort then that is *prima facie* evidence that the policy is fundamentally flawed. In particular, this

¹⁸ Citation from Roger Kerr.

¹⁹ In addition, specialist anti-discrimination bodies develop a vested interest in extending their ambit of operation (extending career paths) and in developing specialist complexity (increasing the value of their specialist knowledge).

analysis supports only a very limited and partial role for anti-discrimination law – the perfectionist casuistry to which this area of the law has been prone is a strong point in favour of Epstein’s simplicity.

An individualist approach to anti-discrimination policy, rather than replacing one collectivist approach with another, affirms that individuals be treated on their merits, and that this is a principle worth public reiteration, to ensure that discriminatory routines or prejudice do not continue to operate as selection devices. An individualist approach is entirely willing to examine institutional arrangements to ensure that they do not unfairly exclude or disadvantage certain classes of people, but makes no presumption that groups shall be evenly distributed throughout all aspects of society. On the contrary, it seeks to provide means for individuals to gain redress for discriminatory action through the mainstream courts rather than providing targets based on some notion of a “proper” distribution (regardless of individuals’ interests or preferences) to be achieved through the actions of some activist agency.

Affirmative action, or other group-specific programs, by contrast, assert that those general characteristics *are* a basis for judgment either in terms of simple eligibility, or in terms of judging processes by their group-distributional results. Evidence suggests that anti-discrimination is a popular principle, affirmative action and group-specific programs much less so. This is an entirely consistent position.

The welfare approach to Maori advancement

Another approach to Maori disadvantage is *targeted* transfer payments or other special entitlements *in addition to*, or as a substitute for, transfer payments available to the general population. Maori have also been disproportionate recipients of welfare payments from *general* welfare programs. The following analysis deals, however, only with the question of programs that are specific to Maori people – Maori eligibility for general transfer programs is taken for granted.²⁰

Additional transfers available only to Maori might be seen as a form of *reparations*, in which case they would be provided as a “one off” payment, or, at the very least, as something clearly limited in scope. Alternatively, they could be seen as an addition to the “safety net”, in which case there would

²⁰ Nevertheless, the alternative path to economic advancement for Maori people envisaged in this chapter is likely to reduce Maori claims on general welfare payments and, in our view, produce better outcomes than continued reliance on such programs.

seem no good argument for differentiating such programs from the *general* welfare safety net. Maori would be entitled to participate in general government welfare programs on the basis of their disadvantage as demonstrated by their *circumstances* but they would not receive special transfer payments *restricted* to Maori people.

The experience of public policy has not confirmed the hope that welfare payments will solve problems of social disadvantage. In particular, social outcomes for Maori have remained stubbornly unresponsive to such expenditure. For example, many indicators showed a relative increase in Maori disadvantage over the decade 1981 to 1991 (Workman, 1997, p 5).

The welfare, or targeted income transfer, approach to indigenous policy has not been successful in any settler society. The welfare approach to indigenous policy fails fundamentally because good social outcomes are not merely the result of resources. Outcomes also depend on how resources are created, acquired and used. Welfare represents provision of resources, but the way resources are provided determines incentives. The offer of transfer payments focuses effort on their acquisition rather than on development of other ways of adapting to circumstances. In particular, the rules for such programs themselves restrict behaviour.

Another fundamental problem with welfare is poor information feedback. Not only can recipients be insulated from the effects of poor decisions, or otherwise discouraged from making good ones, but those making administrative and policy decisions generally are not affected by the consequences of those decisions. Actual effects feed very poorly into program design, policy development and implementation. Significant differences in culture can greatly magnify these problems. The potential for unintended consequences is very high.

Income transfers also provide resources on the basis of proven disadvantage or other failure. The problem is not merely that they “subsidise failure”, in the sense that resources are provided if one is in poor social circumstances; thereby reducing the incentives to change those social circumstances. The problem is that welfare does not provide a path of successful, autonomous adaptation to circumstances, and undermines alternative paths by being the source of a continual flow of resources that are relatively easy to access. Welfare therefore displaces other forms of social activity.

Another major complication is that traditional Maori culture was structured very strongly around kin groups. Such a social structure hinders the development of impersonal formal legal and contractual obligations, and

alienable and transferable property rights in particular. It also creates general problems with asset management, efficient use of assets being based quite strongly on formal obligations. These problems are not insurmountable, but are real and have to be faced. They are part of the process of cultural adaptation which must take place if Maori economic welfare is to improve. Such adaptation is far more likely to be successful if it is a matter of “learning by doing”.

Indigenous policy in settler societies has generally been moving towards the development of skills and acquisition of assets (or “empowerment”). If such a shift is to be successful, however, the assets must be in forms which are genuinely useful, and provide the basis for developing skills relevant to a modern commercial society.

Materially successful cultures and social groups are successful, not because some outside force gave them resources, but because they have adapted successfully to the circumstances in which they have found themselves. It is successful adaptation which has to be achieved: whether at the level of individuals, families or cultures. That is the only real, sustainable and ongoing source of social success, of good social outcomes.

The welfare approach does offer various advantages as a form of political exchange. The deployment of resources provides means of garnering support and facilitating patronage networks. The simple “input-output” approach to policy discussed in chapter 2, with effects being taken to flow fairly directly from intentions plus resources, allows easy display of moral purpose without the difficulties of working out actual effects. Questioning the value and efficacy of such programs can easily be construed as hostility to the recipients or to the purpose of, for example, improving conditions for Maori.²¹

The input-output model of policy also encourages general confidence in political action, particularly at the national level. Yet the brute fact is that Maori social outcomes have not been positively responsive to welfare: indeed, in many areas, such as family break-up, there has been deterioration (Green, 1996, p 84). Nor is New Zealand unique in this regard – similar results have been the experience in Australia and North America. Maori

²¹ Questioning the efficacy of other policies is also often portrayed as opposition to the *intentions*. Similarly, discussion of the Cave Creek disaster in terms of “lack of funding”, or treatment of the problems of government-run education as if it is just a matter of giving more money, exemplify applications of the same naive input-output model of public policy.

unemployment rates have fallen far further as a result of labour market deregulation than they had ever responded to social spending.

Looked at closely, the welfare approach to indigenous policy looks very much like a “cargo cult” attitude to policy. Prosperity and good social results come from “dropping” resources on groups with poor social outcomes. Even the language of “disadvantage” implies that the solution is some sort of giving, that social justice is a gift. Actual experience does not bear this out.²² The “mainstreaming” of Maori programs is therefore supported by this analysis.

Adapting to new circumstances

The welfare approach, even more than the anti-discrimination approach, implicitly assumes that the path to achieving better social outcomes for indigenous peoples is granted to them from the outside. It constructs their policy identity in terms of passivity and failure and encourages, to a degree which is counter-productive, a belief that the central issues of indigenous life are something that someone else has to be responsible for solving.

To achieve better outcomes, indigenous people need to develop ways of operating more effectively in modern society. Such development ultimately has to come from an internal process of cultural and institutional adaptation. It cannot be given from outside. It may, by very careful policy, be assisted; but no more than that.

We may also wonder whether there is indefinite electoral tolerance for expenditure on programs available only to indigenous people and which do not appear to be working – “failure to work” being inferred from the fact that the problem does not seem to be going away even though it is of a type which, at least notionally, should. Popular support for welfare expenditure is a mixture of compassion and social insurance. Programs for which most people are never going to be, or are unlikely to be, eligible are particularly vulnerable to popular disapproval, as they do not provide a general social insurance element. This applies with even greater force to expensive, ineffective, apparently endless, provision for an identifiably discrete group.

In the New Zealand context, the Waitangi Treaty settlement process needs to have some clear end point. The acts for which restitution is being sought

²² Alan Duff, author of *Once Were Warriors*, makes trenchant criticism of the welfare mentality. He points to the success of Maori in Australia where they are not eligible for any special benefits and are far more of a minority than they are in New Zealand (cited in Green, 1996, p 91).

are receding further into the past. Furthermore, a process that appears to be open-ended is likely to become increasingly unacceptable to non-Maori.

THE ROLE OF PROPERTY RIGHTS

Citizens of industrialised democracies take for granted a level of prosperity, and of increasing prosperity, which, far from being the normal human circumstance, is unprecedented in the sweep of human experience. This prosperity is no random event, but the result of the evolution of institutions peculiarly suited to the production, and maintenance, of such prosperity (North [1996] and Powelson [1994]).

The institutional structures of the industrialised democracies are characterised by far lower transaction costs than are present in other societies. This difference is essential for facilitating the huge range of exchanges that underlie wealth and prosperity. These institutional structures not only make exchanges much easier and cheaper to transact, but also direct human effort far more to wealth creation through voluntary exchanges than to the pursuit, use and abuse of coercive political power. Institutional structures with lower transaction costs have a fundamental and enduring advantage in providing freedom and prosperity to their citizens.

Well-defined, tradeable property rights have been basic to that institutional structure. When people can decide how to use their own property, and can be confident of gaining the returns from investment in their property, they have a greatly increased incentive and capacity to discover more effective uses of assets, indeed, to discover new assets. Decision-making is put in the hands of those most likely to be knowledgeable about the asset and with a direct incentive to extend and use that knowledge.

The more uncertain property rights are, either in their extent or in their security, the less incentive there is to invest in finding better uses for resources, particularly over the long term. Insecure ownership effectively raises time discount rates. The larger the number of players that have to be dealt with, regardless of whether they contribute to the exchange, the higher the costs of transacting and the fewer exchanges will take place.

Exchanges where people are only involved if they can contribute some benefit to the exchange maximise the incentive to discover such benefit. Resources must therefore be used more productively than where allocated privileges or extended kin obligations allow involvement of others against the will of the core transactors.

Complex differentiation of property titles – for example, vesting *de facto* mineral rights in some holders of legal interest in land but not others – erodes the framework of property rights. Indeed, such differentiation allocates a privilege likely to be of far less benefit to the owners than the social losses from decreased economic activity. This has been the experience in Australia, most notably with the Northern Territory under the Commonwealth *Aboriginal Land Rights (Northern Territory) Act* where miners have abandoned activity in areas where a more hostile property regime applies.

Similarly, complex transactional processes, involving many parties and rights that are not differentiable and tradeable, undermine property right regimes. So too do sudden changes in rules or wide operation of official discretion.

Security, wealth and freedom

Secure, well-defined private property is an essential element both for sustained prosperity and for a free society. Unless citizens have resources which are securely theirs, to dispose of as they wish, they must be at the mercy of the whims of those holding official power. As Hayek pointed out, a relatively lowly paid official, armed with the appropriate legal discretion, has far more power over our life than the millionaire who lives next door (Hayek, [1944], 1976, p 78). Secure private property is our buffer against the vagaries of power.

These points apply with no less force to land law. In the words of Kirby J, in the *Waanyi* case:²³

In land law certainty is a dominant demand of every mature legal system.

The removal of private land and land purchased²⁴ by state-owned enterprises from the ambit of Waitangi claims is reasonable: there is little point in reallocating property rights in a way which undermines all property rights – including those of the new recipients. Maori owners of land have just as strong an interest in *secure* property rights as do other private owners.

²³ *North Ganalanja Aboriginal Corporation (for and on behalf of the Waanyi People) v Queensland*, 135 ALR 225 at 274 judgment of Kirby J.

²⁴ We have been advised that state-owned enterprise land derived in the first instance from the Crown, but not land purchased on the open market after the enterprise was set up, is subject to the 27B memorials on the land title, which means that if the Waitangi Tribunal orders its return, the present owner is compensated and the land returned to the Maori.

In the strikingly materially successful societies of North Western Europe, their descendant societies and Japan, property rights, including property in land, did not derive from some pre-set principles, handed down from on high. On the contrary, they evolved over time from the interaction of power groups, interests and beliefs. Principles emerged as ways of handling the clash of interests, of codifying the results. The general tendency, because it provided for the widest and strongest congruence of interests in a pluralist society, was for property law, and land law in particular, to evolve towards simplicity, with increasing security and increasing discretion in its use.

Freehold title, with a single legal owner able to sell and otherwise make decisions regarding the land, represents the clearest outcome of this tendency. Secure private property is the basis for sustained prosperity because it allows clear delineation of who can decide what to do with what. A decision-maker who is also an owner has excellent incentives to maximise the value generated from the asset. Freehold title provides a particularly efficient form of ownership. It massively reduces transaction costs in decision-making since there is a single legal holder of rights over the land. As with other assets, mere “ownership” does not provide the basis for wealth. It is the secure right to use that asset as one sees fit which provides the basis for productive use of the asset.

Leases for limited time periods or limited land use are inferior forms of title to freehold. Short-term leases are also notorious for encouraging short-term attitudes to land management: secure title allowing varied land use is considerably more open to sustainable, and therefore better environmental, management.

Communal ownership and inalienability

That (normal) freehold title is neither communal (in the sense we have been using that term) nor inalienable are both very important advantages. That (normal) freehold title is alienable allows property to pass easily to those able to use it more efficiently, as shown by their willingness to purchase it. Alienable property also provides a source of collateral for loans, facilitating investment and development of the assets.

That (normal) freehold title is not communal allows decisions about its use to be made far more easily. The property is also more likely to be used in innovative ways. The incentives in the use of communal property are typically poor, fostering over-use and under-development – a “tragedy of the commons” where there is under-investment in care and improvement and overuse of resources may extend to the point of exhaustion. Living in

communal housing on communal lands also means that an individual is at the mercy of the vagaries of communal officials and politics, creating the potential for authoritarian power structures which would not be tolerated in the wider community.

An individualistic approach to property rights (including share ownership in joint stock companies) allows for much greater diversity in decisions about resources and protection of individuals against group decisions. It also means that the benefits of successful decisions, and the penalties of poor ones, are concentrated rather than dissipated, maximising the incentives for effective use. The incentives are to gain maximum individual benefit for minimum investment or care.

The argument for combating discriminatory behaviour and institutions is that a decent society places no unreasonable or unfair barriers on the pursuit of self-chosen purposes by its members. It is an argument for individual freedom and opportunity. The argument also implies that indigenous property returned under Treaty settlements should *in the first instance* be individually based, although free individuals could, if they so desired, voluntarily choose to pool resources in a communal way (without retaining identified, marketable shares with well-defined rights and responsibilities).

There is a stream of thought which argues that the collectivism of traditional societies (including traditional Maori society) is something particularly precious which ought to be preserved. If such collectivism is applied to asset management, however, it is more likely to lead to undermining of the material basis of a vibrant Maori culture than to support it. Such an approach also would reduce the value of New Zealand's assets, and thus the ability to maintain or improve the *general* prosperity, by largely removing such land from normal economic processes.

Far from being some triumph of gentler cultures, granting land on a communal and inalienable basis greatly reduces its value as an asset to the new owners. The failure of the command economies, particularly in agriculture, provides a stark example of the deleterious effects of communal, inalienable title. Contemplating the apparent starvation of North Korea, it is lunacy to then advocate similar policies as the path to advancement for other peoples. Effective property rights structures were one of the basic advantages of the settlers: it is only by embracing them that Maori can be expected to fully share in the remarkable opportunities modern commercial society provides.

Use of common-stock corporations allows joint ownership while providing individuals with genuine and clearly defined rights, rather than

being entirely at the mercy of some communal body. Individuals dissatisfied with management of the joint asset, or who no longer identify with the relevant community, would be able to “cash out” their entitlements relatively easily. Title which does not allow individuals to “cash out” their holding make the alleged title of those who disagree with communal decision of little or no value.

Any suggestion that, on the grounds of “simplicity”, particular bodies should become the monopolistic agents for Treaty settlements, and even more the exclusive managers of Maori assets, should be treated very warily. Such monopolistic provision would reduce the choices, and thus the real wealth and power, of those whose disadvantage the settlement is supposed to help ameliorate.

SUPPORTING THE MAORI RENAISSANCE

Since 1975, and the establishment of the Waitangi Tribunal, far more vigorous attempts have been made to achieve a more equal *modus vivendi* between Maori and pakeha. As in other settler societies in recent decades, there has been an indigenous renaissance, marked most obviously by greatly increased willingness to identify as indigenous. In the 1996 Census, 14.5% of the usually resident population of New Zealand identified as Maori, compared to 9.7% in the 1991 Census.²⁵

The current Maori land base is estimated to be about 1.3 million hectares,²⁶ or 5% of the land area of New Zealand – equivalent to 7.8% of the 16.6 million hectares²⁷ covered by farms and plantations. This is a remarkably small percentage, given that the *Treaty of Waitangi* explicitly recognised Maori property rights. It is a testimony to post-New Zealand War confiscations, dubious (or worse) land transfers and a lack of effective Maori participation in commercial society. That Maori have almost 60% of the fish quota²⁸ seems rather more consistent with the Treaty guarantees. Indeed, according to the Ministry for the Environment (1997b, p 2.15), the Muriwhenua 1988 and Ngai Tahu 1992 claims:

²⁵ Data obtained from Statistics New Zealand at <http://www.stats.govt.nz>.

²⁶ TradeNZ at <http://www.tradenz.govt.nz/exports/investment/guid/maori.shtml>.

²⁷ Land use statistics from Statistics New Zealand at <http://www.stats.govt.nz/statsweb.nsf>.

²⁸ TradeNZ at <http://www.tradenz.govt.nz/exports/investment/guid/maori.shtml>.

successfully asserted that the new fisheries management regime created by the Crown was contrary to Article II of the Treaty. At the same time, successful court actions led to the *Maori Fisheries Act 1989* and the *Treaty of Waitangi Settlement (Fisheries) Act 1992*, which provided for a \$280 million two-stage settlement that transferred to Maori interests a 50 percent share in the Sealord fishing company, a 10 percent share of existing fish quota, and 20 percent of the quota for any new quota management species.

Management of land and natural resources may constitute a particularly promising bridge to the future for many Maori. For those who are already living in urban areas, more effective education and training could be far more valuable. But property rights to land and natural resources would enable Maori who have yet to complete the transition from traditional to modern society to build autonomy and personal and social responsibility while benefiting from their cultural heritage.²⁹

Acquisition of genuine property rights with commercial value will produce a need for institutional structures capable of making efficient management decisions. It would thus provide a basis for developing the human and social capital which is the only real foundation for Maori advancement: a case of learning by doing.

Income transfers are likely to provide a vastly inferior basis for improving the living standards of Maori than the acquisition of substantial assets, available for full commercial use. Indeed, a full Treaty settlement based on granting of substantial property rights clearly provides the opportunity for a *quid pro quo* of the removal of any *special* entitlements and benefits – although Maori would, of course, remain eligible for any general transfer payments available to other citizens. Even so, the granting of substantial property rights would more than likely also reduce Maori dependency on such general welfare measures.

Given the, quite proper (see above), exclusion of private and much state-owned enterprise land from Waitangi Treaty settlements,³⁰ the 32% of the land area of New Zealand managed by the Department of Conservation provides an obvious source of land settlement – as the Department itself admits (Department of Conservation, 1996d, p 5). Consideration of such transfers creates the immediate question of the extent to which the

²⁹ This analysis assumes utilisation of user pays on public conservation assets so as to allow development of a private conservation market.

³⁰ Whether these exclusions are generally understood is another matter. Regular reminders of such exclusion could do much to reduce pakeha concern.

conservation goals underlying DOC management of the areas might be compromised.

The first point to note is that the *Treaty of Waitangi* is a continuing, albeit revived, contract. While property rights should not be redistributed under it in a way which (further) undermines property rights³¹ the Treaty should, as is expressed in legislation including the *Resource Management Act* (Section 8) and the *Conservation Act* (Section 4), be honoured. While one is hesitant to suggest it automatically trumps other public policy goals, it clearly cannot itself be automatically trumped by them, otherwise it will become vacuous.

Nor can criticism be mounted simply on the basis that land is moving from general (Crown) ownership to specific (Maori) ownership. If that was an issue in itself, it is hard to see how any private ownership could be justified. Furthermore, the historical experience is very strongly that private ownership of land is a necessary element in producing prosperity and freedom.

The appropriateness of use of DOC land as a basis for Waitangi settlement claims is reinforced upon consideration of whether, and to what degree, Maori ownership is likely to reduce conservation benefits. As discussed elsewhere in this report (see chapter 5 in particular), public ownership is *not* required to produce valued conservation outputs. Nor is single purpose use of land necessarily appropriate, even in areas capable of providing substantial conservation benefits (see the discussion in chapter 6). Furthermore, many tourists visiting conservation areas would no doubt enjoy hearing about traditional Maori understanding of the local environment and the foods, medicines and other natural resources the Maori obtained from it. For some tourists, learning about the relationship between Maori and the environment might be at least as valuable as learning about the environment itself.

The Department of Conservation already states that cooperation with Maori is a key part of conservation strategy, as is expressed, for example, in DOC's *Kaupapa Atawhai Strategy* goals (Department of Conservation, 1996d, p 7):

Goal 1: Principles of the Treaty

To interpret and administer conservation legislation so as to give effect to the principles of the *Treaty of Waitangi*.

³¹ Clearly, actions in the past have not properly respected Maori property rights under the Treaty – hence Treaty claims – but that is no reason to multiply such failures.

Goal 2: Resolution of Treaty Grievances

To advise government on conservation issues relating to the resolution of Treaty grievances, and to implement settlements reached.

Goal 3: Relationship with Maori

To develop a relationship with Maori consistent with the status of the Crown and Maori as co-signatories of the *Treaty of Waitangi*.

Goal 4: Biodiversity Conservation

To work with Maori in the conservation of New Zealand's indigenous biodiversity.

Goal 5: Cultural Heritage

To work with Maori in the conservation of their cultural heritage on lands administered by the Department.

Goal 6: Visitor Services

To work with Maori in the provision of services to visitors on department-managed lands.

Goal 7: Public Awareness

To increase public awareness of the involvement of Maori in conservation, to raise Maori awareness of current conservation issues and the Department's role, and foster dialogue between Maori and other stakeholders in conservation.

Goal 8: Staff Issues

To reflect through staff the Department's commitment to biculturalism and relationships with Maori.

Looking through these goals, one wonders what public purpose is actually being served, in areas of significance to Maori, by DOC rather than Maori ownership. If the conservation assets were Maori owned, then the Maori would be genuine partners. They would neither be supplicants nor secondary partners subject to promises of good intentions from DOC and vulnerable to the vagaries of politics and bureaucracy, but instead would be genuine holders of real assets, with DOC or other parties such as the Crown Research Institutes or the Universities providing advice and assistance at the request of the owners. Any such transfers would have to be done on the basis of open, accountable and transparent processes, with clearly delineated rights and responsibilities. But, as explained elsewhere (particularly in chapters 2 and 5), any suggestion that achieving desired conservation goals *requires* public ownership is not supported by clear analysis of the issues. Maori certainly do not provide an exception to this principle.

The recent Ngai Tahu settlement showed a willingness to use a range of measures including:

- transfer of freehold title to Maori;
- having Ngai Tahu administer and manage certain reserves under the same legislation as DOC;
- changing many local place names;
- transfer of further land into the conservation estate under DOC control; and
- leasing of Maori land to DOC in perpetuity for conservation purposes.

According to a DOC Fact Sheet on the settlement (<http://www.doc.govt.nz/maori/land.htm>, October 1997), the current policy is that “return of conservation land would not generally be an option in *Treaty of Waitangi* settlements” although “transfers would be considered in relation to discrete sites of special significance”. However, such a policy seems, at least in part, to be based on a preference for public ownership of conservation assets, a position which is not generally supported by the analysis of this report.

Division of management of the conservation estate between different bodies provides a means of comparing and contrasting performance even within the public sector. Extending the principle to public and private management, and Maori and pakeha management, allows advantage to be taken of the full range of knowledge, skills and innovation possibilities within New Zealand society.

A possible criticism of the process of Treaty settlement regarding land managed by DOC is that it effectively bars other *private* owners who may be more efficient users of the resources. In addition, the process of transfer itself may involve some loss in efficiency as owners need to be identified and disputes about eligibility resolved. Any efficiency gains from greater private (Maori) ownership of land would need to exceed these negotiation and other transactions costs before the transfer would represent a net gain in efficiency as usually measured by economists (that is, ignoring distributional matters).

In practice, any efficiency losses may be small. In some areas, Maori may be the most efficient owners of the land (assuming it is subject to an appropriate property rights and regulatory regime). The cultural heritage of Maori makes them, as DOC itself admits (Department of Conservation, 1996d, p 18), particularly informed about the natural resources of many areas, giving Maori a comparative advantage in tourism, particularly ecotourism. Rather than Maori advising DOC staff about what to tell visitors, having Maori guides do it directly on Maori land may be of considerably greater value to visitors. Even in open auction, Maori may well be the highest bidders for such land, as they would be able to gain most value from owning

it. These points apply particularly strongly for areas of high cultural significance for Maori: except for very compelling reasons, why should anyone but Maori be the custodians of sites of which they were the original owners and whose significance is profoundly connected to such prior ownership?

Furthermore, expanding ownership and management options provides many opportunities for diverse and innovative cooperative arrangements to garner a wide range of expertise and ideas. For example, Maori owners could enter into joint ventures with DOC or other partners – such as firms, private trusts, universities and other research institutions – which have valuable management, scientific, marketing or other expertise.

Finally, *provided the property is alienable*, the normal process of offer and purchase will ensure that it moves towards the highest value user, and in the process ensure that New Zealand gains the best use of its resources (see discussion of the Coase theorem in chapter 2). Thus, even if land and other resources initially transferred to Maori as part of a Treaty settlement are not most efficiently used by them, if the property rights are transferable then efficiency will not be compromised.

On the other hand, we would argue that the case for transferring ownership of land to Maori may be much less compelling if the resulting title is communal and inalienable. Under those circumstances, considerable inefficiency in resource use might result in cases where Maori turn out not to be the most productive owners

CONCLUDING REMARKS

The process of continuing cultural adaptation to the circumstances of global industrial society, required for genuine Maori advancement, should be based on developing various amalgams of the old and the new. Responsibility as custodians of sites of high significance, development of eco-tourism, the blending of conservation with other uses, making the trade-offs of genuine ownership within commercial society, provide a particularly hopeful basis for developing such amalgams. Maori have already proved that their cultural heritage has been, more than most indigenous peoples, compatible with developing sophisticated commercial responses to the challenges of modern society. This can be taken further.

In particular, evidence from many societies around the world has shown that property rights contribute most to economic development where they are alienable or transferable, where individuals can make *unilateral* decisions regarding their ownership stake or share, and the rights and responsibilities

of each owner are explicitly delineated. Immersion in such a fully commercial society is not something to be feared but embraced, as the past adaptability of Maori culture, and the great expansion in Maori commercial activity as the result of Waitangi settlements, have shown.³²

Maori are already developing a “layered” approach to land assets; keeping areas of high cultural value in inalienable form, other areas in corporations with restricted membership, and yet others in full commercial title. This may prove a stage along the path to more widespread use of common stock companies, where shareholders can independently dispose of their shares and rights and responsibilities are well-defined.

Processes of cultural adaptation cannot be fruitfully directed from the outside, however, but must come out of the values, preferences and experiences of Maori themselves. There is no “right answer” knowable before the fact. Public policy must not direct the process, and it can easily inhibit it.

If the *Treaty of Waitangi* is a continuing contract, then it needs to be a relationship where both sides have a real say. Outright Maori ownership of conservation assets – with appropriate regulation³³ – represents a far more equal relationship than a set of (revocable) promises by the Department of Conservation to “do the right thing” by Maori concerns. Furthermore, so long as the new property rights regime is efficient, such a transfer of ownership has far more potential to contribute seriously to Maori development than the anti-discrimination and welfare alternatives. Land currently managed by the Department of Conservation may be an appropriate place to look for settlement of Waitangi claims and for expansion of the economic renaissance of Maori.

³² For example, some Maori people we spoke to in New Zealand feared that alienability may lead to wholesale “dispossession” of many descendants of current owners. They suggested that these people should remain eligible to claim future ownership regardless of what their ancestors had chosen to do.

³³ In particular, such regulation should not be so restrictive as to represent an emptying of ownership of much of its value – such as, for example, not allowing the new owners to gain the value of any mineral deposits.

9. HISTORIC AND CULTURAL HERITAGE

How to gain the benefit from new uses of resources while balancing appropriate retention of the achievements of past generations is an issue all societies confront in one form or other. People value items and traditions inherited from past generations. However, they also value other goods and services and, to obtain these benefits, items or traditions inherited from the past might have to be destroyed or at least substantially modified. It is the creation of new benefits which puts the preservation of the legacy of the past at risk.

Obviously, not everything that comes down to us is worthy of preservation – otherwise we would never be able to create anything new. Equally obviously, future generations would suffer a profound loss were they to be bereft of any signs or examples of what past generations have laboured to create. The preservation of the works of the past gives us a sense of place. It is important to our sense of identity as human beings and as members of particular societies and cultures. Such preservation also provides a vital store of expressed achievement from which we can draw inspiration and understanding. Our cultural heritage is part of the memory of particular societies and of humanity in general. A society without a memory is a society doomed not to learn from the past, from the experiences of successive generations, a society profoundly handicapped in its ability to confront the future effectively.

CATEGORIES OF CULTURAL HERITAGE

In this chapter, “cultural heritage”, the creations of past and present generations, is used in distinction from natural heritage, the natural environment around us. Cultural heritage can be divided into the physical creations of past generations – buildings, landscape workings, works of art, tools, utensils and so forth – and the traditions and institutions that they build. Both are part of the memory of a society.

The preservation of traditions and institutions is a matter of decisions made every day, a myriad of private decisions as well as decisions of public policy and other collective decisions. While a profoundly important issue, it is not the direct subject of this analysis, which is focused on the conservation of physical objects. We shall therefore use the term “cultural heritage” to refer only to the *physical manifestations* of that heritage while acknowledging

that such physical objects might form only a minor part of what we value in our inheritance from past generations and what we hope to bequeath to future generations.

INSTITUTIONAL REFORM OF CULTURAL HERITAGE CONSERVATION

Public and private sector roles

The Department of Conservation currently controls significant cultural heritage resources:

Lands administered by the Department of Conservation cover almost one third of New Zealand's land area. They contain thousands of historic places, many of which are of high cultural heritage value. Much of this value is still to be recorded ... Key historic places representing the full range of human activities can be selected for interpretation and presentation to the public ... Key historic places include 119 historic reserves and 68 places registered by the Historic Places Trust. A large number of the historic reserves are visually magnificent examples of Maori historic places, especially pa sites. (Department of Conservation, 1995).

The Department of Conservation is, however, hardly the only holder of cultural heritage assets:

As the vast majority of the areas administered by DOC were not acquired by the Crown for their historic values, some important themes in New Zealand history are not well represented on the conservation estate, and some are not represented at all. (Department of Conservation, 1995, p 11).

Indeed, most of the 5,900 places registered with the Historic Places Trust are in private ownership. Clearly, in this as in other conservation areas, an appropriate conservation strategy for New Zealand is one which looks beyond the public sector. Indeed, DOC already leases some of its historic sites to other operators. As in other areas of conservation policy, having multiple owners allows far more opportunity for different approaches to be tested and for incorporation of local knowledge.¹

¹ The case of Tiritiri Matangi Island (see Craig *et al.*, 1995b) is a particularly good example of the value of different perspectives, and the dangers of a monopoly provider having a narrow perspective. DOC was less than entirely helpful in what turned out to be an inspirational project. The negative effects on bodies of a desire for a quiet life, and being seen as the authority and source of all wisdom, with the ability to, at least in part, enforce such self-deceptions is not to be underestimated.

Administration of public sector interest in heritage preservation

Currently, the Department of Conservation has primary responsibility for the preservation of New Zealand's natural resources and some limited responsibilities in the area of historic heritage – mainly in managing historic heritage sites on the conservation estate and in providing policy advice to the Minister of Conservation. The Minister of Conservation is also responsible for the Historic Places Trust and the *Heritage Protection Act*. Since both natural and cultural heritage are intended to be conserved, it may seem natural to place both under the control of the one body.

Unfortunately, there are no economies of scope or scale in the management of both natural resources and cultural heritage. On the contrary, there are good reasons to divide responsibility for the two.

First, a body responsible for preservation of cultural heritage which also has other corporate responsibilities may well suffer from conflicts of interest. If DOC has, for example, a corporate antipathy to private conservation efforts, it may be less than diligent in preserving the history of private conservation. This question is raised in considering the heritage of Tiritiri Matangi Island. We understand there is some disagreement within DOC as to the value of preserving the sheds which were used in one of the first restorations of former farmland to nature conservation purposes, a process which was not looked upon particularly favourably by at least some people within the Department.² There is such a thing as inconvenient history. If public sector responsibility for the conservation of cultural heritage is under the control of a body whose sole purpose is conservation of cultural heritage, such conflicts of interest are much less likely.

Nor are there any obvious overlaps in the skills of biology and history. The management actions of a curator and an ecologist are also quite dissimilar.

There is also a general argument for public sector bodies to have as few different objectives as possible, as the fewer objectives, the more accountable they are for their purpose in achieving specific objectives. Fewer objectives mean a much reduced capacity to hide behind the demands of one objective when criticised for not achieving another objective.³

² Information conveyed to Peter Hartley during a field trip. The Tiritiri Matangi case study is written up in Craig *et al.* (1995b).

³ As much experience has made clear, that something in the public sector does not, of itself, mean it will be managed efficiently and in the public interest.

This suggests that public sector responsibilities for the conservation of cultural heritage should be separated from conservation of natural heritage in a specific purpose body. In addition to reducing conflicts of interest between the two conservation agencies, the result for each agency will be clearer, more specific objectives, resulting in better accountability. Extending this point further, it is also preferable to have the body responsible for *regulation* of conservation assets not also being one of several different bodies *managing* conservation assets – self regulation is not usually a recipe for achieving successful outcomes.

There seems no good reason, in terms of regulatory responsibilities, to separate out responsibility for conservation of Maori heritage. On the contrary, the cultural heritage of New Zealand consists of Maori, pakeha and shared elements, and the regulatory structure should encompass all of them. It may be appropriate to explicitly acknowledge this in legislation.

Current institutional arrangements are far from ideal – as the Parliamentary Commissioner for the Environment recently made clear (Office of the Parliamentary Commissioner for the Environment, 1996, hereafter referred to as the PCE Report, 1996). The Historic Places Trust is supposed to be the lead national agency, yet it has policy, regulatory, service delivery and ownership roles. The PCE Report (1996, p 30) notes there are:

confusions as to who is the lead agency for protection in different circumstances, or even whether it should be a national, regional or local organisation. Coordination and cooperation between agencies is at best *ad hoc* and largely dependant on personal initiatives.

On the Historic Places Trust itself, the PCE Report (1996, p 30) says:

the Trust is clearly under stress in many key areas of operation. It is clearly inadequately resourced for the variety of roles it is required by statute to perform, and the lack of resources means that its available protection mechanisms are largely ineffective. Expectations of what the Trust can achieve by the public and members may be unrealistically high ... some of the Trust's problems also stem from the apparent ineffectiveness of long-term strategic planning and priority setting. This has resulted in a perception that the Trust is reactive and internally confused about the roles of different parts of the organisation, particularly between the roles of Trust staff and local committees.

Poor institutional and regulatory design is likely to lead to organisational stress. In the case of the DOC, the PCE Report (1996, p 34) notes:

the Historic Heritage Strategy is not consistent with DOC's activities with respect to natural heritage ... even on the conservation estate, intense internal competition for funding (with different divisions promoting the management

and protection of natural and historic heritage respectively) is hampering DOC's progress with integrated heritage management. The lobbying of politicians by environmental NGOs for increased funding for DOC work is almost exclusively directed at increasing funding for natural heritage. There are serious inconsistencies in the level of attention to historic and cultural heritage between conservancies.

Poor institutional and regulatory structures do not promote good outcomes. The recommendation of the PCE Report (1996, p 69) that responsibility for historic and cultural heritage be placed in a different portfolio from the Conservation portfolio would ensure proper separation of historic and cultural heritage responsibilities from conservation of natural heritage.

MULTIPLE USE OF HERITAGE RESOURCES

One of the interesting questions of cultural heritage is whether any particular site should be heritage "under glass" – explicitly and solely kept as preserved heritage serving no other function – or whether it should be an example of "living heritage" – something preserved but remaining functional, possibly involving some adaptation of the original structure. The process of "regentrification", whereby period homes and neighbourhoods are updated and modernised, is an example of living heritage. For example, a referee pointed out that in Thames:

a portion of the main street has been declared a heritage zone with encouragement to create and maintain building facades and colour. The next step will be the ownership and licensing of the visual images, photographs, and reproductions of written and graphic material.

Similarly, physical historical objects often mean more to people when they can be interpreted, or used in a situation approaching the original historical context. For example, many tourists are fascinated to hear about the food or medicinal uses of plants by Maori people, or to see the way old manufacturing, mining or farming equipment may have been used.

Incentives as well as preferences determine how cultural heritage is treated. In particular, a high market value for an object will automatically give its owner a strong incentive to maintain and preserve it. Inherited items that are subject to conservation concerns are almost certainly scarce. But that scarcity can also give heritage significant market value – the market for antiques being an obvious example of this.

The major conflicts between heritage and market value, apart from simple disinterest by particular owners in preserving heritage, come from:

- technological improvements giving modern construction a wider range of amenity than past constructions; and
- the possibility of more intensive use of the land containing heritage property.

In both cases, if heritage orders or listings⁴ impose restrictions on what owners can do with their property, the value of the property is reduced and so an incentive is created to eliminate the subject of such restrictions. It is also fundamentally unfair to expect particular property owners to bear the costs of society's wish for heritage to be preserved.

The appropriate response is to remove both the disincentive and the inequity by compensating property owners for the loss of value and of potential amenity. This, of course, means that heritage orders and listings on private property are limited to the size of the budget allocation to such conservation. But this is appropriate, not only on equity grounds, but also to stop frivolous imposition of heritage restrictions. A process whose costs are shifted onto particular individuals against their will is an irresponsible process. It is only if those responsible for decisions are also held responsible for the costs of those decisions that well-considered judgments are likely to be made. Various local authorities currently provide financial incentives to heritage owners (PCE Report, 1996, pp A72–A73). Such incentives, if properly resourced and managed, do much to promote an effective and fair heritage preservation structure.

Dealing with both the above reasons for heritage to conflict with market value – the potential for increased amenity and more intensive use – can be successfully approached through adaptations and multiple use. Facade preservation, such as in central business district buildings, can be a way of preserving heritage while not forgoing the significant value to be gained from more intensive use. Similarly, partial upgrades – such as installation of modern kitchens, heating, wiring, plumbing – can allow use for purposes such as bed and breakfast providers, restaurants, hotel accommodation, and so on while retaining much that is of heritage value.

⁴ Use of heritage orders is rare in New Zealand – there are only about 16 currently operating. Listing of sites in heritage schedules in District Plans under the *Resource Management Act* is much more common, and often subject to legal and other conflict. Such listings have shown some tendency for dramatic increases – for example, the recently released Central Area plan for Auckland City quadrupled the list of heritage items (to 200) while Wellington's list went from 100 to 500. (Information supplied by Historic Places Trust).

Such multiple use provides a means of incorporating heritage as a living thing, allowing reference to, and preservation of, the past side by side with incorporation of technological and other improvement. Indeed, given that technological, social and organisational dynamism unparalleled in human history is a distinguishing characteristic of Western civilisation, one could reasonably argue that such an approach expresses the heritage of Western society particularly effectively.

In the case of more intensive use of land containing heritage assets, one of the major problems is that, particularly in central business districts, the air space above an old building has value which is not reflected in the current use of the land. If property rights in such space could be established and sold *separately*, market trades could be established to bring heritage and market value more closely into alignment. If limits were established on how much could be built above a certain level in a particular area, developers could purchase such rights from owners of heritage sites and aggregate them together for particular developments.⁵ This would not only increase the market value of heritage sites, but reduce the tendency to create skyscraper “canyons”. As it is, air space above land is (subject to local zoning laws and building codes), a potential resource inseparable from land title and thus capitalised into the land itself.

A major issue in heritage preservation is the desire to preserve the period “ambience” of an entire area. Whether it is appropriate to limit use of property to preserve such ambience is simply an extension of the above issues. If such preservation is judged appropriate, property owners should be compensated for any loss of value. Then appropriate decisions about trade-offs can be made – for example, whether building a new hotel allowing more visitors to enjoy an area’s qualities is appropriate.

There can be other costs to owners of heritage items from poor regulatory and institutional structures other than explicit restrictions on use of their property. Delay, uncertainty, the costs of participating in decisions and a lack of clarity in divisions of responsibility between levels of government⁶ and bodies with statutory responsibility all provide further disincentives to

⁵ The PCE Report (1996, p A62) notes that creation of “Transferable Development Rights” can be useful as a heritage mechanism.

⁶ We have been informed, for example, that one developer currently renovating a major inner-city heritage building estimates that he has spent an extra \$50,000 as a result of continual negotiations between the City Council and the Historic Places Trust about the development.

private ownership and preservation of heritage items. Imposition of standards which represent modern sensibilities not reflected in older buildings, such as access for disabled persons, can provide further disincentives to ownership and preservation of heritage items. If society is interested in the preservation of cultural heritage, it should not penalise its ownership. This is a particular problem in “grey” cases – such as buildings which might be subject to orders or listings but have not been as yet. In the absence of clear criteria and transparent processes not only does uncertainty reduce the value of such buildings and items, but it can also create a powerful incentive to “demolish now”.

CONCLUDING REMARKS

Public ownership is not necessary for heritage preservation. Indeed, it may often not be the best solution. What is needed is not a particular form of ownership, but an overall regulatory and institutional approach which maximises the value New Zealand gains from its heritage assets. Such an approach should incorporate:

- separation of policy and regulatory responsibility from asset management;
- separation of policy and regulatory responsibility for conservation of cultural heritage from other objectives;
- removal of disincentives to not preserve the heritage quality of assets via compensation for loss of value from heritage restrictions;
- ensuring equity and discipline in heritage orders and listings by requiring compensation for such restrictions from a specified budget; and
- permitting appropriate adaptations and multiple use of heritage assets.

While there are a range of initiatives already being undertaken in New Zealand, particularly by some local authorities, in the words of the PCE Report (1996, p 91):

The system for protection of historic and cultural heritage as a whole is performing poorly, is very reactive, and at present characterised by poor resourcing and a lack of vision and integrated strategic planning.

As in other conservation areas, careful attention to institutional structures and their incentive effects, and intelligent use of the wide variety of institutional forms, and capacity for innovation, provide the optimum basis for getting the best value out of New Zealand’s heritage assets. Reliance on

outdated and flawed command and control mechanisms is no more the right approach here than it is elsewhere in modern public policy. The current poorly defined roles and institutional structures do not provide New Zealand with a satisfactory regime to maintain and preserve its cultural heritage. Specific purpose institutions with clear roles are much more likely to provide effective and accountable regulation and management of New Zealand's cultural heritage assets.

10. SUMMARY OF POLICY RECOMMENDATIONS

Each of the previous chapters has recommended policy changes and suggested reforms. Arguments supporting those recommendations have been presented within the relevant chapter. This chapter reiterates the main reforms, focusing on the trade-offs and interactions between them and the way they might be combined into an integrated package.

The major reforms suggested in earlier chapters can be grouped under the headings:

- changes to the structure of Department of Conservation and its controlling act;
- changes to classification and use of the land areas;
- reform of the DOC financing; and
- alterations to policy that would make conservation more a part of *all* activities that use natural resources – so that conservation becomes better integrated into the economy rather than one of the major remaining “ghettos” of socialism.

CHANGES TO THE STRUCTURE OF THE DEPARTMENT OF CONSERVATION

Changes to DOC need to start with the *Conservation Act*. The major difficulty with the current Act is that it defines “conservation” to mean:

the preservation and protection of natural and historic resources for the purpose of maintaining their intrinsic values, providing for their appreciation and recreational enjoyment by the public, and safeguarding the options of future generations.

Similarly, it defines “preservation of a resource” to mean:

the maintenance, so far as is practicable, of its intrinsic values.

Unfortunately, as argued in chapter 3, the concept of “intrinsic values” borders on being meaningless, and defining the goal of a government department (or any other organisation) to be something that is meaningless is unlikely to produce satisfactory outcomes. Even under the most charitable interpretation of the concept “intrinsic values”, it *cannot* form the basis for an organisation whose goal must be to use the resources it is entrusted with for the benefit (most widely defined) of the people of New Zealand – and what else possibly could be meant by “serving the public interest”?

The functions of DOC, as specified in the *Conservation Act*, would appear to be in conflict with the principles of resource management enunciated in the *Resource Management Act* (RMA). Section 5 of the RMA states that the purpose of the Act “is to promote the sustainable management of natural and physical resources”. The section then defines “sustainable management” as:

managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while –

(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

(b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and

(c) avoiding, remedying or mitigating any adverse effects of activities on the environment.

Managing resources *solely* “for the purpose of maintaining their intrinsic values” while “providing for their appreciation and recreational enjoyment by the public” is unlikely to ensure that people and communities obtain the maximum “social, economic and cultural well-being” from the resources *subject to* the constraints that “health and safety”, the “life-supporting capacity” of the resources and the “reasonably foreseeable needs of future generations” are all protected. In short, the Department of Conservation, like other resource managers in New Zealand, should be required to manage resources on a *sustainable use* basis.

It has been suggested to us that while the *Conservation Act* might specify objectives for the Department that are inconsistent with sustainable use, DOC could nevertheless change its internal operating procedures to ensure that they are consistent with the principle. The difficulty with that argument is highlighted by DOC itself. The DOC Fact Sheet *Legislation* (in Department of Conservation, 1996a) stated that:

The Department is not a free agent. It has only those functions explicitly stated in legislation.

The legislation therefore needs to be amended.

There are other reasons for amending the *Conservation Act*. The Department of Conservation does not have a structure that is consistent with the principles that underlay the reform of the New Zealand public sector in the late 1980s. In particular, the Department suffers from a number of conflicts of interest:

- DOC advises the government on conservation policy while also funding and delivering conservation and other related services.
- The Department is an advocate for conservation. This may require it, for example, to argue in the Environment Court against other resource users such as farmers, while in its capacity as a neighbour it is at the same time trying to obtain the cooperation of these same individuals on fencing, the control of weeds, pests and water pollution and so on.
- The Department is a consumer of scientific research services, such as wildlife research, a producer of those services and a producer of an important input (relatively undisturbed habitats) for the production of those services.
- DOC regulates the safety of activities undertaken in conservation areas by franchisees, while it also provides facilities and services that ought to be subjected to independent safety regulation.
- The goals of conserving natural environments on the one hand and cultural and historical heritage on the other can also lead to conflicts of interest when areas of high cultural or historical value are found in conservation areas.

A principle underlying public sector reform in New Zealand was that conflicts such as these prevent departments from providing the best possible service in all dimensions. Allowing departments to specialise in their functions, and holding them responsible for the achievement of narrow, but transparent, objectives is more likely to deliver satisfactory outcomes. We believe that the experience in New Zealand with separating the functions of departments has been quite positive overall (Schick, 1996) and that the time has come for the reforms to be extended to conservation and environmental policy. The various core functions now undertaken by the Department of Conservation should be allocated to different agencies.

The Department of Conservation should become primarily a regulatory and funding agency for activities undertaken in conservation areas and a clearing house for scientific research into natural ecosystems, wildlife, species recovery plans and so on. Operators of services provided in the conservation areas, whether they are public entities or private franchisees, ought to be legally liable for safety violations, damages caused to others by inadequate pest and weed control, incompetent management of water resources leading to pollution or flood damage, damage caused by fires resulting from negligence and so on. Managers of conservation areas ought also to compete for revenue by providing desirable tourist and recreational

services, sites for scientific research, genetic material for pharmaceutical firms, breeding stock for zoos, engaging in net conservation value trades with other resource users and so on.

Another separation of functions we advocated in chapter 9 involved heritage assets. We fail to see any economies of scope between the heritage and other functions of DOC. Similarly, we argued in chapter 8 that areas of high cultural significance to Maori ought to be owned and managed by them, albeit subject to the requirements of the RMA as is the case with any other property owner in New Zealand.

A number of commentators also suggested to us that the regional councils have been doing a much better job on advocacy than has DOC. We have not examined the operation of the RMA in any detail and therefore do not have a firm opinion on how the RMA, the Environment Court or the various government agencies involved ought to be reformed to better promote the goal of sustainable resource use. The suggestion that the regional councils ought to be responsible for advocacy regarding matters that affect the coastal waters and sea bed, just as they are responsible for inland waters and lakes, seems to us, however, to be eminently sensible.

RECLASSIFICATION OF LAND AREAS MANAGED BY DOC

There also needs to be a thorough review of the categories of land managed by DOC. There are so many categories now (at least 50) that no-one could know the management rules applicable to each category or why they are distinguished. Something like the IUCN system with just 6 categories (discussed in chapter 6) could be adopted. As part of this process, land suitable for Treaty settlements and multiple and sequential use needs to be identified.

At a minimum, land currently managed by DOC should be disposed of where it has little or no value for producing conservation outputs, or where the value of the conservation outputs is substantially below the value of alternative uses. For example, DOC received former quarries in the land originally allocated to it. We have told that, because some of these at least are no longer available for producing aggregate, new quarries are being developed on other land. If our information is correct, it would be difficult to find a more obvious example of inefficient resource use.

As another example, when DOC was established a category of land called a “stewardship area” was also introduced. These are governed by part V of the *Conservation Act*. They are areas that can be disposed of following a

public process. According to Davis (1986), stewardship areas were intended to be a type of “holding category” for land for which there was no immediate requirement for permanent allocation to producing either conservation or alternative outputs. Such areas would be prime candidates for sale. There were also areas of state forest land that were allocated to DOC but which can be leased for other uses. Presumably the alternative use value of these areas is also relatively high.

If at least part of the revenue from such land sales was used to support conservation activity, the result could be a net gain in conservation output in addition to greater output of other goods or services.

While re-examining the land managed by DOC, the *Treaty of Waitangi* should also be kept in mind. We argued in chapter 8 that substantial land assets, available for full commercial use, provides a far more promising basis for Maori achieving improved living standards than the dependency status of transfer payments. As has been demonstrated by the allocation of commercial fishing quota to iwi, genuine property rights build autonomy, personal and social responsibility and a functioning institutional structure. They form an effective bridge between traditional culture and the modern commercial world. A full Treaty settlement based on granting of substantial property rights clearly provides the opportunity for a *quid pro quo* of the continued mainstreaming of government income transfer programs specifically aimed at Maori.

Such a policy would be most appropriate in cases where land is suitable for multiple or sequential use, such as where there are substantial opportunities for the development of eco-tourism ventures that could benefit greatly from explanation of the historical connection of iwi with the land and associated natural resources. Any such multiple use would, of course, have to occur under the regulatory framework of the RMA – as would any other land use in New Zealand under our proposal to also make DOC management of resources conform with the criterion of sustainable development.

REFORM OF DOC FINANCING

Separation of the various functions of the Department of Conservation would also have the desirable effect of clarifying some of its financial arrangements. More explicit transfers of funds between the divisions of DOC would produce greater accountability by managers of individual activities.

A very important financial reform is that users of conservation areas should pay the *full price* not only for facilities and services but also for “access”. The user fees would thus include components to cover:

- costs of operating facilities (such as the costs of gas supply for huts);
- the opportunity cost of the time that DOC officers allocate to servicing tourists including enforcing ticketing;
- depreciation of structures;
- costs of activities such as track and hut maintenance;
- costs of repairing damaged vegetation, cleaning litter, handling waste disposal and so on;
- congestion costs imposed on other users including the loss of amenity value from disturbed wildlife, damaged vegetation, increased noise or spoiled views; and
- the opportunity cost of using land and other resources for conservation purposes as opposed to their next best *alternative* use (this value could be zero).

Higher prices for users would tend to occur in any case if more of the tourism and recreation services were provided on a franchise basis or by private operators (including iwi).

Several people we spoke to in the course of undertaking this research suggested to us that it is quite impractical to charge for access to conservation areas in New Zealand. We believe this underestimates the ease with which fees could be collected from tour buses and individual patrons entering the major parks through the main entry points.

We also suggest, however, that the collection of fees could be greatly enhanced by instituting large fines for people found guilty of *illegal trespass* in conservation areas. There are many other laws in our society, such as those relating to compliance with the tax regulations, that are largely enforced through voluntary cooperation accompanied by the threat of very large fines for non-compliance that has a relatively low probability of detection.

Just because infringement of a law or regulation is very difficult to detect does not mean that the law cannot be enforced. Very low probabilities of detection merely need to be offset by very large fines for those found guilty of the offence in question.¹ This is the approach used not only for tax avoidance but also for most so-called “white collar” crimes.

¹ See, for example, the discussion in Buchanan and Hartley (1996).

In the present case, we suggest that there could be a program of random enforcement aimed at ensuring a minimum probability of detection of trespassers. The new policy would also be greatly assisted by a public relations campaign to inform people of the true costs of allowing use of conservation areas. A pricing mechanism that gave discounts to New Zealand residents, for example by offering a “bulk discount” or “seasonal pass” so that they make a contribution to fixed costs but then are allowed to spend additional time in conservation areas at a low marginal price, can be justified on efficiency grounds. The costs of selling tickets and passes could be greatly reduced by allowing them to be sold by travel agents or by mail, telephone, the internet or in person in the major cities of New Zealand.

This reform could be coupled with peak load pricing to encourage users to switch demand to periods when congestion, and the costs imposed on DOC and other users, are less. Another advantage of charging entry fees is that users could be charged an insurance premium that would cover the costs of rescue services should they become necessary. This component of the entry fee would be paid to the Police or whoever else undertook the search and rescue work.

Asking consumers to supply their usual address when purchasing entry tickets or passes would also provide managers with substantial information about the customer base that could be extremely useful for improving management and resource allocation strategies. This would provide one very important component of an improved system of financial reporting and target setting.

Whether or not the Department is radically restructured, DOC should be encouraged to introduce a comprehensive system of measuring key operational activities and comparing them internally and against similar organisations overseas. One avenue for this would be to become much more involved in the Benchmarking and Best Practice Program of ANZECC.

DOC should also extend the public reporting of its performance. For example, its Annual Reports should include indicators of efficiency and effectiveness, not just raw inputs and outputs. These indicators should be used by management to influence resource allocation decisions.

DOC also needs to be encouraged to consider whether resources under its control are being allocated to their most highly valued uses. Allowing multiple or sequential uses of some areas would provide revenue that could be used for other conservation purposes. In particular, species recovery programs, island restorations, pest and weed control and scientific research necessary to conserve New Zealand’s indigenous biodiversity are not low

cost activities. Additional revenues would enable DOC to pursue many of these activities much more vigorously with a resultant *net* gain in conservation output.

Many trades between conservation and other resource uses are implicit, and appear to involve a good deal of arbitrary and wasteful official action, with the result that DOC obtains less useful revenue than it might. The procedure for undertaking “net conservation value” trades therefore needs to be made open and transparent.

Furthermore, at present, DOC does not have any legal authority to undertake net conservation benefit trades except possibly under the *Crown Minerals Act*, where it may have limited ability to accept “*equivalent* compensation” but not to achieve a net conservation *gain*. The objectives of the Department also need to be changed so that it is encouraged to maximise the conservation value of its portfolio of assets as a whole through net conservation trades.

At a minimum, this will require the development of consistent and agreed upon indices for assessing the value of conservation outputs. Apart from being necessary for evaluating the conservation benefit of asset trades, such indices are also needed for ranking conservation expenditures as we argued above. Relying instead on a possibly meaningless, and at best incommensurate, goal such as maximising “intrinsic value” is not a satisfactory alternative.

To encourage net conservation value trades, DOC would have to be allowed to fund significant management or land offsets from the revenue raised through alternative resource use in conservation areas. If instead such revenue is used to reduce the budgetary allocation to DOC, the Department would have no incentive to allow the trades with consequent negative implications for efficient resource use.

A budgetary reform that would encourage DOC to make a more rational trade-off between alternative uses of resources under its control would involve extending the capital charge. It should include a charge for the “opportunity value” of the land and other natural resource assets under DOC’s control – that is, the value, if any, that those resources would have in their next best *alternative* use. An increase in the value of those assets for alternative uses (for example as a result of mineral discoveries or a desire to undertake exploration) should raise the capital charge (*and budget*) for DOC. A trade of the more expensive areas of relatively low conservation value for relatively less expensive areas of high conservation value would then also release funds that could be used for operational purposes.

ENCOURAGING MORE PRIVATE CONSERVATION

Thus far our suggestions have largely focused on the Department of Conservation. This reflects the fact that the Department currently plays a dominant role in conservation in New Zealand. While the Department manages approximately 32% of the land area of New Zealand, however, other parties manage the remaining 68%. The key to successful conservation in the twenty-first century has to involve better integration of conservation with other economic activities.

While we have emphasised that other uses of resources can co-exist to some extent with conservation in many conservation areas, so too can conservation outputs be produced along with other marketable farming, forestry, fishing, mining, recreation and tourism outputs. The value of the conservation output produced jointly with other marketable outputs could be quite high. Many indigenous species, and indigenous habitats, might have difficulty surviving to the end of the next century and beyond if they are restricted in range to the official conservation areas.

For conservation to attain its rightful place in the private sector, producers of “conservation services” have to be allowed to sell those services at prices that reflect their underlying value. This is one of the main reasons we emphasised that DOC has to charge the full price for access to conservation areas. If the government gives away recreational opportunities for free, or charges a highly subsidised price, the market price for private supply of the same opportunities is close to zero. The market price will not reflect the true social value and resources will be misallocated.

The problem is compounded if heritage orders, or other restrictions, can be placed on private property without the government having to pay full market compensation. Indigenous habitat then not only is not an asset. It actually becomes a liability. The *signal*² being sent to every land owner in the country is that the optimal thing to do is to remove all traces of native habitat as fast as possible and substitute exotic species that will be of no interest to interfering third parties. Similar points apply to historic properties.

As we mentioned above, greater use of franchises or private ownership to provide tourist and recreation services in areas currently managed by DOC

² Land owners might not respond to this signal if they place a high personal value on natural habitats or are happy to maintain them on their property out of a sense of “public duty”. It would hardly seem to be good public policy, however, to “tax” people of goodwill while those with less regard for the public good are allowed to pursue their private interest at no cost.

would automatically raise funds that can be used for further conservation services. An additional effect of such a policy, however, is that private owners of significant areas of native habitat, including iwi, will be encouraged to manage the land more for conservation and eco-tourism output and less for other marketable outputs such as farm products or forestry based on exotic species.

Other steps can also be taken to ensure there are stronger economic incentives to conserve native species. Requiring pharmaceutical companies to pay royalties (or some other agreed fee based on a percentage of revenue or perhaps an equity position) on medicines or other chemical compounds derived from indigenous species will encourage the retention of those species. Genetic engineering might also enhance the usefulness of native species for food production, gardens, plantation forestry and so on. These developments would also be encouraged by allowing engineered genotypes to be patented and sold under exclusive licence for a fixed period of time.

A related issue is that private conservation businesses ought to be allowed unrestricted rights to sell native plants and animals that are bred on their properties. It makes little sense to require the destruction of rare or endangered wildlife in situations where a successful private breeder has an inventory that exceeds the carrying capacity of the property.

The counter-argument is that a legal trade allows poachers to conceal their illegal activity. A legal trade would, however, reduce the prices for the desired species and therefore reduce the incentive to poach. As with the ITQ for fishing in New Zealand, legal traders will also have a financial incentive to assist with policing any illegal activity.

Property rights can also be extended from native species to native habitats. The “wetlands banking” scheme in use in Florida could be extended to a wider range of habitats. As we noted in chapter 4, an adviser to the Chicago Board of Trade has suggested a “habitat banking” scheme. Developers wishing to destroy or modify habitat occupied by native species would have to buy permits from the exchange before they could proceed. Conversely, producers of suitable native habitat could sell permits. By purchasing permits on the exchange, private individuals or groups could raise the market price of permits and encourage greater levels of private conservation. Funds from supplying habitat permits would augment funds raised through eco-tourism and other conservation-related outputs. A related scheme that has recently been considered in the Northern Territory was discussed in chapter 4. If private individuals or firms could earn a monetary income from providing conservation services that more closely

approximated the real benefits, companies like Earth Sanctuaries, discussed in chapter 5, would become more the norm rather than a glaring exception.

Private sector involvement in conservation also can be increased by encouraging volunteer activity. DOC already has a number of programs to encourage volunteers. Better performance monitoring would assist in discovering how these programs could be improved.

Motivation and leadership are extremely important in volunteer activities. The volunteers need to be rewarded for their service by, for example, being given some sort of stake in areas that they help to restore. For example they could be given privileged access to areas when others have to pay access fees. A kind of “reverse homesteading” program might be started where ownership of restored areas was vested in private volunteer groups once the habitat reached a certain level of functioning natural ecosystems.

A very important motivating factor for volunteer groups in New Zealand is the release of rare birds and other “charismatic species” into areas they have worked to restore. DOC should be careful not to discourage volunteers by delaying the release of such species beyond the earliest opportunity when the species are likely to survive and breed in the environment.

Volunteers should also be encouraged by spending revenues raised from activities such as guiding for use in the area where the services were provided. High implicit “tax rates” on funds raised through volunteer activity are likely to be very detrimental to the continued supply of volunteer labour.

The production of conservation outputs, like the production of many other goods and services, can be quite complicated. The optimal strategy to use can also vary from one location to the next. It is precisely in these situations that decentralised market processes can best demonstrate their superiority to centralised allocation mechanisms. The optimal conservation strategy for New Zealand is to remove conservation from the grip of central planning approaches and rely instead on decentralised processes and individual initiative to get the job done.

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