Sustainability and its significance for the Resource Management Law Reform

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Unpublished report to the Core Group
of the Resource Management Law Reform

Centre for Resource Management
University of Canterbury and Lincoln College

1st July 1988

Acknowledgements

We are grateful for the efforts and contributions from those who attended our workshop in Christchurch on 20th May:

Maurice Gray - consultant on Maori issues
Angus MacIntyre - policy analyst
John Peet - chemical engineer and energy analyst
Basil Sharp - resource economist
Graeme White - systems ecologist and entomologist

and from external reviewers of the interim report:

Terry Anderson - economist, Montana State University
Chris Collins - Dept of Conservation
Jeanette Fitzsimons - Planning Dept, University of Auckland
Molly Melhuish - private energy consultant
Hillary and John Mitchell - private social research consultants

The Centre for Resource Management acknowledges the financial support received from the Ministry for the Environment for part of the costs of producing this unpublished report.

Contents

		Page
Preface		1
Chapter One:	**Interpreting sustainability**	4
	A framework	4
	Cultural basis	5
	Attributes	9
	Components of a strategy	14
	Definitions	26
Chapter Two:	**Illustrations of sustainability**	27
	Illustration 1 - Fisheries	29
	Illustration 2 - Catchments	33
	Illustration 3 - Climate change	36
	Illustration 4 - Pounamu	39
	Illustration 5 - South Westland	42
	Illustration 6 - Energy	45
	Summary and implications	47
Chapter Three:	**Issues & the role of government**	51
	The general roles of government	51
	Issues & potential government roles	53
	Epilogue	62

References: 64

Appendices:

1 - Fisheries 67

2 - Catchments 76

3 - Climate change 85

4 - Pounamu 89

5 - South Westland 90

6 - Energy 97

PREFACE

Introduction

1 The concept of sustainability is already embodied in the Environment Act as government policy. If sustainability is to be a fundamental concept underlying the whole process of reforming New Zealand's resource management laws, it requires interpretation and illustration. That is the purpose of this paper.

Study objectives

2 To interpret sustainability in a way that is helpful for designing resource management laws, policies and institutions.

To illustrate this concept of sustainability with a number of examples.

To describe potential roles in resource management for government consistent with adopting sustainability as one of a number of national policies and recognizing the current direction of government policy.

Study conditions

3 This work was done as part of Phase One of the Resource Management Law Reform.

Sustainability is a management goal written specifically into the Environment Act, which is not itself under review. We were required to address the issues of the sustainability of natural and physical resources and the needs of future generations together.

We were required to make use of the work which has already been done as preliminary contributions to the review process.

Study approach

4 An interactive, interdisciplinary approach to this work is essential. The concept of sustainability is commonly interpreted in a variety of ways, depending on disciplinary and institutional perspective. No single perspective can provide either adequate interpretation or appropriate policy prescription.

5 Consequently, we have made an honest attempt to be both interactive and interdisciplinary. Our study group is multi-disciplinary with much internal discussion and mutual critiquing of individual contributions. We have drawn upon a range of ideas and resource material and our

work has been subject to multi-disciplinary university review as well as review by people working in government departments and the private sector. Initial ideas were criticized and reformulated at a workshop where our working group was joined by five people from different academic disciplines. An interim report to the Core Group was reviewed externally.

6 Emphasis has been given to searching for consensus and isolating the issues and contradictions that remain.

7 The scale of many issues in sustainability is global. However, the immediate need is to give some specific guidance to the management of New Zealand's natural and physical resources. Governments may choose to go further and promote New Zealand's global responsibilities under international treaties and conventions, as the present government has done with limits on chlorofluorocarbon compounds.

8 Sustainability has been treated as a multi-faceted concept not amenable to simple definition. The literature is full of different expressions: "sustainable society", "sustainable development", "sustainable welfare", "sustainable resource use", "sustainable livelihoods". Each carries its own emphasis. We have worked towards conceptualising sustainability by incorporating most common current understandings.

World views

9 Much of the writing and discussion on sustainability reflects strongly held views about human society and the global ecosystem (Dunlap(1983), Livesey(1988), Goodrich, Taylor and Bryan(1987)). Livesey (1988) has summarised three world views which are distinct and yet overlap substantially.

10 These world views, have in common an acknowledgement of many aspects of biophysical and technological reality. People must draw on biophysical resources from within our global system in order to meet some human needs, no matter how "needs" are culturally defined. Everyone needs some food to live; everyone's survival would be jeopardised if ultra-violet radiation received at the earth's surface increased too much. They all acknowledge that science and technology have in the past sometimes helped communities to adapt when confronted with resource shortages or unacceptable impacts of pollution.

11 Important points of disagreement among world views concern perceptions of the particular status and rights of humans and future expectations of human ingenuity. Dunlap (1983) summarises the contrast: "adherents to the

human exemptionalism paradigm tend to see the world as infinite and humans as essentially omnipotent, while adherents to the ecological paradigm tend to see the world as finite and humans as inevitably constrained by that finiteness." Such different world views can thus prescribe very different resource management decisions.

12 All world views have been "wrong" much of the time; they have also sometimes been "right". History provides plenty of evidence of communities which experience resource constraints and individuals and communities which display considerable ingenuity as a result of the experience (Catton, 1982).

13 Most frequently the differences between world views are emphasised, rather than the points of agreement. In this work we have searched for points of agreement rather than disagreement. Advocates of an "ecological" paradigm would not have built the Clyde dam, but neither would advocates of an "economic efficiency" paradigm. With reference to the economic reforms of the current New Zealand government, Salmon argues that: "... thousands of hectares of native forests, swamps, rivers and wildlife habitats are being saved by the dismantling of state-sponsored carnage" (Environmental Council and MfE, 1987, p31).

Three caveats

14 Sustainability is only one of a number of national policy objectives. The task of making tradeoffs between policy objectives when they are in conflict belongs to the elected representatives.

15 While the purpose of this report is to help clarify "sustainability" for the purpose of law reform, there are limits to how precisely policy can be specified in law (MacIntyre, 1986). There is a stage when interpretation and implementation of policy becomes a matter for those "on the ground".

16 Finally, this work is concerned with the "end" of sustainability, not with the "means" for attaining it. Maximising net present value, for example, is a "means" for finding the most economically efficient way of achieving a socially desired "end" (Sagoff, 1984). The examination of "means" is a task for Phase Two of the Resource Management Law Reform.

CHAPTER ONE

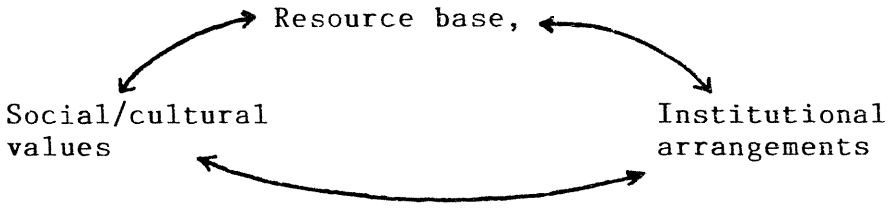
Interpreting sustainability

Introduction

17 This chapter has four parts. We begin by presenting a framework which makes it possible to link together different views of sustainability. The value basis for sustainability in our society is then examined followed by a discussion of general attributes associated with sustainability. Finally, components of a sustainability strategy are presented.

A framework for interpreting sustainability

18 "Sustainability" is interpreted in a number of ways, depending on discipline, perspective and purpose. Thus a concise rigid definition is inappropriate. We have formulated a conceptual framework that makes it possible to link different perspectives. We see resource use, sociocultural values, and institutional arrangements for management as all closely inter-related. These relationships are all constantly changing.



19 * Communities are "based" on natural resources. For example, many coastal communities in New Zealand have evolved around the harvesting and management of adjacent fisheries and the nature of these resource systems has had a strong influence on patterns of community development.

* The types of institutions reflect, at least in part, community "values". For example, New Zealanders have set up institutions to express the value they place on sustaining the fish resource in New Zealand; this value is expressed in cultural traditions of taonga and stewardship.

* The condition of the resource base is influenced by resource management institutions. For example, institutions can be set up for the purpose of sustaining the fisheries such as rahui and the MAF quota system.

The basis for sustainability in Maori and Pakeha culture

20 The range of cultural values found in most modern nations is very broad. We do not pretend to consider all cultural values in New Zealand but merely set out some evidence indicating the substantial support for the concept of sustainability that is found in mainstream cultural values.

Maori

21 This summary of traditional and latter-day Maori views of the relationship between people and the natural environment is drawn from material put together by the working group at the Centre for Resource Management on the principles of the Treaty of Waitangi (Gray et al., 1988 - all quoted sections) and from the contributions of external reviewers. In preparing their material, Gray et al. acknowledged the "plurality of traditions and interpretations" but observed that "Within these traditions the unity and continuity of attitude and action are recognised for each subsisting unit, whether whanau (family), hapu (subtribe) or iwi(tribe)", or (where these traditional units are not entirely appropriate) runanga, trust board or incorporation (Mitchell, 1988).

22 "The central concept underlying the Maori relationship with the natural environment is whanaungatanga - being related to the natural world. Maori ancestry is genealogically traced back to the primal parents Ranginui, the Sky Father, and Papatuanuku, the Earth Mother."

23 Everything possesses mauri - the physical life principle. "Through mauri, all things cohered in Nature. As all things are descended from common ancestors, so all elements of the natural world possessed life, a universal living spirit. Preservation of the mauri was all important. Because in everyday life use was made of the environment, there was constant risk of limiting or affecting the mauri. To guard against this a set of rules governing conduct and behaviour consistent with their spiritual tribal (ancestral) beliefs had to be followed."

24 "Belief in the mauri of the natural world and their protection exerted a real influence over economic affairs. It fostered an atmosphere of respect and fear obviating deliberate destruction of essential resources. Through the concepts of mauri, tapu, mana, wehi, ihi and noa, the conduct of people was regulated toward their natural environment."

25 The nature of the relationships between different Maori groups (roopu) was also an important determinant of their behaviour towards the natural environment. The Maori had a strong sense of sovereignty over occupied territory. The role of guardianship was most strong in the exercise of management over the natural resources of one's own roopu. However, this did not inhibit the members of one roopu from raiding and destroying the resource base belonging to another. Thus attitudes and conduct in Maori society depend to a large extent on sovereignty (Mitchell, 1988).

26 "The concepts/institutions initiated by tohunga or rangatira (chiefs) were the means by which Maori society functioned and regenerated. Derived from both whakapapa and deed, their individual mana was bestowed on them by the Atua (God) and reinforced by the people."

27 Having a strong "conservation" ethic is, by itself, not enough to ensure sustainable management of the resource base. Particular knowledge is required as well. "There is no doubt that they brought with them a strong "conservation" ethic; ... there is good evidence that the Maori people did not sustain all the resources that they found on arriving here. In Palliser Bay, for example, they worked their way through the forest birds, the marine mammals and the inshore fisheries. Pakeha society finished off the remaining forest and is now working its way through the soil resource. Even after one thousand years of settlement, no culture appears to have achieved sustainable resource development along the south Wairarapa coastline. In most places the Maori rapidly acquired experience with resource management and around the 18th century had learnt enough to come into balance with their environment. Meanwhile a lot of forest (perhaps, a third) disappeared" (Collins, 1988).

28 Maori views of the natural environment are grounded in acknowledgement of an essential relationship between human and non-human elements. However, this is not the only cultural source for such a perception.

Pakeha

29 Modern Western attitudes to the natural environment are often portrayed as founded on the perception that humankind is a separate entity from the rest of the natural world. This duality or "human exemptionalism" is seen as originating from the Judeao-Christian doctrine of creation setting humankind apart from and with authority over nature (White, 1967). Thus everything in the environment is relegated to the status of a resource and humans are considered exempt from the sort of ecological constraints experienced by other species.

Such an interpretation of the relationship between Pakeha people and their environment no doubt has many supporters. But it is equally true to say that many Pakeha people do not share such perceptions.

30 In Pakeha New Zealand, there are many manifestations of the perception that humans live in an interdependent relationship with their natural environment and that people place considerable value on sustaining this relationship into the future. The concept of sutewardship is a deeply rooted Western tradition (Attfield, 1983).

31 In law, the Environment Act, the Conservation Act and the Town and Country Planning Act all embody a concern that humans should act with caution in their "uses" of natural resources, lest current activity should jeopardise or pre-empt future opportunities. Hearn cites a decision under the Town & Country Planning Act regarding land of "national importance" for the production of food: "The object of the subsection is to protect it against the day when it will be required for that purpose, be it 20, 50, or 100 years in the future" (Hearn, 1987, p192).

32 Other institutions already in place also reflect a concern for sustaining elements of the resource base so that future generations can continue to derive physical support and economic benefits from their use. Examples of such arrangements are "total allowable catches" set for commercial fishery species, "closed seasons" for amateur fisheries administered by acclimatisation societies, sustainable yield logging practices, "minimum instream flows" in the management of rivers, and "maximum biological oxygen demands" in the management of waste disposal into receiving waters. The existence of national parks directly reflects value placed on the sustainability of the natural environment. Education, inheritance of property and planning are all investments in the wellbeing of future generations.

33 A growing concern with the harmful effects (actual and potential) of human activity is evident in this country's non-nuclear stance and its promotion of restraint in the global rates of use of chemicals that appear to threaten the stability of the ozone layer. Groups like Guardians of the Lakes and the Native Forests Action Council exemplify another sort of cultural response where a value on sustainability is paramount. The growing interest in the organic agriculture movement is an instance where individuals clearly relate economic sustainability to sustainable practices in the management of biophysical systems. Furthermore, many consumers are prepared to pay a premium for "organic" produce.

34 The discoveries of science (with its diverse roots) indicate that humankind cannot take sustainability for granted. Thermodynamics (with its concepts of irreversibility and entropy constraints) and ecology (with its concepts of the interconnectedness of systems) both provide science-based arguments for considering sustainability as an overriding policy goal (Georgescu-Roegen, 1979, Ehrlich et al., 1977).

Attributes of sustainability

35 In this section we describe some attributes of sustainability which should be considered explicitly in the design of institutional arrangements for resource management. These attributes fall into four groups: systems behaviour, the time dimension, the space dimension, and uncertainty.

Systems behaviour

36 It is essential that resources be seen as parts of resource systems and cycles and not as separate entities.

37 All elements of a system are not the same. One important difference is between flow and stock resources and this should not be obscured in institutional design. Depletion of stocks is inevitable, whereas depletion of flows is not. Only one generation can use a barrel of oil, whereas every future generation could reasonably expect to eat orange roughy.

38 Some of the most important resource systems have large stocks and small flows: geothermal energy, certain aquifers, native forests, fisheries are some examples. Biological resource systems generally have regeneration rates that depend on the size of the stock; therefore management decisions which have immediate effects on critical stocks within resource systems will influence the sustainable yield (flow) (Melhuish, 1988).

39 The relationship between people and their environment that is the focus of sustainability is one of interdependence. Discharging raw sewage into the sea at Half Moon Bay threatens Stewart Island's fishing industry since clean water is needed for processing fish. From a human perspective, the notion of interdependence implies both current dependence on environmental services (conditions favourable to life, materials and energy to use) and the need for caution under uncertainty.

40 Thresholds are another important characteristic of systems which must not be ignored. Thresholds for parts of systems can be observed - for example, the concentrations of salt in groundwater or acid in rain at which certain tree species die. However, thresholds for systems (like minimum instream flows for rivers or optimum city size) are frequently difficult to define. Nevertheless, harvesting resources like fish and timber on a sustained-yield basis means living within our best guesses of these constraints; this cannot be guaranteed by short-term maximising of yields.

41 Another significant attribute of systems is the existence of cumulative phenomena brought about by links between various parts of a system. Just as a stock market crash is brought about by the cumulative effects of many individual actions transmitted through a communication system, so too can safe standards of potable water be jeopardised by the cumulative impacts of many extractors and polluters channelled together into downstream aquifers or reservoirs. The consequences of individual actions, each of which might be considered acceptable in isolation, take on a different significance when viewed from the wider perspective of the community of interest that is served by an entire resource system.

42 Sustainability can be seriously compromised or threatened if collective behaviour ("resource demand") is not observed over the time and space horizons appropriate to the resource systems involved. (Sustainability only has significance collectively since the life of an individual human, animal or plant is not indefinitely sustainable.)

Time

43 Sustainability is a dynamic concept. The concept of sustainability must incorporate the fact that relationships between elements of a system (and the elements themselves) change over time. No living system is static; change is continually occurring in response to resource opportunities and constraints; growth and decline are ever-present within living systems. The time dimension must be embedded in institutional design. Sustainability is sometimes pictured as economic stagnation; this is a caricature.

44 "A policy of sustainability means adjusting the overall rate of human use of the environment to a level that can be physically supported in the long term" (Cronin and Lawrence, 1988). What is the "long term"? One answer, from a human perspective, is given in the literature on future generations which makes a distinction between people in the "near future" (those with whom we expect to share a common life) and those in the "far future" (Wright, 1988).

45 From an ecological point of view, whether the long-term is "long enough" depends on the physical processes at work. "In the case of organic waste assimilation, the ecosystem may "tell us" within a few years whether our interaction with it is sustainable; in the case of heavy metal accumulation, fifty years may be needed; while for methane waste (global warming) we might need a century and a lot of investigation!" (Collins, 1988).

46 The time dimension of sustainability can be incorporated either explicitly as a time horizon, or implicitly through physical rate criteria. Where self-replenishing resource systems are involved, the acknowledgement of critical rates is particularly important. Critical rates range from reproduction rates of species to socially intolerable rates of resource price increase.

47 Management for sustainability requires regulatory mechanisms that balance resource demands between competing uses, allowing for the possibility that the relative demand for each use will change over time. It is not concerned with sustaining particular uses per se. A policy of sustainability does not mean, for example, that land currently used for pastoral farming must be used for this purpose in the future.

Space

48 The spatial dimension is critically important when considering institutional arrangements for sustainable resource management, particularly the matter of boundaries of jurisdiction and rights.

49 Some systems are global - the atmosphere and the sea in particular - and therefore not confined within national boundaries. As well as being separated a long way in time, benefits and costs of resource use can be spatially separated as far apart as opposite sides of the globe. Depletion of the ozone layer and residual radioactivity are good examples.

50 Regional boundary definition is critically important for the management of resource use within New Zealand. Resource systems involving very mobile elements (air, water, and other materials transported via air and water) present major challenges to the management of externalities. Boundaries which are seen as appropriate for regional government may be inappropriate for managing some systems. Catchments are a good example; coherent, sustainable management of the Waitaki watershed would be difficult to achieve if a Canterbury regional government was to manage the north bank of the Waitaki river and an Otago regional government was to manage the south bank independently.

Uncertainty

51 The chief characteristic of the future is uncertainty. How do we respond to this? Shall we pursue a policy of caution or deliberately take risks?

52 "Incomplete knowledge and understanding also means that there is often considerable uncertainty about the importance to the health of the biosphere and hence to human well-being of particular aspects or elements of the biological and physical environment. Where uncertainty exists, a fundamental question concerning the criteria for decision-making arises. Namely, whether to assume that something is important until it is shown that it isn't, or whether to assume that it is not important until it is shown to be important" (Livesey, 1988, p2).

53 We advocate caution under uncertainty for two reasons. Firstly, resources are elements of systems. Do we understand all the links and their relative importance? Secondly, an ethic of caution is advocated by many philosophers who try to establish our moral obligations to future generations. We acknowledge a moral duty not to throw bombs at distant figures even if they are shadowy (Feinberg, 1974). In a New Zealand context, deer shooters don't shoot if there's a possibility of a human rustling in the bush.

54 The uncertainty that characterises our current understanding of ecological relationships means that, for example, the preservation of other species can be justified, even on utilitarian grounds, as part of overall sustainability policy, whether or not one acknowledges the concept of intrinsic value. This deduction should not be taken to belittle or prejudice the validity of intrinsic value as a concept in its own right.

55 It is important to acknowledge that uncertainty is not uniform. There are many things about which we are reasonably certain. Regarding "bads" we might bequeath our descendants: "Of course, we don't know what the precise tastes of our remote descendants will be, but they are unlikely to include a desire for skin cancer, soil erosion, or inundation of low-lying areas as a result of the melting of ice-caps" (Barry, 1977). Regarding "goods" we might bequeath our descendants: "Although it is impossible to predict with much precision the likely interests of future generations, it is prudent to assume that their need for natural resources (soil, air, water, forests, fisheries, plant and animal species, energy, and minerals) will not be markedly less than ours" (Goodland and Ledec, 1987).

56 When the potential harm is sufficiently great, we act to prevent it even though the probability is low or information is unreliable - for example, buckling up a child's seatbelt. The probability of disaster is low; we judge the risk to be high.

57 A huge area of uncertainty exists in technology - potential innovation and resource substitution. To what extent can we extrapolate from recent history? Although sustainability is partly concerned with constraints, it should not constrain human ingenuity and inventiveness. There is common sense in the adage that "Resources are not, they become." However, lower-grade ores are tapped partly by better technology and partly by increasing use of energy. Cleaning up a widely dispersed pollutants is also likely to take a lot of energy.

Components of a sustainability strategy

58 A strategy is usually taken to mean a combination of goals, objectives and instruments for achieving those objectives. Here we present policy goals that arise out of our interpretation of sustainability.

59 There are benefits and costs to society associated with each of these goals. An assessment of relative benefits and costs is part of the job of making trade-offs when several policy objectives have to be addressed simultaneously. This presupposes, however, that we are clear on what it is that is being traded off. The question of priorities among policy objectives is initially a political decision for elected representatives. To some extent, policy trade-offs will be reflected in the design of the institutional arrangements that ultimately gain legislative backing.

60 Discussion of instruments for achieving policy goals, if they are judged important, is a matter for Phase Two. Our task here is to establish how the concept of sustainability can be interpreted as a set of specific policy goals. Our immediate clients are those who have the political responsibility to decide the trade-offs.

61 The following summary of our obligations to people in the future describes the basis on which we have set out a sustainability strategy.

> "... the passing on of unruined self-renewing sources of the satisfiers of basic human needs and wants... These self-renewing resources include not just physical ones like seas, forests and land, but cultural ones..., social institutions.., and moral ideas themselves. To people in the near future..., we owe responsible planning, planning aimed at seeing not merely that they inherit basic resources 'as good' as ours, but also the means to get 'enough' of the divisible exhaustible resources we know they will need. To enable them to get enough, control of population size as well as size of our depletion of nature's resources is needed" (Baier, 1984).

62 Activities which are currently judged to be prejudicial to sustainability because of the depletion of a resource or its associated side-effects may become acceptable in the future as a result of technological development. That does not provide a case for relaxing policy targets at present. Clearly articulated and enforceable policy targets can provide incentives for technological innovation.

63 We propose nine major components of a sustainability strategy. No ranking is intended; all are essential. These components are presented in three sets which correspond to the three interlinked elements of the framework presented at the beginning of this chapter.

Resource base,

A To protect the life supporting capacities of environmental systems

B To harvest from renewable resource systems so their capacity for long term yield is not endangered

C To ensure that the aggregate rate of use of fossil energy does not preclude a high probability of an orderly transition to non-fossil energy sources

D To promote increased physical efficiency in the use of stock-constrained resources and their recycling

Social / cultural values

E To promote an equitable distribution of the benefits and costs of resource use

F To foster understanding and expression of cultural values compatible with sustainability

G To recognize the interdependent relationships between a community and its resource base and the implications for community viability

Institutional arrangements

H To develop the set of institutional arrangements necessary for promoting the above components of sustainability policy

I To actively increase understanding and to monitor both environmental systems and resource management institutions

64 These nine components are presented in turn with interpretive comments and examples. The list is not exhaustive in detail. Although some of the goals appear "biophysical", some "social/cultural/economic", and some "institutional", these facets are always linked as the examples below indicate.

65 Increased UV radiation due to a depleted ozone layer would incur increased economic expenditure on health. Hence institutional arrangements are needed which can deal with situations where benefits and costs are separated in time.

66 The collapse of self-replenishing resource systems leads to the collapse of the income streams that support communities. Unsustainable harvesting of fish is an instance. As New Zealand has already discovered, this can happen even with basically good institutional design, if the underlying scientific knowledge is faulty.

67 The capacity of biophysical processes in water bodies to "clean up" some waste streams from human activity provides a substantial service to human communities. The benefits of sustaining such assimilative capacity are both cultural and economic as are the costs of water pollution.

A To protect the life supporting capacities of environmental systems

68 This goal - perhaps the most fundamental - is concerned with the discharge of wastes into the environment. Pollution is not necessarily merely an unfortunate side-effect; some pollutants have the potential to threaten human life on a large scale.

69 Wright (1988) argues that there are three initial questions to ask about environmental harms.

Firstly, is the particular impact of human activity potentially reversible?

Secondly, what is the scale of the impact?

Thirdly, what is the quality of our knowledge regarding the impact?

70 Consider the example of nuclear waste (isotopes with long half-lifes). There is no way we can alter the rate of emission of radiation from nuclear waste, so its release into water or air is effectively irreversible and the impacts are cumulative. The scale of the impact is not usually large; more worrying is the potential for wide dispersion. Finally, our knowledge regarding the impacts on human life is variable; high doses are defintely harmful but we need to know more about the effect of low doses. Does a threshold exist or is all radiation harmful?

71 Additional examples of potentially serious threats are:-

in the atmosphere - ultra-violet radiation, accelerating emissions of "greenhouse gases", acid rain;

in water bodies - toxic wastes, eutrophication, pathogens;

in soil systems - erosion, salination.

B To harvest from renewable resource systems so their capacity for long term yield is not endangered.

72 This objective is concerned with those resources which are renewable or "flow-constrained" (including biological resources which can be dubbed "interest-bearing"). We recognize that the distinction between renewable and non-renewable or flow and stock resources is not a rigid dichotomy but rather a spectrum. Resources are more or less renewable. Of course, in practice we frequently use a mix of renewable and non-renewable resources; we tap the flow of solar energy, for instance, by mining stocks of copper or silicon. We are not advocating "maximum sustained yield" here; rather that renewable resource systems are not "mined" to extinction.

73 The following are examples pertinent to this objective:

sustainable harvesting of fish and timber species;

"non-depletion" of water bodies - both in quantity and quality;

maintenance of the biological productive capacity within biological resource systems such as agriculture and forestry - costs of imported inputs should not exceed commercial value of harvests;

maintenance of viable representative samples of native flora and fauna systems that comprise the adapted gene pool.

C To ensure that the aggregate rate of use of fossil energy does not preclude a high probability of an orderly transition to non-fossil energy sources.

74 An apparent contradiction for sustainability is that the use of non-renewable resources cannot be sustained indefinitely. Substitution by other non-renewable resources and by essentially renewable resources will occur as a price response. However, transitions from one resource to another may not necessarily be "orderly"; price rises may be rapid in some cases and the impacts on society inequitable. For example, another steep rise in petrol prices (as in 1973/74) would be more damaging to those who live in Porirua and Wainuiomata than to those in the gentrified inner suburbs of Wellington.

75 We can import stocks of fuels but we cannot import renewable energy systems. Heavy reliance on imports of fuel stocks makes the importing country extremely vulnerable to the social and economic impacts of supply disruptions and large price discontinuities, particularly if alternative indigenous energy systems would be incapable of adequate substitution.

76 Because of this there is a case for:

developing a thorough knowledge (detailed inventory) of the capacity of all indigenous energy systems, even though many will not be in use or considered for commercial development under current circumstances; and

looking at physical efficiencies in material and energy use.

D To promote increased physical efficiency in the use of stock-constrained resources and their recycling

77 By physical efficiency, we are referring to input/output efficiencies in the use of materials and to thermodynamic efficiency. Improved physical efficiency will to some extent show up in measures of economic efficiency such as cost/benefit ratios and productivity measures.

78 By recycling, we refer to "waste management practices" that do not dump spent materials in a dispersed manner.

79 Both increased physical efficiency and recycling extend the utility to be derived from a given resource stock. Thus "sustainable" use of stock resources implies using them in a manner "which does not unneccesarily preclude easy access to them by future generations" (Goodland and Ledec, 1987). Increased physical efficiency of resource use slows the rate of depletion of more easily accessible reserves. Recycling both reduces depletion demand and the demand for ancillary resources needed to gather and re-use dispersed residuals. Of course, there is no such thing as recycling of energy, therefore improved efficiency of use is the only means for extending its utility.

80 All resource use has its associated externalities. Improved physical efficiency of resource use is a way of reducing the externalities associated with each unit of consumer benefit.

81 Examples of situations where improvements in physical efficiency are relevant are:

in the conversion of energy to energy services;

in the use of agricultural fertilizers, and sprays; and

improved durability of consumer goods.

E To promote an equitable distribution of the benefits and costs of resource use

82 The management of natural resources for sustainability will affect the distribution of social benefits and costs from the use of resources. Present unsustainable practices can include the uneven distribution of their negative effects across society, while the people who cause these effects retain the benefits. This inequity is achieved through political or economic power, or power over information, including the maintenance of ignorance about environmental degradation. One goal of sustainability is therefore the more equitable distribution of goods and bads of resource use among people today, and between ourselves and future generations. This goal will require new institutional arrangements.

83 Most importantly, under sustainable practices the specialised needs of groups who require a narrow environmental niche would have special recognition compared with those groups whose needs for that type of resource can be met from a wide variety of sources. For instance, many valleys can become hydro-electricity reservoirs whereas only one of them may have the special conditions of soil, water and climate needed to grow apricots. (A low dam at Clyde would have provided both, but still have eliminated a special stretch of wild river with historical and scenic values.) Any trees can be pulped; hardwoods have specialised uses. Is intensive recreational walking appropriate in a fragile biological reserve? Resources would be managed for the maximum satisfaction of all user groups with specialised resource needs.

84 To assess and accomodate these needs, the interests and values of a wide range of social groups have to be integrated into decision making.

F To foster understanding and expression of cultural values compatible with sustainability

85 Both Maori and Pakeha value systems in New Zealand society have a rich tradition of cultural values related to sustainability. The Maori have a heritage of principles of resource management derived from over a thousand years of adaptation to a unique island environment. For future positive adaptation, however, it is necessary to maintain or enhance values relating to sustainability. For instance, Maori rights under the Treaty of Waitangi need better recognition, while at the same time their cultural values need to be reinforced, through language and education (kohunga reo), for example.

86 Similarly, an emphasis on utilitarian education and reductionist science in the formal education system can stifle alternative philosophies. Ethics held by the community can also be threatened, for example, land ethics held by family farmers who are leaving farming through economic restructuring, or enhanced, by increased numbers of small farmers promoting multi-tier/objective farming, or organic agriculture.

87 Examples of actions to promote values of sustainability are:

the Treaty of Waitangi to be held as a long term basis for sustainable use by both Maori and Pakeha;

the promotion of environmental education and teaching of a balance of systems and reductionist science;

recognition and enhancement of collective and community consciousness of sustainability - for example, a soil conservation ethic.

G To recognize the interdependent relationships between a community and its resource base and the implications for community viability

88 Many communities at the interface of the relationship between our society and its natural resources experience considerable social instability over time. This instability causes rapid fluctuations in population and associated social upheaval, as stock resources are used, new technology introduced, or economic restructuring takes place. Examples include communities largely committed to mining and energy production, forestry, and farming.

89 Management for sustainabilty would minimise extreme changes in population and accentuated boom-bust cycles, and enhance community viability.

H To develop the set of institutional arrangements necessary for promoting the above components of sustainability policy

90 Bromley (1988, pp7-12) provides a helpful and concise discussion of the significance of institutional arrangements as "important choice variables" for implementing policy. The range of choice of actions available (for example, in matters of how the services of the environment will be used, managed, and controlled) is defined by the set of institutional arrangements which are worked out as part of the policy formulation process.

91 Such institutional arrangements are aimed at "reconciling the role of the individual vis-a-vis the role of the collectivity." They "define who may do what to whom while protected by the ultimate sanction of the state;..." Since sustainability must recognise both the controlling functions exercised by people and the integral control functions within natural resource systems, it is logical to incorporate into institutional arrangements what it is that humans have to accept about the workings of biophysical systems.

92 Thus, the design of institutional arrangements is determined in the policy making process by the policy goals they are meant to facilitate. Not only do they provide for mechanisms to resolve conflicts, they are also important to developing the necessary environment for technological innovation.

93 Human behaviour results "in outcomes that will be regarded by the citizenry as either good or bad." If the outcomes are perceived as bad, "then there will be collective action to attempt to change the institutional arrangements that define individual opportunity sets ... that is, citizen input will be directed at the policy level to seek a new constellation of rules and laws (institutions) that will alter the domain of choice for firms and households." If outcomes are seen to be incompatible with established sustainability policy, then the on-going process of policy assessment and review must allow for adapting and reinforcing the institutional arrangements to improve their effectiveness.

I To actively increase understanding and to monitor both environmental systems and resource management institutions

94 Gathering information is not an end in itself. It serves two vital purposes - (i) research to improve understanding, and (ii) monitoring for enforcement and accountability.

95 Research into the way biophysical and social systems function is aimed at improving the empirical base of our understanding, although some uncertainty will always be unavoidable. With the potential for imposing major irreversible damages on future generations, uncertainty cannot be used as an argument for lack of decision or action.

96 On-going monitoring of the behaviour of these systems for indicators of improved or impaired sustainability is an integral part of implementing policy and adapting institutional arrangements. Since the systems in question are complex and dynamic, the monitoring must be on-going. Since many physical processes have very long time constants (or slow rates of change), long-term information sets are essential if the information is to be of any use.

97 Monitoring is a necessary part of enforcement and of accountability. In particular, monitoring the performance of institutional arrangements designed to promote sustainability is an essential pre-requisite to their future reform.

98 This component is essential to implementing all the other components of the sustainability strategy.

Definitions of sustainability

99 Our discussion of the concept of sustainability points to the difficulty of concise definition. Nevertheless, we have often been challenged to provide one.

100 Goodland and Ledec (1987, p36) offer the following tentative definition: sustainability is "... a pattern of social and structural economic transformations which optimizes the economic and other societal benefits available in the present, without jeopardizing the likely potential for similar benefits in the future."

101 The papers by Ashley-Jones and Taylor (1988) and Cronin and Lawrence (1988) list a number of definitions of the term sustainability taken from such documents as the World Conservation Strategy (1980) and the 1981 Draft New Zealand Conservation Strategy.

102 Ashley-Jones and Taylor refer also to a definition by Sharp (1980): "A sustainable society is one that recognises the current and likely future ecological, social and economic implications of its practices and implements policy that minimises future regrets." In emphasising the important relationship between biophysical and sociocultural systems, discriminating between what is more certain and what is less certain about the future, and emphasising the need for caution under uncertainty, our interpretation very closely mirrors that of Sharp.

103 If we must try to encapsulate our concept of sustainability into one concise definition, it would be something like the following:

> to manage human use and control of biophysical cycles with full regard to the future.

This "definition" avoids the arbitrary treatment of resources as discreet entities. It acknowledges that resource management involves the question of human demand from the resource base as well as the impacts of human activity on the resource base. The "definition" also emphasises that the long-term matters as well as the short-term. It accommodates both Maori and Pakeha approaches.

CHAPTER TWO

Illustrations of sustainability

Introduction

104 In this section we present six resource management case studies in order to illustrate practical aspects of sustainability. Our aim is to identify specific policy issues that stem from sustainability, and to provide a basis for exploring possible government roles.

105 Each case provides a different context for interpreting sustainability.

1 Fisheries are one of New Zealand's principal natural assets, but our track record in their management is not impressive. The major part of this illustration deals with fisheries management in general. A particular fishery, the eel fishery at Wairewa, is used to illustrate conflicting cultural values.

2 Catchment management is concerned with the conflict of objectives that occurs when interrelated systems contain several resources with several potential uses.

3 The case of climate change is a global resource management problem where "benefits" and "costs" are separated in time and space.

4 The management of the pounamu/greenstone resource looks at the depletion of a single stock resource with particular implications for conflicting cultural values.

5 The South Westland case (mining, forestry and tourism) deals with sustainability on a regional level; community viability and conflicts between different communities of interest emerge as major issues.

6 The management of energy use focuses on the difference between "using particular resources" and "optimising social benefits from the use of resources".

106 We are conscious of the need to keep these illustrations brief. However, because brevity can often mean leaving out important assumptions and steps in logic, we have decided to present only a short synopsis of each case illustration in this chapter. Fuller discussion can be found in the appendices.

107 Each case incorporates:-

(i) a description of the resource system being managed;

(ii) specific policy objectives that derive from sustainability;

(iii) key indicators of unsustainability; and

(iv) a summary of issues for sustainability and the role of government in each particular case.

108 We have been constrained by time to these six case illustrations. We believe that it will be important to work on other cases, particularly as part of examining appropriate institutional mechanisms for pursuing sustainability (Phase Two of the Resource Management Law Reform process). Nevertheless, the cases given here should serve to illustrate something of how sustainability could be interpreted in practice.

Case illustration 1 - Ocean fisheries

109 When one speaks of "a" fishery or "the" fishing industry as a resource management problem, there is always the risk of over-generalising, of assuming away the "real" issues. Fisheries can be characterised as extremely complex ecological systems that are constantly changing, but that does not get us very far either. Fisheries are one of the most important renewable resources to people, and their management for sustainable use for present and future generations is a matter of worldwide interest. Marine fisheries are one of New Zealand's greatest natural assets, yet our track record in exploiting the benefits could not be described as optimal or wise. Improved management procedures are needed and the objective of sustainable use can guide future policy development.

The resource system

110 Management of complex biological-hydrological systems like marine fisheries is extremely difficult. Some important characteristics of fishery systems which complicate management are:

1. the multispecie nature of most fishery resource developments and the consequent problems associated with joint products and by-catch waste;

2. the migratory nature of many fish species requires international agreements and coordination of policy;

3. the resource area is enormous, and is difficult to research, monitor and control;

4. the natural habitat of fisheries is dynamic, and, because of high natural variability in these systems, the effects of human activity are sometimes difficult to discern, particularly in the short term;

5. interactions between the fishery resource and human communities are governed by institutions which are changing over time;

6. the capital invested by fishers is high, quotas are restricted and expensive to obtain; there is always a potential conflict with management policies;

7. farming of wetfish, crustacea and shellfish is poorly researched and underdeveloped in New Zealand; and

8. coastal and estuarine habitats have been poorly protected.

Maori cultural values

111 The eel fishery at Wairewa (Lake Forsyth, Banks Peninsula) can be used to illustrate the management of a fishery and its associated ecosystem on the basis of Maori values and rights (Gray, 1988). Traditional methods and practices are still being used at Wairewa, despite social and cultural change and many external pressures, including commercial fishing. These practices include a "quota" system in terms of the timing of fishing, and restricted access for fishing. There are also cultural restrictions on the use and exchange of eels that are caught.

112 Wairewa is a taonga of the Ngai Tahu people. It is part of their mahinga kai, the matrix of life that sustained them both physically and culturally. The mana whenua and control of the lake system is held by the people of Irakehu Wairewa. The eel resource in the lake is managed by them through a set of natural or spiritual laws, which include notions of tapu, kai tiaki and utu. Those who understand and live within these laws sustain the resource, catching appropriate numbers and size of eels at appropriate times.

113 The use of the eel catch is socially relevant. For instance, it is used in food for hui and tangi hanga, for "gifts" to kaumatua and rangatira, or exchange for other cultural resources, such as tiiti (mutton birds) or pounamu. Any surplus not for immediate use was traditionally hung and dried, and left for the next group of fishers.

114 Changes and external pressures on the traditional management system have been leading to unsustainable practices. Easy transport to and from the lake has increased access for users. Smoking of eels and sales of fish, including a commercial operation at the mouth - outside the jurisdiction of the tribe - has added pressure. Loss of much of their mahinga kai and language, social and economic disadvantage, an ongoing and unresolved land claim, and unfulfilled rights under the Treaty of Waitangi, make it very difficult for the local Maori people to maintain their system of management at Wairewa. The implications of not retaining the system seem obvious to them given the current state of the much larger Waihora (Lake Ellesmere) nearby. Described as once being a principal "food basket" of Ngai Tahu, Waihora is now virtually useless as a source of mahinga kai.

Policy objectives for sustainability

115 In order to improve management, some problems must be recognised and overcome first. Some important dimensions of the problem of policy-making relate to:

1. vague or unclear objectives which are difficult to translate into policy targets that are achievable, and policy instruments which are not linked to specific performance measures;

2. human influences (besides overfishing) on important habitats and biological food chains, which in turn affect stability and productivity levels;

3. the failure to account for the established relationships between human communities and fishery resources in setting policy, including objectives which reflect different economic, socio-cultural and environmental values;

4. the role of institutional change, including the rules and regulations which guide individual behaviour, and the conditions under which governments are responsible for intervention to coordinate and/or resolve conflicts;

5. the inherent climate of risk and uncertainty in policy-making when the information base is generally inadequate.

Indicators of unsustainability

116 Sustainability policies are targeted by measureable indicators which reveal directions in change. Some examples of such indicators in fisheries management which can alert decision-makers to possible unsustainable conditions or practices include economic, socio-cultural and environmental variables. Some examples include:

Economic - declining total fishery revenues, high variability in annual earnings, over- capitalisation of certain specialised or individual fishing sectors and processing facilities, rising real fish prices;

Ecological - instability of productivity parameters, long term productivity decline, irreversible loss of habitat, changes in species diversity, discharge of pollutants in fishery environments;

Socio-cultural - changes in established patterns of fishing or fishery-dependent communities over time, unrest and social conflict due to fishery ownership and management practices.

The role of government

117 Special policy interests such as affirmative action measures (for example, "partnership" and fishery "redevelopment") will clearly involve central government decision-making and coordination. Harvest policy, the setting of TACs, the administration of fishery management "zones", etc. could not be devolved to regional and local governments without major problems of coordinating the relevant actors and actions. On the other hand, there is no compelling reason why fisheries could not be "owned" and used by private industry and/or cultural groups economically and equitably, provided the institutional framework put in place by central government was appropriate to the requirements of sustainability.

Case illustration 2 - Catchments

The resource system

118 A systems view of catchments is essential where the links between systems are emphasised. Within any catchment there are major, interrelated systems of water, soil, mineral deposits, flora and fauna communities and human communities. The main elements of any catchment's external environment are climate and weather; cultural and economic influences and the effects of management practices in adjacent catchments.

Policy objectives for sustainability

119 Policy objectives pertinent to sustainable catchment management are:

(1) to encourage land-uses which facilitate good drainage;

(2) to conserve soil;

(3) to efficiently allocate available water resources and to maintain water quality standards so that no particular use is irreversibly lost;

(4) to preserve viable representative samples of natural ecosystems;

(5) to manage the introduction of exotic species of flora and fauna in a way that does not compromise other objectives;

(6) to manage the harvesting of flora and fauna in recognition of the critical importance of regeneration rates; and

(7) to protect the long term assimilative capacity of natural waste-receiving systems.

120 To achieve these objectives, limits must be recognized - for example, maximum permissible levels of toxins in groundwater, minimum instream flows to sustain aquatic habitats, water abstraction rates from underground aquifers, rates of soil loss. These limits will require revision as we discover more about the resilience, productivity and vulnerability of the systems. The word "limit" should not be taken to automatically imply regulation. Rather, any sustainability objective should be seen as the focus of a wide range of options within the management process itself.

Indicators of unsustainability

121 The systems within catchments are dynamic. Indicators of unsustainability therefore usually relate to rate phenomena of some sort. Some common examples are:

(1) excessive fluctuations in water flows (very low river flows leading to loss of in-stream habitat, very high flows eroding river margins and causing flooding);

(2) long-term persistent change in water bodies such as an increase or decrease in aquifer levels leading to soil salination in coastal areas, depletion of water supplies, and increasing contamination (lake eutrophication or nitrate build-up in town water supplies);

(3) depletion of the soil base (soil erosion and soil slumping resulting from overgrazing, deforestation, misplaced cultivation or carelessly built roads);

(4) the inability of land-based systems of production to survive periodic extreme conditions such as droughts; and

(5) the disturbance of natural regenerative processes as a result of introduced exotic species not subject to adapted prey-predator constraints (deer grazing destroying forest undergrowth).

Issues for sustainability and the role of government

122 These issues derive from the nature of the systems involved. The systems of water, soil, and flora and fauna are connected dynamically, which means that events in one part of a catchment can cause impacts elsewhere and after some time delay. There is considerable separation both temporally and spatially between causes and effects.

123 Our understanding of the dynamics of biophysical processes still involves much uncertainty, giving rise to the on-going need for monitoring as the basis for adapting biophysical constraints and improving management practices. Improved understanding raises the question of how to implement knowledge. Uncertainty should not always be used as an excuse for inaction.

124 Biophysical systems are susceptible to irreversible change. What institutional arrangements are appropriate in such circumstances, particularly situations of high risk? There are some regions of critical importance in catchments - natural aquifer recharge areas, unconfined aquifers with special uses, upper catchment areas particularly vulnerable to erosion, unique habitats - which need special management.

125 Sociocultural systems are also connected dynamically. Different communities of interest have different objectives. It is important to identify these in order to match responsibility for particular policies with the appropriate agencies and actors and to determine jurisdictional boundaries. The interconnectedness of the resource systems means that there will also be separation of economic and social costs and benefits; management practices in one place will have impacts of various kinds elsewhere.

126 A policy of sustainability will thus generate conflicts and a need for conflict resolution as part of the political process. There will be conflicts over competing objectives (for example, sustainability, equity, economic efficiency), conflicts over the distribution of benefits and costs (the needs of various constituents now and the needs of future generations), and conflicts over different cultural values. These conflicts also indicate the need for on-going monitoring, as part of the basis for conflict resolution. Indeed, they highlight the importance of decision rules, the role of institutions, and political process.

127 Management in pursuit of sustainability must integrate biophysical and sociocultural considerations as closely as possible. An example where there is good agreement is the need for on-going monitoring. An instance where the nature of sociocultural and biophysical systems are often at odds with each other is over the "return times" of important processes.

128 Sustainability in biophysical systems often needs to be addressed over time horizons stretching to many decades - for example, soils accumulation, aquifer recharge, recurrence of extreme weather events, community development. Many sociocultural processes have cycles that are very short by comparison - for example, parliamentary electoral cycle, return of capital, liquidity, the human memory of past problems. It is important that institutional arrangements are designed to overcome the long-term management difficulties imposed by this mis-match of "return times".

129 Another important issue to be addressed in the design of institutions for managing catchment resources is the need to incorporate cultural and scientific understandings. Should there be any absolute restrictions on human activity derived from cultural considerations - for example, the tapu on mixing waters of different status?

Case illustration 3 - Climate change

130 The long term environmental effects of human activities on the earth, particularly since the beginning of the industrial era, have only recently begun to be appreciated and understood. The composition of the atmosphere that is so important for sustaining conditions suitable to life depends upon sustaining certain chemical balances. This case example illustrates the kinds of questions and possible approaches that need to be considered in examining the relevance of sustainability in an international context.

Description of systems

131 The global atmosphere performs several functions that are vital to life such as maintenance of temperature stability in the biosphere and screening out of ultra-violet radiation that is harmful to all living organisms. Weather systems redistribute heat, moisture and other airborne and atmospheric materials. The impetus for this process comes from temperature differences due to the imbalance of tropical heat gains and polar heat losses. Because of this transport mechanism, materials released into the atmosphere can be carried to virtually any part of the world. Human impacts on climate are not new; they began with agriculture, about ten thousand years ago.

Policy objectives for sustainability

132 With sustainability as an objective, the main concern centres on the potential risks in disrupting important chemical balances in the atmosphere as a result of human activity. In the case of halocarbon emissions, human action is introducing a new set of chemical species into the atmospheric chemistry. With carbon dioxide, methane and nitrogen oxides, the concern focusses on rates of emission of these gases to the atmosphere.

133 Policy objectives pertinent to vital atmospheric functions are:-

(1) to reduce/control rates of emissions of gases which disturb atmospheric composition and the global radiation balance;

(2) to learn more about the behaviour of the global atmospheric climate system, particularly about which insults pose the greatest threat to climate stability and which consequences are most likely; also much more effort

is needed on investigation of regional change (an emphasis on southern hemisphere work, on consequences that are likely for New Zealand and differentiation within New Zealand).

134 Policy targets will focus on critical rates of emissions; the stringency of particular targets will depend upon perceptions of what emissions constitute more immediate risks and have a greater likelihood of irreversible consequences.

Indicators of unsustainability

135 Signals of climate change which should give rise to concern are:

(1) ozone holes and their behaviour;

(2) increased frequency of severe storms and/or droughts;

(3) acidification of forests and water;

(4) ice advances or retreats; and

(5) global heating and cooling.

Issues for sustainability and the role of government

136 Four of the major issues in climate change are potential irreversibility, uncertainty, accumulation of impacts, and the problem that neither causes nor effects are contained within national boundaries.

137 The potentially irreversible effects on the atmosphere of burning fossil fuels are external to the marketing of those fuels. Externalities must be addressed, at least initially, by governments; markets do not cope well with irreversibilities.

138 Uncertainty plagues this area; there are many different scientific models of the Greenhouse Effect, for example. However, uncertainty is not uniform and there is far more certainty about the causes and effects of ozone depletion. New Zealand has a global responsibility to do its share of the monitoring since regional effects may vary widely.- cumulative impacts, critical emission rates, potential irreversibility and its risks.

139 Pollution in the atmosphere is cumulative - there is nothing to flush it out. New Zealand is only a minor contributor by world standards (but a significant per

capita contributor) and this should not lull us into a false sense of security.

140 The atmosphere is shared by everyone - all countries contribute and all may be at risk, although some perceive the possibility of benefits, for example, from atmospheric warming. Participation in international agencies and institutions in matters affecting national sovereignty is a role for national government.

Case illustration 4 - Pounamu

The resource system

141 Pounamu is a stock resource that is found in rock form as crude jade in the beds of Weat Coast rivers. It provides this study with an example of a stock resource that is at present managed by two very different cultural systems (Maori and Pakeha) that are at times in conflict. In particular, the use by non Ngai Tahu interests is at a rate of extraction that greatly exceeds the current cultural use of the resource. The cultural usage primarily "recycles" existing worked stone whereas commercial uses result in export or one way transactions (Gray, 1988).

142 Pounamu was discovered by the Southern Maori in the 15th century and was traded with North Island tribes who did not have their own sources of supply (see Appendix 4). By the time of Cook's first visit in 1769-70, the Ngai Tahu had discovered all of the primary sources of pounamu from Nelson to Fiordland, and exercised complete control of access to the resource. This control was disrupted during the Maori wars of the early 1800s and later by the sale of Westland to the NZ Government in 1860. However, even though there was an active trade between Northern and Southern Maori tribes for over 300 years, the commercialisation of pounamu (in the modern meaning of the term) did not occur until the stone was "rediscovered" by the European settlers (Brailsford, 1984).

143 Gold was discovered in the Taramakau River area in 1864, and as a consequence considerable quantities of pounamu were found by diggers and sluicers. Significant amounts of "greenstone" were exported during the next 40 years, primarily to Australia and Europe. Between 1890 and 1939 Germany was the largest importer of New Zealand greenstone. During World War II the "discovery" of high quality, cheaply priced "jade" by U.S. servicemen visiting New Zealand created such a high demand that the Government was forced in 1947 to prohibit the export of unworked greenstone. In the past 40 years the demand for greenstone has grown primarily in line with the growth of the New Zealand tourist industry. Today some 95 percent of the jade marketed in New Zealand is purchased as souvenirs by international visitors.

144 An interesting development since 1980 has been the importation of jade pieces of jewellery by NZ retailers. The source of these souvenir pieces is primarily Taiwan, where the familiar hei-tiki and other designs are fashioned from Chinese and Canadian jade by craftsmen on

(comparatively speaking) very low wages. This presence of imported jade products in the market attributes (in part) to the decline in the real price of New Zealand greenstone products over the last five years. There is an emerging fear among the three domestic greenstone "factories" that the cheap foreign imports will continue to capture a growing share of the tourist market and eventually drive them out of business.

145 Because of its finite nature and relatively high quality by world standards, it is possible that the pounamu resource could be exhausted in a relatively short time if the requisite conditions for commercial development should prevail. On the other hand cultural values, and the associated uses of the resource by Maori interests, (which require relatively low rates of use), would be more resource conserving. In between these two possible extremes are joint-use regimes which involve both commercial and cultural interests. In fact outright depletion would be difficult since "mother-lodes" have never been found. Because the supply of pounamu occurs as boulders in stream-beds which change markedly from year to year, the rate of recovery could be similar to a renewable resource harvest regime.

146 The aim of government policy should be to ensure that present and future beneficial uses of the resource are sustainable. What this means in terms of appropriate political action is not clear. Should imported greenstone artworks to meet the growing tourist trade be encouraged or discouraged? Should the commercialisation of pounamu be promoted or prohibited? To what extent are commercial and cultural interests complementary? Since so little is known about this resource what exploratory and monitoring information would be most valuable to management policy? Since the main commercial sites fall under one tribe's jurisdiction, can local or regional management mechanisms adequately serve the national interest?

Policy objectives for sustainability

147 The basic aims of pounamu management policy include:

(1) the maintenance of mutual obligations of Maori and Pakeha under the Treaty of Waitangi;

(2) sustenance of Ngai Tahu culture and the social relationships of kin groups extending from the managing tribe, through recognition of the cultural importance of the pounamu resource;

(3) the maximising of economic benefits to tourism and

ornament/ jewellery industries, including a suitable depletion policy and flow of benefits, and the achievement of regional economic objectives, for example, employment and community viability; and

(4) fulfilment of management objectives for national parks, reserves, recreation and wilderness areas which include pounamu resources in-situ.

The role of government

148 The roles of government may include:

(1) taking an active role in reconciliation of conflicts of interest and property rights between Maori and Pakeha views, for example, through the Treaty of Waitangi Tribunal and recognition of recommendations from the Tribunal hearings of 1987 and 1988;

(2) encouraging and participating in establishing a partnership concept in the management of pounamu, for example, setting policy for extraction by non Ngai Tahu interests, or, formulating a policy for extraction of pounamu for cultural purposes from national parks or reserves which are not owned by Ngai Tahu people;

(3) acting as agent under the Treaty of Waitangi in control of mining rights and depletion rates by non Ngai Tahu, and policing of illegal extraction; and

(4) protecting Ngai Tahu rights to use pounamu as culturally and economically appropriate, and their rights to control the allocation of uses, receiving resource rentals, and setting conditions of use for all user groups.

Case illustration 5 - South Westland

149 Regions typically contain many different ecosystems, but the most distinguishing feature of regional management is the interrelations that occur between regimes. This case study emphasises the region as a sociopolitical and economic entity.

150 The remoteness of South Westland, with its long distances from major commercial centres and the dispersed nature of consumer demand in the region, imposes disadvantages for sustaining the regional economy.

Description of the region

151 South Westland south of the Cook River encompasses New Zealand's largest remaining pristine wilderness area, rich in native flora and fauna and landscapes unmodified by humans. To some extent this reflects the very low population density. (The permanent population is around four hundred.) There are also believed to be substantial mineral deposits (gold, ilmenite, chromite, nickel, scheelite, asbestos, limestone, greenstone, coal) that could attract proposals for commercial development. The communities of interest concerned with management of resources in the region cover the whole spectrum - from small settlements permanent residents, earning their livelihoods and striving to maintain their sense of community, to the global conservation community with its World Heritage proposal. (MfE, 1987)

Policy objectives for sustainability

152 In order to ensure the viability of communities in the region, the West Coast Regional Planning Scheme seeks to promote the overall policy to "safeguard the interests, promote the unity and provide opportunities for the people of the West Coast as residents of the region and New Zealand." (West Coast United Council) Under this umbrella policy, the scheme promotes several objectives pertinent to sustainability.

There are several which emphasise its collective nature:

(1) to maintain the right to a regional and community identity;
(2) to extend "the benefits of advancements in civilisation" to residents;
(3) to ensure that residents meet a number of "obligations to society, the region, and the country" such as gainful employment, wise and prudent resource

use, and contribute to the well-being of the region and the nation.

Another recognises the interdependence of community, economic and environmental systems:

(4) to ensure that "effects of decisions or actions in one part of the system on other parts shall be identified and taken into account by all public and government agencies."

153 The emphasis in this case study is on community viability, although we recognise that this is largely dependent upon sustaining the productive capacity of the environmental resource systems involved. Community viability is perceived as the "ability of individual communities to achieve their own objectives" as well as those of the planning scheme. Forests provide the source of livelihood to residents (through timber-based commerce, recreation and tourism) as well as habitats to a range of species of flora and fauna. The two aspects should not be seen in isolation. Similarly, the water resource supports direct community needs, wildlife habitats and recreational pursuits.

154 Thus resource management objectives and procedures should be considered in the context of achieving both community viability and environmental sustainability.

Indicators of unsustainability

155 A number of indicators might suggest unsustainable conditions or practices at the regional level:

(1) persistent loss of population, particularly of working age;

(2) persistent unemployment;

(3) relatively high prices for goods and services in the region;

(4) long-term decline in tourist visits;

(5) predominance of business closures over new business developments; and

(6) increased incidence of community conflict/violence.

156 These indicators, associated with community viability, may also be linked to unsustainability in environmental resource systems, such as loss of ecological areas, coastal erosion, or deteriorating water quality.

Issues for sustainability and the role of government

157 The interests of local and regional communities in pursuing community viability are very likely to conflict with the interests of other "communities" - the national tourist industry, or the "nature conservation community" both in New Zealand and internationally. There is a history of conflict between these different communities of interest that highlights the importance of mechanisms for resolving conflicts.

158 A principal reason for conflict arises out of the uneven distribution of the costs and benefits imposed when one objective takes precedence over others. For example, establishment of a World Heritage Park over a large portion of the region (with its consequent prohibitions on minerals extraction and commercial logging operations) may deny to residents important opportunities for developing commercial and community infrastructure, creating employment and earning income. A framework for dealing with compensation and the redistribution of costs and benefits needs to be established.

159 Vulnerable systems - whether they be remote regional communities or pristine wilderness areas - need monitoring as a safeguard against unsustainable developments. A government responsibility exists for this function, acting on behalf of the communities of interest most vulnerable to unsustainable change and least able to carry out the function themselves.

Case illustration 6 - Energy

160 This case study examines energy as a special resource management issue in sustainability.

The resource of system

161 New Zealanders obtain energy from a variety of primary sources, some of which are flow-limited (for example, hydro-electricity and geothermal heat), and others which are stock-limited (for example, oil and natural gas). Although energy is an essential input to all human activity (in fact, to all physical transformation processes) it is not energy itself that people value - rather the services which energy, in its various forms, can provide. We value warm homes, motive power for vehicles, and industrial processing.

162 The utility derived from using energy depends not just on the quantity of energy used but also on the physical efficiency with which the energy is used. We keep warm by switching on heaters and by insulating our homes. Thus physical efficiency can be regarded as a legitimate source of energy supply (Wright and Baines, 1988).

Policy objectives for sustainability

163 Policy objectives pertinent to sustainable energy management are:

(1) to broaden the focus of management attention (within energy utilities such as Electricorp) from a narrow preoccupation with "supply-side" primary resource development to embrace the more general concept of delivering energy-based services;

(2) to establish and enforce resource development priorities that give preference,

firstly, to:-

> investment that increases the physical efficiency of energy use and thereby reduces demand, so long as the incremental unit costs are not greater than the least cost, similarly reliable and available primary resource option;

then to:-

> investment in the development of renewable energy sources, with the same caveat as above;

and finally, to: -

development of non-renewable energy resources.

164 Investments in demand reduction as opposed to supply increase have minor environmental impacts and, in some instances, are labour-intensive.

Indicators of unsustainability

165 Unsustainable energy practices could be indicated by:

(1) The existence of inefficient energy use when more efficient means are available and are more cost effective. The costs of externalities should be included in the comparison.

(2) an aggregate rate of energy use that exceeds the estimated supply capacity of renewable energy systems.

Issues for sustainability and the role of government

166 A major issue for sustainable energy management arises from the traditional "supply-side" approach to marketing energy by:
(i) emphasising traditional primary energy reserves and ignoring well documented "reserves of conserved energy", and
(ii) imposing a technologically centralised resource management structure (appropriate to dealing with concentrated stock resources) on all energy management developments.

167 "Conservation" suffers from a negative image and is seen in opposition to resource development. In fact, conservation can be development - whether it be an investment in cogeneration, an investment in an efficient irrigation system, or an investment in preventive medicine.

168 Energy conservation is often not served well by the market. For example, electricity pricing policies do not give the correct signals to consumers about energy conservation / efficiency investments. The household sector, for instance, is subsidised by the commercial sector. Consumers in all sectors pay an average price for electricity, but a marginal price for upgrading the efficiency with which they use that energy.

Summary and implications

169 In concluding this chapter, some general observations on the operational aspects of policies for sustainability are warranted. The discussion centres around two themes which have emerged from the case illustrations: complexity and community of interest. Complexity focuses attention on the general character of the decision-making problem. This summary discussion seeks to clarify the circumstances under which sustainability is a workable policy objective of government. In discussing community of interest issues we briefly examine the appropriate levels of government for policy-making and implementation over a broad range of circumstances.

Complexity

170 It is clear from the case illustrations that as the complexity of the system increases the application of the concept can become more difficult. In the simplest case, the sustainability of the pounamu resource involves relatively straightforward policy objectives and instruments (for example, decommercialise and preserve for exclusive cultural use; manage the depletion rate to optimise multiple end-uses; etc.). Similarly, more sustainable energy practices involve revision of institutional arrangements and should not be too difficult to implement. The management of fishery resources for sustainable long-term use also involves conflicting cultural values, but these are much more complex systems where the lack of knowledge is a severe limitation to applying sustainability objectives. It was noted as symptomatic that uncertainty in management of harvest generally resulted in depletion (e.g. the deep-water orange roughy fishery). For many fisheries, sustainable development means "redevelopment" first, as it would be inconsistent with the concept to manage resources for any length of time in a depleted (less than optimal potential) state.

171 Catchments are yet a higher level of complexity and involve highly inter-related sub-systems that are managed for many uses, both complementary and competitive. The general character of multi-objective and multi-means planning and management is conflict resolution. Risk and uncertainty is also an important characteristic of catchments, but a large body of information is available on how catchments behave and are likely to respond to alternative human activities. The application of the sustainability concept in catchment management has to account for a number of "interests" of groups of people

with well-established and divergent value positions on most issues. Examples of such value-position conflicts include agriculture vs forestry, development vs preservation, urban vs rural, individual vs group. Sustainability instruments and policy targets are more difficult to formulate in the context of a catchment because of the divergent views and the pressure to compromise. Sustainability, then, can become an objective in a rival stance on resource use which might appear to be tradeable with other policy objectives (e.g. economic efficiency) rather than as part of a multi-objective set of management policies.

172 The West Coast is a regional illustration of all the complexity of catchment management, where inter-catchment and inter-regional linkages are the focal point. Here regional sustainability issues basically concern the interests of communities and the community of interest (constituency). Regional community interests such as the sustainability of local industries and the stability and vitality of human/cultural "community" are frequently at odds with the sustainability objectives "others" may have (e.g. another region or the nation as a whole) concerning the same natural and/or physical resources. The examples of tourism development, forestry and other land-use issues, minerals developments, etc. illustrate very clearly the need for policy objectives and instruments which do not confuse the levels (or hierarchy) of relevant interest. "Coasters" must see the application of sustainability in their own eyes, including implications beyond the region. Likewise the "national interest" perspective on sustainability must recognise the consequences to the regions. In this way, constructive debate can take place to inform decisions regarding the trade-offs between the sustainability stances themselves.

173 The illustration of global climate change extends the argument of the region to the nation. Only, in this case there is a loss of integrity of decisions and accountability. New Zealand can affect, and similarly depends upon, other countries who may or may not be prepared to co-operate in global sustainability strategies and programmes. The contribution to and consequences of a changing world climate is seen differently in individual countries, since appropriate mechansisms for accountability and equity in the distribution of beneficial and harmful effects are not yet in place. For example, the inability to internalise the social costs of acid rain, which only concerns a few western industrialised nations in the North Atlantic and Europe, pales into insignificance when compared to the possible effects of global warming or ozone depletion which concerns all mankind. Unlike the common property

problem in managing a single resource system, the similarity to common property in global resources ends here. The practical application of the sustainability concept in global environmental and development policy is difficult to imagine for the world community at present.

Community of Interest

174 The community of interest or constituency comprises all the relevant parties and actors in a policy dispute or decision. Constituency is often interpreted as the direct beneficiaries (or losers) of a policy action. All those "unaffected" individuals and groups are ignored. By contrast the notion of "affected parties" can be linked geneologically to primal parents. In some cultural traditions nature itself can be seen to have "intrinsic" values for which policy actions are explicitly accountable. The community of interest in modern society can be further defined as local, regional, national, or even international in scope. Where the affected parties of a policy action are included within prescribed jurisdictional boundaries (i.e. towns, cities, counties, districts, regions), it is appropriate to apply local, regional and/or national "accounting stances" in defining more precisely the policy consequences.

175 The Government's current policy of devolution of authority and responsibility in resource management takes the argument one further step, namely that the appropriate role of government is to recognise the hierarchy in decision boundaries and devolve local authorities full responsibility and accountability for resource management where regional or national constituencies are not directly affected. Regional authorities and regional accounting stances are appropriate where the external effects of local policy actions do not affect the public at large. Hence direct actions by the national government are appropriately confined only to situations of market and institutional failure and to the provision of public goods. When reviewed as an objective of public policy, sustainability, like any other public objective, will be defined and applied within this general, three-tiered accounting framework.

176 The case illustrations generally underscore the position that the appropriate role of government, particularly the matter of constituency, is not readily apparent. Resource management issues are not easily delimited to local, regional and national communities of interest; to do so would oversimplify the importance of conflicting interests in defining "relevant" boundaries. History teaches us that these have a tendency to change. The

Ngai Tahu could be the appropriate level of authority and accountability for managing the pounamu resource of New Zealand. Another argument could be advanced that jade is an internationally sought after gemstone, and that since its physical presence is confined to a specific area of the country this warrants its inclusion in regional development plans and policy. Finally, since there is an active trade in foreign-sourced jade and jade products in New Zealand, with almost no control over gemstone quality and/or cultural sensitivity, a sound case for a national policy involvement could also be made.

177 The other case examples offer essentially the same policy conundrum. It is possible that local and/or regional authorities would manage effectively the fish, forest, arable land, water, air and energy resources within their jurisdictions and following conventionally-accepted stances, but it is certain that not everyone would agree with this view. Climatic change is a possible exception in that it falls clearly within the realm of central governments. Nonetheless the ultimate beneficiaries of global policy actions may be situated in particular regions in countries. Like the implications which stem from complexity in managing resource systems, the implications of constituency in applying sustainability policies, targets and instruments requires a full measure of faith in democratic processes. Science can only inform the debate.

CHAPTER THREE

Issues in sustainability and the role of government

Introduction

178 What roles must government play in implementing its policy of sustainability (as expressed in the Environment Act)? Government has both establishing and on-going roles in the management of natural resources. The case illustrations give strong clues to where government should take an active role.

179 In this discussion we do not prescribe roles for various levels of government - national, regional and local; this is a matter for Phase Two of the Resource Management Law Reform.

180 We begin this chapter with a discussion on the role of government in a general sense and move on to identify particular policy making and administrative roles in sustainable resource management.

The general roles of government

181 Government has responsibility for:-

* formulating public policy;

* establishing and enforcing the institutional arrangements by which public policy is put into practice - this includes enacting legislation and establishing mechanisms for resolving conflicts of interest;

* acting as the agent for communities of interest, both present and future;

182 In relation to the resource management law reform, government has one major role in implementing its policy on sustainability, and possibly two. Government has, as a minimum, an establishing and enforcing role - endorsing the specific policy components of sustainability, establishing a set of management institutions (including markets) that will achieve these objectives and which embody the key attributes of sustainability, and setting up procedures for resolving conflicts.

183 It may also be necessary for government to continue to act as an agent of various communities of interest. Such an on-going role might involve setting up government agencies with specific resource management functions and responsibilities, or government in ownership or custody of resources - both being examples of certain types of institutional arrangements.

184 In looking at elements of an on-going government role, it is important to distinguish between a role of government and the mechanisms for achieving policy objectives (particular institutions and policy instruments). They are not the same, although sometimes government may discharge the responsibilities itself rather than give the task to the private sector.

185 Strongly polarised positions on the relative merits of different institutions and arrangements for resource management - government vs market - do not take us very far. Government versus market is always a false dichotomy. Both have strengths and weaknesses and each will therefore produce less than optimal management solutions - "second best" solutions - in practice. There is no "a priori" argument for expecting that one option will produce the best "second best". Hence, there is no case for an automatic default to either private or public types of institution. Rather, a burden of persuasion rests on both options. The existence of market failure is a necessary but not sufficient condition for exploring an active government role. Similarly, the existence of past public service failure is not a sufficient basis on which to reject a possible role for government in the future.

186 Further, the case for particular types of institutions needs to be argued on a case by case basis. Ignoring the essential differences between different types of resource systems is no basis for consistency in resource management.

Issues and potential government roles

Three central questions

187 Because sustainability is not well suited to a prescriptive approach, we have analysed the potential roles for government in the following way. We consider the issues that have emerged from our case illustrations and ask:-

* What is the problem for sustainability?

* What needs to be done to remedy the problem?

* Is there a role for government in the process of remedy?

188 It is important to recognize that these issues are fundamentally a part of the problem of resource management in general. They are not unique to sustainability.

Issue: uncertainty

189 Uncertainty is a frequent and widespread problem for implementing sustainability policy. Our understanding of the behaviour of complex biophysical systems is frequently very limited - fisheries, underground aquifers, and the atmosphere are good examples. The consequences of today's actions may not show up for years to come, yet when they become obvious may have already led to very long term or even irreversible disruptions. An example is the unintentional "depletion" of a renewable biological resource like a commercial fishery.

Roles: research, monitoring, setting constraints

190 To remedy the problem requires (i) a continuous research effort to learn more about the systems involved including the social/cultural/economic systems, and (ii) the authority to set and adjust over time the critical rate limits - e.g. the "total allowable catch" limits for fisheries or their equivalents in other resource systems. An institutional arrangement like TAC's for orange roughy only works if we know a lot about orange roughy. In such a case, good economic theory based on insufficient scientific information can lead to unintentional depletion.

191 In the case of resource systems like fisheries, catchments, and the atmosphere, the mobility of the resources or the extent of the systems makes it impractical to give the responsibility for research and monitoring to individual actors in the market. Government's role is to ensure that a sustained programme of research and resource monitoring is carried out. Government need not perform these tasks itself; it can contract them out or provide incentives for the private sector to initiate such work.

192 There is also an on-going role for government in reforming institutional arrangements for resource management in the light of better information.

Issue: conflicting management objectives

193 Policies to achieve sustainability focus most immediately on the condition of natural resource systems because their continued health is an essential basis for maintaining community viability and economic welfare. However, individual resource users are often faced with conflicting management objectives (e.g. immediate income generation vs. costs of implementing sustainability measures which realise benefits far in the future). A major problem for sustainability is posed by deliberate non-compliance with particular institutional requirements - for example, ignoring catch quotas in commercial fisheries, or persisting with destructive land uses in vulnerable catchment zones.

Roles: conflict resolution, monitoring for compliance, enforcement

194 There are several parts to the remedy for this kind of problem: eliminating the cause of conflict, minimising the impacts of conflict, monitoring for non-compliance with institutional constraints, acting quickly to halt illegal exploitation.

195 Constraints most significant for sustainability are those which are necessarily external to market forces: sustainable-yield limits, or prohibitions or discharge-rate limits on pollution. It is a government responsibility to ensure that the rights to use resources are properly administered, and that constraints on resource use are enforced quickly and effectively.

Issue: disassociation of costs and benefits, externalities

196 Many situations of conflicting objectives are brought about because the costs and benefits of a particular resource use are separated in time and space. Grazing on steep upper catchment areas serves to bring in more immediate revenue for the land owner but imposes greater burdens of flood damage lower down the catchment in years to come. On the other hand, protection forestry for soil conservation purposes imposes immediate costs on the particular landowner (planting costs and revenue foregone) while conferring benefits on a large number of people and over a long period of time. There is also the difficulty that the private benefits or costs accruing to the hill-country landowner are much easier to assess than the public costs and benefits accruing to downstream catchment communities.

Roles: internalizing externalities, redistributing costs and benefits

197 Where costs and benefits are particularly difficult to internalise to a single actor (or subset of actors), and where they are spread throughout a wide community of interest, a government role exists to provide a mechanism for redistributing costs and benefits associated with achieving a particular policy objective - soil conservation in the above example.

198 Furthermore, the mechanism for such redistribution will need to operate over a prolonged period and allow for variation over time, implying a monitoring (accountability) function to assess the effectiveness of the redistribution mechanism.

Issue: Negative image for resource conservation, conservation as resource development

199 Physical efficiency in the use of resources is frequently seen by commercial resource developers as counter-productive to profit-maximisation. This happens even when "resource development" that would improve the physical efficiency of resource use can be clearly shown to be economically preferable (Wright and Baines, 1988). The problem is most pronounced in cases where consumers are unable to influence supply options because natural monopolies exist - e.g. electricity and gas supply, although the extent of market failure is usually not limited to this one aspect. The principal problem for sustainable resource use is the absence of incentives to consider non-traditional commercial alternatives.

Role: establishing priorities for resource development

200 In order to provide the incentive to technological and institutional innovation, government can take the responsibility to provide clear and overriding policy guidance on resource development priorities (Bonneville Power Administration and U.S. Dept. of Energy, 1980). These give criteria for preference in the development of stock and flow options and the promotion of increased efficiency of resource use.

Issues: boundaries, jurisdictional areas

201 Another case where conflicting objectives can jeopardise the sustainability of resource systems occurs when jurisdictional boundaries separate key elements of the same resource system. An example is where kaitiaki have had jurisdiction to establish and enforce management institutions for a lake fishery (eel fishery in Wairewa) which cover the lake itself but not the outlet to the sea, although this zone is critically important to the spawning cycle. Lack of jurisdiction over fishing practices at the lake outlet have led to depletion of the fishery, despite the existence of appropriate management institutions for the lake itself. Another example is where the jurisdictional boundary for managing the water resource in a catchment bisects the major river. In such a case, unsustainable management practice on one side of the river would jeopardise the success of even the best sustainable management regime on the other side.

Roles: set up appropriate system boundaries

202 Within New Zealand, the boundaries of management jurisdiction must be specified so as not to separate key elements of a single resource system. There is a major caveat here for the reformers of local government. This will be a problem with resource management by regional government and/or iwi authorities if their boundaries do not coincide with natural system boundaries.

203 In the world-wide context, national boundaries transect global systems (for example, oceans, atmosphere, capital movements, trade, etc.). National governments lack jurisdiction over other sovereign states. Thus government has a role (as an agent of the national community of interest) to act in global matters which affect New Zealand's sustainability policies and programmes. This may involve taking unilateral initiatives and attempting to apply moral suasion in the international arena (for example, New Zealand's anti-nuclear policy). Alternatively it may involve the government in promoting international conventions (for example, chlorofluorocarbons and Antarctic minerals) or seeking to influence policies of the United Nations or other global agencies (for example, endorsing the findings of the Brundtland Commission).

Issue: risks and advantages of unilateral decisions, competitive advantage

204 Unilateral imposition of stricter constraints on commercial activities as a result of policies on sustainability creates the risk of imposing additional costs and, therefore, jeopardising the competitive advantage of New Zealand businesses. Possible examples are: more stringent controls to reduce water pollution from freezing works; fish quotas, controls on boat size, net size and fishing techniques; a total ban on the use of chlorofluorocarbons as propellants or refrigerants. The problem is accentuated if standards and constraints are very different from those experienced by competitors in international trade. On the other hand, competitive advantage need not necessarily be threatened if technological innovation can respond to the new constraints.

205 Sometimes unilateral policy initiatives can yield economic benefits. The perception in overseas markets of nuclear-free New Zealand as being a pollution-free source of food has been taken up by some exporters as a particular selling point.

Role: monitoring impacts of government policy

206 If there is cause for concern, the government can take action to modify the implementation of its own policy as a result of monitoring the impacts (reflecting its role as an agent of community interest - national interest in this case). Government can retaliate against discriminatory practices against our exports and their manufacture by legislating for similar standards for imports from the countries concerned.

Issues: failure in memory, lack of accountability

207 Being serious about sustainability depends on adopting a long term perspective beyond the usual short economic and political time horizons.

208 The case of soil conservation and flood control is a good example. If left to individual memory and individual actions alone, perception of the relevance of certain policy objectives declines with the passage of time. Memories of the acute effects of soil erosion and flooding that afflicted many parts of the country in the early decades of this century have grown dim. These symptoms of unsustainability were the result of ill-considered or ignorant management practices in the hill country decades earlier and they gave impetus to the major water and soil conservation policies which have been in place ever since. The relevance of these policies has been questioned because more recent experience has not been so bad and also because the effectiveness of some of the policy instruments has not been regularly assessed against the policy targets that were established years ago. Similarly, differences between Maori and Pakeha in resource management can be attributed in part to initial failure to honour article 2 of the Treaty of Waitangi, and subsequent memory loss of its significance.

209 Thus sustainability is jeopardised not only by a failure of memory but also by a failure of accountability in pursuing policy targets. For example, what incentives and disincentives have catchment boards had for ensuring that vulnerable hill country regions designated as suitable only for protection forestry were in fact so developed?

Roles: building in collective memory and accountability

210 Sustainable resource management practices should have an explicit basis in legislation, rather than leaving them to individual judgement. A necessary complement is to ensure regular review of progress towards achieving sustainability policy objectives, reinforcing the need for on-going monitoring and rigorous mechanisms for accountability.

Issue: alienation of cultural values

211 A single management ideology, narrow set of values, or institutional arrangements which deny legitimate participation in the development of resource management policy will erode the broad and diverse base of cultural values that currently exist in New Zealand, and which manifestly support the general policy of sustainability. Cultural values exist across a wide spectrum of interests and must have legitimate channels for expression, otherwise sectors of the community are effectively disenfranchised and the legitimate influence of some cultural values is lost.

Roles: fostering cultural diversity, public participation, and investment in education

212 Central government has already made significant moves to endorse the standing of the Treaty of Waitangi as an essential basis for bi-cultural approaches to resource management. Because of the constitutional significance of this Treaty, government has an on-going role to ensure that the principles of partnership are fostered in the community. Furthermore, as agent for any community of interest, government has the responsibility to ensure that processes for public participation are developed that provide genuine opportunities to influence policy development. Education is an important process in maintaining cultural values. The government's on-going responsibility in education is a practical expression of its investment in the needs of future generations.

Epilogue

213 When a public decision-making body is confronted with having to trade off one objective against another, the issue of commensurability of perceived gains and losses is of paramount importance. This is true whether it involves local, regional or national constituencies. All too often the best that can be done is to array consequences, albeit apples and oranges, and hold decision-makers responsible, politically, for guessing correctly (on average) on the many matters that confront them during a relatively short time frame. Sustainable resource use policy is fundamentally directed at the long term, and therefore is almost by definition in competition with resource use strategies based on short or intermediate term perspectives. What we have not examined in the sustainability case studies is the problem of the decision rules themselves, and the fallback positions. What priority should attach to long term vs short term policy objectives? How, and under what circumstances, can decision-makers trade off sustainable or non-sustainable resource use policies?

214 The basic character of a sustainability objective is an all or nothing proposition: either one consciously provides for a use (or being) in perpetuity, or one elects not to. It is that simple. First, risk or uncertainty considerations only create margins for error; they do not change the basic nature of the choice. Second, we have learned from the case illustrations that concrete problems are important in clarifying the meaning of sustainability for practical purposes. Complexity and constituency (community of interest) matters, in effect, determine the degree of precision with which sustainability matters are proffered and judged credible in light of competing social objectives (for example, to create jobs for minorities and the disadvantaged; to build a second Maui platform). Third, the consequences of options to soft-pedal the hard choices and close off sustainable futures are not clear.

215 Finally, as with most categorical imperatives there are certain grounds or conditions under which they are inoperative (overriden): "Thou shalt not kill" - <u>unless</u> in self-defence. Sustainability policies can become dictatorial where they conflict with other policy objectives unless there is a suitable fallback position for resolving this problem. One such position would recognize the principle of social opportunity cost. This principle means that the sustainability policy "thou shalt not endanger specie survival" will be enforced by society if and only if the perceived social costs are not too great a burden for society to bear. Without knowing

what good the Black Robin is to future social welfare, preservation seems a good policy partly because its cost is minimal. Yet species of plants and animals continue to disappear. The consequences of not "developing" rainforests, for example, are thought to be more unacceptable than the human-ecological and long-term ones. The present costs (of "non-development") are high but the future costs are likely to be global and irreversible.

216 Redistribution of the costs and benefits of human activity will always be difficult. Were New Zealand to adopt a sustainability strategy like the one in this report, both courage and imagination will be required.

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Appendix One - Ocean fisheries

Introduction

217 Common property resource problems pose some of the most difficult and pervasive challenges in the management of public resources. Fisheries, particularly the inshore ocean resource, are well-known examples of this class of problem. It has been estimated that only about five percent of the world's inshore fisheries are not threatened by overfishing. The ability to exploit an ocean fishery is largely a function of the development of appropriate technology, hence the common property problem of "overfishing" is a more recent experience than, for example, "overgrazing". The management techniques that have evolved over time have generally not kept pace with the adoption of improved catch technology. Consequently, many of the world's most famous fisheries -- Peruvian anchovy, Monetary sardine, Pacific salmon -- collapsed before depletion controls could be made effective. In several other instances entire populations of some marine species have been harvested to the point of extinction.

218 While New Zealand is small in human population, its Exclusive Economic Zone is one of the world's largest. In economic terms, fish export revenues have risen faster and now comprise a much larger share of foreign exchange earnings than the better-known glamour export, kiwifruit. This rapid expansion in total yield of fish was the result of many factors, but chief among them: the increase in joint ventures with foreign (more experienced, better equipped) fishing companies; the exploitation of previously underutilised offshore fisheries such as squid, tuna, orange roughy; and the over-exploitation of many inshore fish species. Some of the worse-hit inshore species are also among the most favoured by New Zealanders: rock lobsters, scallops in Tasman Bay, snapper in the Hauraki Gulf, elephant fish in the Canterbury Bight, trevally in the Bay of Plenty, marlin off the Bay of Islands. Even deep water species such as orange roughy, first discovered in 1980 and currently New Zealand's largest revenue generating fish specie, is under catch restrictions this year due to the risk of overfishing.

219 The problem faced by the responsible industry and government officials is that the general knowledge base to support sound biological resource management is inadequate. While most informed individuals would agree that the recent rate of expansion of the fishing industry cannot be sustained indefinitely, they would argue that optimal harvest policies based on sustained yield concepts are a misnomer. Until sufficient time series data is available from monitoring fish stocks in response

to catch (or fishing effort), management policies are likely to remain imprecise, even crude. The more immediate task in many fisheries is to reduce excess fishing pressure and allow populations to build up above critical threshold levels. Because so many individual fisheries are depleted (i.e. harvested beyond an economic sustained yield), the orientation of current fisheries policy is perhaps best characterised as "redevelopment" rather than sustained use.

The Resource System

220 In order to manage such a complex biologic-hydrologic system, a number of key factors or characteristics of the ocean fishery system should be recognised. These include: (1) the multispecie nature of most fishery resource developments -- the proportion of marketable biomass is often quite low; bycatch species are managed by default; (2) the fact that many commercially important fisheries are migratory, hence international agreements are necessary; local and regional management strategies are largely oriented to administrative rather than resource utilisation needs; (3) recognition that the natural habitat of most fisheries is highly variable, and that the consequent effects of human control systems on such ecosystems are often difficult to isolate; and (4) the fact that all interactions between the human community and the fishery resource are governed by institutions (social-environmental relations) which guide behaviour and suggest changes in patterns of adaption.

221 Most "fisheries" are a mix of several species (often many) which can complicate the design of management policy geared at controlling the rate of harvest. For example, in the Canterbury Bight cod, barracuda, salmon and some other species occupy basically the same thermocline in the sea (depth and temperature) in the same geographic region at the same time of year. Commercial trawlers catch all these species as a bycatch when targeting a single specie (for example, Akaroa cod). In effect, modern ocean fishing techniques result in "joint products", some of which are highly marketable and some of which are too costly to handle, other than to dump along with the offal at sea. Even though an unintended catch, the bycatch species are just as much at risk as the target specie from overfishing. The fact that up to 60 percent of the fishery biomass collected in the nets of commercial fishers is thrown overboard as by-catch waste deserves some careful study. A more sustainable management approach would emphasise the utilisation of byproducts and waste materials in recycling nutrients where a competitive advantage exists.

222 Second, many important fisheries are fugitive resources.

Migratory species such as the Southern Bluefin tuna may move through the Exclusive Economic Zones of many countries during their lifecycle of six to eight years. This means that management policy and strategy agreements must be developed between several different governments. For example, because of the pattern of migration of the Southern Bluefin, Australia's harvest this year affects New Zealand's next year, and both countries harvest policies affect the allowable harvest of the fish in their breeding grounds by Pacific Islanders the following year. A similar argument can be made for locally fugitive fishes with respect to zonal or regional management strategies. The ancient proverb "the pearl is where you find it" may not be heartening to a highly trained fisheries biologist, but the fundamental meaning would almost always be acknowledged "so true!" Attempts to regulate fishing on a regional or geographic basis has always been suspect for this reason. In fact, learning the temporal behavioural patterns of certain fish species by the more astute fishermen has been a major contribution factor to fisheries depletion. Life-cycle (intertemporal) behavioural patterns in some species are also important management parameters for inshore fisheries. Management zones, however, have been almost exclusively used for administrational convenience rather than policy significance.

223 Third, our knowledge of the natural habitats of most fisheries -- the hydrodynamic effects such as changing currents, temperatures, salinity, oxygen, turbidity, among other factors -- is so rudimentary that observed perturbations in the relevant dependent variable (i.e. catch over time) cannot be disassociated unequivocally from man's harvesting efforts. The natural flux in ocean fishery productivity is not well understood for most commercial species. It is conceivable that much of the recent decline in fishery productivity might be attributed to natural changes in the ocean environment. For example, the fear that the orange roughy resource in the Chatham Rise has been depleted by overfishing may in fact be the result of natural shifting patterns in spawning habitat preference. (Like many commercial species orange roughy are typically caught off their spawning beds.) Salmon ranching operators in Canterbury have noted a marked decline in expected return rates of mature fish in the past two years. This is generally associated with the increased incidence of salmon in the commercial by-catch off Bank's Peninsula during the same period. However, it also could reflect a general reduction in available nutrients at sea, possibly due to climatic factors beyond our control. The natural dynamics of the system, then, must be incorporated into any effective strategy that purports to achieve long-term sustainability objectives.

224 Fourth, the institutional relationships which govern the identification of relevant fishery species, their capture and use, their value in use (including export values to foreign nations as well as domestic markets), and the policies which affect the commercial and cultural development of the resource in general, are important to sustainability policy analysis. Improved fisheries management policy must build on a better understanding of the physical paramaters of the problem, but effective management (i.e. improved performance) relies on appropriate policies and programmes which bring the policy objectives into practical focus. Unfortunately, while current institutional arrangements may provide a much better general understanding of individual rights to use of specific fishery resources, the actual entitlements are not necessarily commensurate with the sustainable use of fisheries in the longer term. Current entitlements which are largely based on historic factors, are most likely to overstate optimum sustainable yields of fisheries that have not already shown signs of collapse, and understate the potential harvest of new fisheries of which very little is currently known.

Sustainability Policy Objectives

225 The evolution of fishery management policy in New Zealand has followed a similar track as elsewhere in the world. Various methods of controlling access to the resource via licencing, restrictions on areas, nationality, etc. worked for a time, but access is an indirect means of managing catch. Larger, faster boats and more sophisticated techniques and equipment meant that catch rates improved and, along with them, total fishing effort increased. Policy objectives tended to be unclear with respect to specific species and fishing areas, consequently policy instruments such as quotas, size limits, and monitoring of fish stocks and harvests were often poorly focussed. Because of staff and other resource constraints, fishery management policies have never been adequately enforced. These observations can be illustrated in the present situation concerning the Hauraki Gulf snapper. The rapid decline in size and total numbers in recent years is attributed in part to the significant percentage of the annual harvest caught by sport fishermen who are not regulated. In turn, a significant proportion of the sport-caught snapper are sold illegally through retail fish outlets because a strong demand exists and there is no effective enforcement of the law.

226 Another important dimension to the problem of policy-making for managing fisheries is the effect of man's activities on habitats and biological foodchains.

Harbours and estuaries are natural sinks for chemical and other wastes which interfere with ecological systems and animal habitats. Once polluted, these complex biological systems are very costly to rehabilitate. Outfalls of waste into the sea allow nutrients and other substances to enter foodchains which can ultimately cause severe health risks. Many of New Zealand's shellfish beaches, for example along the Canterbury coast, around Auckland and in the Bay of Plenty, contain shellfish that have been polluted by faecal coliforms. While officially not recommended for human consumption they continue to be collected as food by many New Zealanders. Further, some inshore fishery habitats are directly at risk due to coastal land use practices. The general collapse of the whitebait fishery throughout most of New Zealand is primarily attributed to the drainage of swamps and destruction of estuarine habitats where these fish breed.

227 Sustainability also concerns the relationships between fishery management systems and the human communities which depend on them. The previous boom-bust history of crayfish depletion in the Chatham Islands is a good example of this relationship. The discovery and exploitation of the fishery brought an influx of fishers and their families to the sparsely inhabited islands. Because the resource was depleted rapidly a larger permanent community could not be sustained. Opportunities for social and economic stability presented by the new commercial prospects of long term crayfishing have been temporarily lost because the initial management objectives did not adequately reflect the social and community interests in fishery development. Similar opportunities exist for Chatham Islanders in terms of their future involvement in the development of the Chatham Rise fishery. Sustainable management systems for the orange roughy and other species could contribute substantially to the social vitality and wellbeing of these people.

228 A related management issue is the distinction between objectives and policy instruments based on cultural values. The eel fisheries of Waihora (Lake Ellesmere) and Wairewa (Lake Forsyth) illustrate the different Maori and Pakeha concepts of management, and approaches to sustainability. The eel fishery of Waihora has been greatly reduced by commercial fishing for export since the early 1970s. Local Maoris today consider the lake as virtually useless as a cultural resource in respect of eels. It should also be noted that changes in the lake ecosystem may be a factor in affecting eel habitat via eutrophication, siltation, and lake levels and openings. In contrast, Wairewa continues to be used and managed as a cultural resource, although this management is affected by social-cultural change and some commercial

exploitation at the lake outlet.

229 The above has highlighted several considerations that are important in the design of policies meant to ensure the sustainability of fisheries and their benefits to mankind. There can be no exhaustive list as each particular situation could conceivably have some unique requirements. In terms of the examples used, these general observations appear pertinent to improvements in specifying sustainability policy targets:

(1) The problem of joint products (multispecie catch issues) in commercial fisheries is important because "optimal" sustainability of harvest implies that the full social costs and benefits are adequately reflected in the policy choices which impact those fisheries (very complex biological- hydrological systems);

(2) Even if policy targets are necessarily vague in certain circumstances, the various instruments of policy available to influence performance levels must be clearly focused (i.e., the specific links established between action (policy) and target (performance);

(3) To reinforce the importance of the kinds of information implied by the above statement, adequate assessment of risk and uncertainty in fishery management due to natural forces is the component of knowledge most clearly lacking;

(4) Because the property rights in most fisheries involve some sort of private-public alliance of interest, unless the specific entitlements are clear there will always be controversy over fairness in the sharing arrangement (this applies to commercial agreements between individuals as well as to partnerships between tribe and Crown);

(5) Even where respective "property entitlements" are accepted by all parties and fully implemented within a fishery management regime, the dynamic nature of ocean fisheries is such that sustainable yield targets will be both over and under achieved at any point in time: clearly a sustainability policy programme would entail a systematic monitoring activity that will ultimately address fishery harvest decisions in real time;

(6) The sustainability of migratory fishes is a special problem in that several different regional decision-making bodies and possibly different nations are involved. The coordination of policies between decision authorities with different priorities and perceptions of management needs are likely to reflect compromises that result in policies inconsistent with a particular

sustainability approach to management (i.e., What is correct for the nation may be wrong for the regions).

(7) Cultural factors - such as bicultural partnership in resource ownership, use and management; and cultural value differences in access and end-uses of fisheries and fish products - represent some obvious conflicts in specifying policy objectives and instruments. Clearly the traditional Maori aims of fishery resource utilisation are in some ways fundamentally different from the commercial uses of the Pakeha. To what extent are rival value systems relevant in specific fisheries policy, and how do the responsible management agencies incorporate these interests in settling policy?; and lastly

(8) Sustainability is obviously a concept that cannot be confined to any particular state of physical resource use or misuse. Ultimately, the human dimension of the resource use system emerges as the operative evaluative (meaning) system. Hence the concept of sustainability is also relevant at the individual community level. Where local communities are dependent on fisheries development it is logical that such community needs be incorporated in the formulation of fisheries policy.

Indications of Unsustainable Practices

230 Presuming that comprehensive sustainable resource use policies were to be implemented, it would be a difficult task to set up the types of qualitative indicators necessary. Indeed, even if the problem of specifying what in fact it was to be monitored/evaluated could be overcome, there would be limited empirical data with which to support any affirmative tests of relevance. Nonetheless, there are some obvious "indicators" of unsustainable practices, and these should be carefully scrutinised along with the more conventional fisheries policy issues.

The indicators of unsustainable fishery utilisation manifest themselves in many forms. The following are only a few ideas in which nonsustainable practices may be identified. ("Indicators" are only that: Such indices report changes that suggest possible consequences on the target ecosystems).

Economic indicators include declining total revenues, high variability on annual earnings, over-capitalisation within specialised fishing sectors, rising real prices of fish or fish products;

Ecological indicators include high variability (instability) of productivity, long term productivity

declines, irreversible loss of habitat, changes in species diversity or mix, discharge of harmful pollutants or wastes in fishery environments;

Socio-cultural indicators include changes in established patterns of fishing or fishery use, instability of fishery-dependent communities over time, unrest and social conflict arising from fishery management practices.

The Potential Role of Government

231 Sustainability of fishery resources and their contribution to social wellbeing requires that a relatively simple objective be adhered to, namely that the resource benefits less costs to society be maximised for both present and future generations. Since future generation's preferences are (presumably) accounted for in the decisions of the present (living) generation, the sustainable use of fishery resources is both appropriate and prudent as long term policy given an uncertain future. The important issue that remains, however, is the appropriate role of government in implementing this objective. To what extent are local, regional and national governments necessary in determining the allocative rules and development policies to ensure sustainable use of fishery resources?; In cases of conflicting interests (such as Maori vs Pakeha), who has jurisdiction and for what purposes?

232 The New Zealand Government's current policies toward the fishing industry - total allowable catch (TAC) and individual transferable quotas (ITQ) - aim at achieving long term sustainability by combining both administrative (regulatory) and market forces. Transferable property rights in the fisheries themselves are meant to deal directly with the problem of common property, and ultimately the role of government is reduced from complex day-to-day decision making to a more prospective role of monitoring and long term direction. The potential range in the roles that governments could take in managing fishery resources is illustrated in the table on the next page. Because of the high degree of uncertainty in managing multispecie fisheries, and partly because some of these resources are in a depleted state already (they require "redevelopment" measures), the need for a central control in setting allowable catch policies and to collect management information is clearly evident. Local and regional agencies may best implement policies, but a central agency is needed to provide coordination and policy guidance. Affirmative action policies, particularly where socio-cultural issues are concerned, would be difficult to administer by local bodies without the guiding support of the central government.

Table Institutional or policy mechanisms for managing aquatic ecosystems and for allocating the use of fish and their habitats. Items at the top are largely administrative while those at the bottom have a prominent role for the market system.

Mechanism	*Instrument of control*	*Purpose or observed consequence*
Prohibition	Exclusion of sport fish from commercial harvests	Improve recreational opportunities for anglers
	Specification of zero discharge of some toxics or contaminants	Reduce exposure of biota and humans to poisons
Regulation	Specification of low phosphorus concentrations in sewage effluents	Control eutrophication which, if intense, degrades the aquatic ecosystem
	Specification of gear and area, in fishing	Reduce fishing intensity to prevent overfishing
Direct government intervention	Control nonnative sea lamprey by lampricide, dams, etc.	Foster recovery of lake trout and other preferred species to benefit fishermen
	Development of islands and headlands with fill and dredge spoils	Provide recreational facilities and spawning areas to benefit anglers, boaters, etc.
Grants and tax incentives	Subsidy to industry for antipollution equipment	Lower pollution levels and distribute costs more widely
	Subsidy to commercial fishermen to harvest relatively undesirable species	Reduce competitive undesirable species to benefit preferred species and their users
Buy-back programs	Government purchase and retirement of excess harvesting capacity	Reduce excess fishing capacity and compensate owners of the excess capacity
Civil law	Losers enabled to sue despoilers in civil court	Preserve ecosystem amenities for broader public, recompense losers
Insurance	Compulsory third party insurance for claims of damage	Reduce pollution loadings because insurance premiums are scaled to loading levels
Effluent charges	Charge for waste disposal, either direct cost of treatment or indirect cost of impacts on ecosystem	Reduce pollution and/or allocate resources to high-value and/or profitable uses
License fees	Tax or charge on harvesters, scaled to level of use	Foster efficient use of resource by discouraging overcapitalization, recovering fair return for the owners (populace) of the resource
Demand management	Rates involve marginal cost pricing and/or peak responsibility pricing	Improve overall efficiency of use and foster conservation
Transferable development rights in land use planning	Limited rights to develop one area exchanged for broader rights to develop another	Direct the development to areas preferred by government
Specific property rights, as with transferable individual quotas	Purchase of pollution loading rights to predetermined loading levels	Limit pollution and foster efficient use of resources
	Harvest rights to explicit quantities to be purchased	Limit effective fishing effort and allocate resources to high-value and/or profitable uses

Source: Regier, H.A. and Baskerville, G.L. (1986)

Appendix Two - Catchments

Description of a catchment system

233 It is probably helpful to think in terms of a cluster of interrelated systems, i.e. systems within systems and the key interactions between them. Within any catchment there will be water systems, soils systems, mineral deposits, a gene pool of natural flora and fauna, and human communities - these are the biophysical resources that provide the basis for local "development", which is driven by culturally-perceived imperatives that may be social, economic or environmental. Sustainable development, in the general ecological sense that we have given it, implies sustaining a balance over the long term among these imperatives (objectives).

234 A catchment itself is any land area that drains to its lowest level. Jackson (1982) suggests that a catchment is defined topographically by the gravity flow of water. "It can be the slope of a street or the run-off area of a farm or factory. It can include the drainage of a creek or the total land area upon which rain falls to drain or seep to make a major river system." In the context of this case illustration, "catchment" is not limited only to the upper regions of a river valley. It includes the whole drainage area.

235 In order to understand the workings of any system, we must look beyond its boundaries at some stage and observe what external phenomena influence the internal dynamics and inform resource management decisions. Particularly important for catchments are the climate system and the weather patterns. These are primary determinants of the major biophysical processes that take place in any catchment - water flows (quantities, rates, fluctuations and extremes); weathering processes leading to soil creation and erosion; maintenance of habitat conditions and so on.

236 In acknowledging the importance to catchments of climate and weather patterns, we necessarily make the link between the impacts of humanly induced climate change and aspects of management within any particular catchment. (This theme will be further elaborated in another case illustration.) One consequence of global climate change that is widely expected is an impact on the frequency and severity of extreme weather events. The impact is not expected to be uniform for every catchment. That is not the point. The significance is that humanly induced changes in global climate may bring about changes in weather patterns with effects on catchments that may be uncontrollable and irreversible.

237 Also important are cultural factors which influence the type of social and resource management institutions ("institutions" meaning rules, rights, agencies, procedures, etc.) and economic factors such as access to markets outside the region, comparative advantage within the region and other factors that influence commercial developments within the catchment area.

238 The interdependence of biophysical, cultural and economic elements is apparent in the history of many catchments. As Ludecke (1987) points out, many rural towns "originally established as mill towns for the surrounding native timber industry, have now become service and market towns for the district's agricultural community." "Employment is primarily based on agriculture, and agriculture-related industries such as .. freezing works .., the various timber mills, and the service facilities in the towns." It is clear that we are not talking about a static relationship.

239 Rainfall determines the overall rates of water flow in any catchment but particular drainage mechanisms (surface and underground) depend on the nature of ground cover and soil and rock characteristics. Management practices can influence the relative proportions and rates of flow of different drainage mechanisms.

240 The soil base is continually being formed by weathering processes within the catchment and continually depleted by various sediment transport mechanisms. Management practices affect the rate of soil loss and the state of productivity of living soils systems.

241 Flora and fauna adapt to ecological conditions in communities that have their own in-built regulatory mechanisms which ensure that any single species does not develop excessively at the expense of system viability as a whole. Stable patterns of water flow, soil productivity and vegetatitive soil cover are closely interdependent.

242 Water has several attributes that make it useful: life depends on it as a chemical constituent, particularly in an uncontaminated form; water flow acts as a transport mechanism; it has capacity to absorb substances and dilute them; water quality has cultural significance; wild rivers have aesthetic appeal. Living soil is the productive basis for all terrestrial biomass. Sustaining the cultural amenties and economic benefits that people derive from access to these biophysical systems depends on having management practices that recognise the important ecological interdependencies between the various parts.

243 Use of resources is linked to patterns of employment, application of skills and the development of social and commercial infrastructures and institutions. All these may change over time. If the change is brought on by changing consumer tastes which are signalled through the marketplace, it is essentially reversible. If change comes about as the result of (perhaps unanticipated) impacts on the resource base, then it may well be irreversible. Sustainability is concerned with whether or not human activity in the past or present irreversibly forecloses options for development in the future or unnecessarily constrains options for a very long time into the future.

244 There is much about the behaviour of water, soil, flora and fauna systems that is beyond human control, although human activity can impact on these systems. Resource management focusses in part on the discretion that people, either individually or collectively, exercise in choices over things that do impact on these basic biophysical systems. There is discretion over such things as land-use options and managed vegetation; the construction of physical structures (e.g. stop banks, drainage networks, irrigation systems, roads, etc.); introduction of exotic species; siting of industries and residential and commercial developments; restrictions on disposal of wastes and effluents, and so on. These are elements that contribute to social amenity, economic benefit, and cultural identity.

245 Although all these choices apply within each and every catchment, the areas of jurisdiction of the various management agents have not always been appropriately coordinated. For example, district and county councils have areas of jurisdiction that transect catchments, and each of the councils may have varying prescriptions for catchment management within their areas.

Policy objectives and policy targets

246 To the extent that management agents pursue identifiable objectives, those relevant to sustainability will be informed by the need to sustain the potential capacity of the biophysical systems to support social amenities and economic benefits over a prolonged period. This (particularly the emphasis on potential) reflects a balance between ecological and welfare maximising objectives.

247 The time horizon that such management agents acknowledge will be informed by the general requirement to consider the needs of future generations (e.g. "near future/far

future" horizon), the specific time constants associated with particular biophysical processes in the catchment area (e.g. residence time of water in groundwater storages; timber growth rates in forests that are managed for yielding timber; etc.), and the commercial time horizons associated with loan terms and the need for returns on investment. Expressing this in economic terms, management agents have to consider returns to people, to the natural resource systems and to the accumulated capital which is sourced from both people and natural resources.

248 Management within a catchment area focusses on the aspects where social and economic objectives impact on natural processes; where there are choices to be made, the outcomes of which have different implications both for the environmental systems concerned as well as for the human communities. The principal areas of choice are:-

249 * options for land-uses which influence the interplay between soil and water systems. Land cover affects water drainage patterns and soil stability. Possible impacts relate to water quality, soil erosion and sediment transport down the catchment. Policy objectives pertinent to these choices are: to encourage land-uses which facilitate good drainage and to conserve soil resources.

250 * options for water use which influence both the quantity and quality of water for other uses. Other uses can be competing human uses and non-human uses in the present and in the future. Use implies abstraction and subsequent discharge and possible impacts relate to quantity and quality of water needed to sustain competing uses. Policy objectives pertinent to these choices include: to allocate available water resources and to maintain water quality standards so that any particular uses are not irreversibly lost.

251 * options for land-use which influence the sustainability of the soil system productivity. Land uses and management practices can become dependent on high levels of exogenous resource use to maintain soil productivity (e.g. artificial fertilisers and pesticides). Possible impacts, apart from the fact that such inputs become "strategic" to future wellbeing, relate to surface soil loss and water quality, particularly of slow recharge groundwater storages (leaching and run-off of excess chemicals). Policy objectives pertinent to these choices have already been mentioned above (i.e. soil conservation and maintenance of water quality standards).

252 * options for harvesting native flora and fauna or

modifying local habitats that influence the sustainability of the local gene pool and other natural resources of cultural value. Ecosystems of native flora and fauna have adapted over very long periods in the local conditions of climate and natural resource endowment. These systems are dynamic and capable of further adaptation, providing sudden changes are not arbitrarily imposed. Possible impacts of the introduction of exotic species or excessive harvesting from native ecosystems relate to the interruption of regenerative processes or the disturbance of natural regulatory mechanisms that keep balance among species. Policy objectives pertinent to these choices are: to control the introduction of exotic species of flora and fauna; to preserve representative samples of natural ecosystems; and to impose restraints on the harvesting of flora and fauna that recognise the critical importance of rates of regeneration. Soil conservation and the maintenance of water quality standards are also relevant here.

253 * options for siting industrial, residential and commercial premises which influence the demand for specific uses of water, the demand for land, and the demand for waste treatment and receiving capacity. Possible impacts relate to encroachment on high productivity soil systems around cities, towns and villages; to the capacity for water storage; and to the assimilative capacity of biophysical systems to receive wastes particularly those with large, long-lasting and perhaps irreversible impacts on the receiving systems. Policy objectives pertinent to these choices are: to avoid reducing the assimilative capacity of waste receiving systems and to maintain air quality standards so that particular uses are not irreversibly lost. Water quality standards and soil conservation are also relevant here.

254 Policy targets are even more particular specifications that relate to the institutional mechanisms chosen for a management situation, e.g. minimum instream flows as a form of control on rates of water abstraction from a river, or maximum biological oxygen demand as a means of limiting pollution levels.

255 Such policy targets provide the basis for monitoring the effects of certain actions and informing policy makers about the effectiveness of particular policy instruments. As such, the matter of policy targets is beyond the immediate focus of this work - it is a matter for Phase Two investigation. Nevertheless, it illustrates the direct link between interpreting policy objectives and designing institutional arrangements to pursue them.

256 On the matter of policy targets, we need to distinguish between situations where absolute limits appear necessary (e.g. maximum threshhold levels of atomic radiation, maximum permissible levels of a toxin in the groundwater supply), other cases where limits may warrant adjusting over time, as we learn more about the behaviour of systems subject to evolving patterns of competing uses (e.g. minimum instream flows to sustain aquatic habitats, water abstraction rates from underground aquifers) and cases where quantitative limits are likely to be impossible to assess (e.g. rates of soil loss).

Indicators of unsustainability

(1) excessively low flows in rivers leading to destruction of in-stream habitats - cumulative effects

(2) excessively high flows in rivers due to rapid runoff, leading to erosion of river margins and flooding

(3) increasing incidence of extreme aquifer levels (fluctuations) or the persistent increase/decrease in aquifer levels over a long time

(4) increasing concentrations of contaminants in water bodies which have specialised uses, e.g. high nitrate nitrogen levels in town water supply aquifers or advanced degrees of eutrophication in lakes destroying aquatic habitats

(5) soil erosion as a result of overgrazing, deforestation, misplaced cultivation, carelessly built roads in upper catchment areas (Ludecke, 1987)

(6) soil slumping - land loss into rivers - upper catchment soil base depleted faster than renewed and consequent damage in lower catchment as a result of sediment deposition - preventable by management up to a certain level of intensity of weather events (i.e. Cyclone Bola would damage anything)

(7) the inability of land-based systems of production to survive periodic extremes of weather such as droughts

(8) long-term depletion of forest soils which have the greatest biomass-producing capacity

(9) disturbance of natural regenerative processes as a result of introduced exotic species not subject to adapted prey-predator constraints, e.g. deer grazing destroying forest undergrowth

257 In the context of a catchment (or region) sustainability is not necessarily concerned with the long-term viability

of particular industries. However, the capacity of a catchment area to sustain a population of communities is central to sustainability. Any evidence of long-term decline in the capacity of a catchment area to sustain its human population would indeed be evidence of unsustainability.

Issues for sustainability

258 Natural processes carry impacts of local actions over a wide area; e.g. upper catchment practices moderate the intensity of flood events and flood control practices channel floodwaters - inevitably hill country is linked to lowland areas by rivers

259 Need for monitoring - for improved understanding; for revision of standards, guidelines for rates of use, etc. Sustained monitoring is necessary to learn about dynamic processes and long-term adaptation

260 Emphasis on preventing particular disruptions rather than denying particular uses - are there any absolute no-nos? - preventing disruptions by tech. fixes or regulation?

261 Any critical regions within the catchment? e.g. natural aquifer recharge areas needing special management, unconfined aquifers with special uses, upper catchment areas particularly vulnerable to erosion, unique habitats with significance beyond the immediate catchment,...

262 In some upper catchment situations, multiple use (e.g. agri-forestry or selective harvesting of timber from protection forests) may compromise soil conservation objectives. In some situations, "block afforestation" for soil conservation and flood protection on behalf of the whole catchment community is the only sustainable management strategy (Ryan, 1988)

263 There are varying degrees of instability - a blanket rule is inappropriate, yet experience in different regions may be usefully transferred

264 In some particularly erosion-prone areas of a catchment which have been stripped of their original ground cover and put into pasture, strategies to stabilise the soils require urgent and persistent effort. For example, retiring vulnerable land and allowing it to revert to native scrub and bush is not realistic; it does not happen fast enough; block afforestation which has had time to reach maturity offers the greatest degree of protection against extreme events (Ryan, 1988)

265 When it comes to preserving species, a number of issues

crop up: who benefits and who pays? trade-off between different objectives like pursuing sustainability and maximising current welfare

Issues for the role of government

266 Setting up the framework for catchment management; need to distinguish between levels of government (i.e. which level of government is appropriate for a given responsibility? identify individuals and groups most directly affected by a particular policy decision to answer this question) and to identify constituencies - what are the communities of interest?

267 Catchment boundaries and jurisdictional boundaries - aggregation may not be a problem but division would be; management in one catchment area can affect adjacent catchments, e.g. introduced flora and fauna, effects of large scale forestry on regional climate; what need for multi-catchment institutions?

268 Conflicting objectives i.e. objectives that may conflict with sustainability. For example, in the case of a commercial enterprise wanting to use highly toxic chemicals on a site that is over an unconfined aquifer. Aquifer contamination must be absolutely prevented since, once contaminated, it might take many decades to purge. Short term commercial profitability could be seen to be in conflict with sustainability's need to preserve water quality. Another example could be a conflict between sustainable and commercial forest harvesting practices.

269 Is "unlimited liability" ever appropriate, adequate, feasible as a means of preventing externalities when consequences can be extreme (e.g. aquifer contamination)?

270 Need for monitoring for enforcement of standards; conflict resolution/judicial process is reliant on well-founded, impartial evidence - who was responsible for pollution, who is affected, how badly?...

271 Memory of the problem - need for longer term perspective in management; extreme weather events with a return time of 50 or 100 years compared with governments which have a return time in multiples of three years and businesses with shorter-than-annual cash-constraint return times and capital return times of only a few years. Extreme events have happened in the past and will happen again - there is no uncertainty about that; the uncertainty is about precisely when, and that can never be resolved

272 Who are the beneficiaries of catchment management - soil conservation and flood protection? users of roads, railways, bridges as well as landowners on flood plains;

not just individual landowners in areas of the catchment that are vulnerable to soil erosion

273 How do you implement what you know - about land-use capabilities; designating appropriate uses of particular land areas or designating unallowable uses in certain areas

274 Preservation of habitats and natural areas of unique character - relative significance of local, regional and national perspectives; can each catchment be managed in isolation without consideration of other areas; does aggregation of impacts make a difference?

275 Recovering from the effects of unsustainable practices in the past; whose responsibility; people in the present carry the costs imposed by the actions of a previous generation; what about the needs of future generations?

276 What is the significance of the principles of the Treaty of Waitangi for catchment management?

277 Can property rights be appropriately specified so as to acknowledge (i) the variety of cultural values, as well as (ii) current understandings of the natural biophysical processes?

Appendix Three - Climate change

Description of the climate system

278 The global atmosphere is the main system of interest. Within this, two layers, the troposphere (up to 10-12km) and the stratosphere (up to 50km), encompass particular atmospheric functions which influence climate and weather patterns around the globe. Of key significance to life on earth is the maintenance of temperature stability in the biosphere and the screening out of ultra-violet radiation that is harmful to living organisms.

279 In each case, the composition of the atmosphere is important. Chemical composition is not simply a matter of static proportions. Chemical constituents within the atmosphere are the product of dynamic chemical equilibrium processes. For example, carbon dioxide in the atmosphere is involved with a whole cycle of carbon exchange processes - atmosphere/ground, atmosphere/ocean, deep/shallow ocean transfers. Ozone in the atmosphere is constantly being broken down and reconstituted in another cycle of chemical reactions driven by radiant energy received from the sun. Thus the composition of the atmosphere that is so important for sustaining conditions suitable to life depends upon sustaining chemical balances.

280 The stratosphere contains concentrations of ozone that filter out much of the sun's ultraviolet radiation. Were this radiation to reach the earth's surface, "it could be extremely disruptive to the life forms that evolved in the absence of these wavelengths" (Ehrlich et al.,1977).

281 If the atmosphere contained only oxygen and nitrogen, its major constituents, it is estimated that the mean temperature at the earth's surface would be about -20°C. What makes the difference so vital to life is the presence of minor constituents - water vapour, carbon dioxide, and other minor trace gases. Current temperatures in the biosphere are a product of historical atmospheric composition and the presence of trace gases is important to this thermal balance.

282 The troposphere is the region in which most of the general global circulation takes place. The weather systems redistribute heat, moisture and other airborne and atmospheric materials around the globe. The impetus for this process comes from temperature differences around the globe due to the imbalance of tropical heat gains and polar heat losses. Because of this transport mechanism, materials released into the atmosphere can be carried to virtually any part of the world. The

atmosphere acts as a link between actions in one part of the world and their possible effects somewhere else.

283 Apart from being the major reservoir of essential oxygen, the atmosphere acts also as a receiving medium for by-product gases from many human activities, principally carbon dioxide, nitrogen oxides, methane and halocarbon compounds. The energy and chemical balances within the atmosphere are stable but not static; they have cycles and they have shifted before. Only in the twentieth century, with the exponential growth in world population and a similar trend in the use of fossil fuels and other critical chemicals, has there existed the probability that cumulative human activity will have a major impact on these balances.

Policy objectives and policy targets

284 The main concern of sustainability policy centres on the potential to disrupt important chemical balances in the atmosphere as a result of human activity. In the case of halocarbon emissions, human action is introducing a quite new set of chemical species into the atmospheric chemistry. Transport mechanisms in the troposhpere not only carry the halocarbons (chloro-fluorocarbons are a particular subset) up to the "ozone layer" in the stratosphere but distribute them around the globe. These compounds are destabilised by the ultra-violet radiation reaching those levels and the resulting chlorine becomes a catalyst for reactions that rapidly deplete ozone. This depletion leads to increased levels of ultra-violet radiation reaching the earth's surface and the consequent increased potential to induce chemical mutation in living organisms as well as the potential to shift the heat balance within the biopshere.

285 In the case of carbon dioxide, methane and nitrogen oxides, the concern focusses on rates of emission of these gases to the atmosphere. Anthropogenic contributions of these gases have increased in rate to the point where there is serious potential to shift the balances of chemical composition in the atmosphere and thereby shift the heat balance. Global atmospheric warming is a distinct possibility, resulting from the increased concentrations of gases that are opaque to low temperature, low frequency terrestrial radiation. Other possible impacts relate to changes in the behaviour of weather systems (frequency and severity of extreme weather events may change) and relative changes in sea level around the world.

286 The combination of nitrogen oxides with the oxides of sulphur that are released particularly from the burning

of fossil fuels is thought to contribute substantially to the process of acid precipitation. Once again, the mobility of weather systems within the troposphere, ensures that such effects are distributed widely from any point of emission.

287 Policy objectives stemming from considerations of sustainability focus on the control of emissions: to reduce/control rates of emissions of gases which disturb atmospheric composition and the global radiation balance. There is still much uncertainty about the chemical processes involved and even more about longer-term consequences, although there is the possibility of serious risks from ultra-violet radiation, increasingly rapid changes in climate and weather patterns, and acid precipitation. With this in mind, another important policy objective would be: to learn more about the behaviour of the climate system, particularly about which insults pose the greatest threat to climate stability and which consequences are most likely; also much more effort is needed on regional differentiation of possible consequences. Since research must focus on changing rates and varying patterns, it is vitally important to sustain a continuous research effort. Evidence on changing climate and the significance of emissions data and impacts data can only be assessed over decades. The difference between cycles and long-term secular trends cannot be distinguished over shorter periods.

288 Particular policy targets will focus on critical rates of emission: CFC's for preserving the thickness of the ozone layer; carbon dioxide and methane for atmospheric warming; and nitrogen and sulphur oxides in relation to acid precipitation. There is still uncertainty about which gases present the greatest risks at present, and therefore uncertainty about where to target the most effort in reducing emissions.

Indicators of unsustainability

(1) ozone holes and their behaviour

(2) increased frequency of severe storms? increased frequency of droughts?

(3) acidification of forest biomass and waterways

(4) ice advances as in the past would be a serious threat (very long term)

Issues for the role of government

(1) Uncertainty: cumulative impacts, critical emission rates, potential irreversibility and its risks

(2) International context: all countries contribute and all may be at risk, although in some instances some perceive the possibility of benefits (e.g. from atmospheric warming)

(3) The perception that NZ is only a minor contributor by world standards (but a significant per capita contributor!)

(4) The effectiveness of international agencies and institutions in matters affecting national sovereignty, etc.

Appendix Four - Pounamu discovery/utilisation time chart

(Dates approximate)

1350	Arrival of "The Fleet".
1400	Waitaha people settle in eastern South Island, Ngati Wairangi settle in Westland.
1400-1500	Pounamu discovered in Westland and traded to the North Island.
1500	Waitaha dispossessed by Ngati Mamoe. Greenstone well-known throughout New Zealand.
1627	Ngati Mamoe defeated by Ngai Tahu.
1650	Ngai Tahu learn of the source of greenstone, discover passes over the Southern Alps and overthrow Ngati Wairangi.
1769 - 1770	Captain Cook's first visit.
1790 - 1820	Whalers, sealers and traders on NZ coasts. Bitter tribal warfare with muskets among Maoris.
1820	Te Rauparaha defeats Ngai Tahu.
1836	Otago expedition of Te Rauparaha's followers and their defeat at Waipahi.
1860	Purchase of Westland by the NZ Government.
1864	Gold rush to the Taramakau area.
1864 -1890	Greenstone found in considerable quantities by gold diggers; export of greenstone to Australia and Europe.
1890 - 1939	Increasing exports, especially to Germany.
1947	Export of unworked greenstone forbidden by NZ Government.
1980 - present	Worked greenstone from China, Taiwan, Canada imported by NZ retailers for tourist trade.

Source: Brailsford, 1984.

Appendix Five - South Westland south of the Cook River

Description of resource system

289 This case illustration coincides with the area currently undergoing study by a working party of the Secretary for the Environment. It does so because of the ease of access to information and time constraints, and, as such, is not an attempt to pre-empt the committee's work. While recognising the sustainability concept as one which encompasses all aspects of the global system, this illustration focuses, to a large extent on the sustainability of the human communities in the region.

290 The South Westland south of the Cook River is New Zealand's largest remaining pristine wilderness area, containing large unbroken stands of lowland native forest (podocarp, kahikatea, beech and others), numerous native bird species (including two kiwi species, takahe, kakapo, Fiordland crested penguin, and yellowhead), and native fish species. It is the least modified landscape in New Zealand. Active mountain building is still occurring because the region straddles the Alpine Fault, the junction of two continental plates, and the area also contains examples of glaciated landscapes. While large areas have already been reserved as national parks (Fiordland, Mount Aspiring and Westland National Parks), there are still a number of unprotected areas, largely designated as State Forests.

291 South Westland is a very desirable area for many different and, often, conflicting uses. Present uses include timber harvesting, sphagnum moss gathering, tourism, pastoral agriculture, fishing, hunting, recreation, and mineral exploration and production. Identified issues include conflict between community, regional, and national objectives, recognition of Maori values, provision of community infrastructure and services, the World Heritage Proposal, the future of timber supplies in surrounding regions, and roading.

Particular objectives

292 The establishment of an overall sustainability goal for the region would necessarily include consideration of both environmental ecosystem and (human) community viability over the long-term. Maintaining community viability would include both socio-cultural and economic aspects. To attain some measure of sustainability, tradeoffs would be required between various uses and components of the biophysical environment. This requires setting policy objectives and targets for different activities, the environment, and the communities within the region. The consequences of trading off one goal

against the other would be evaluated from the perspective of the policy targets. For example, if the objective of maintaining the native forests was adopted, creating the need for a shift in employment from the forest to tourism industry, the consequences of this shift would have to be evaluated from the perspective of what effect the nature of tourism employment would have on the quality of life in and social characteristics of the communities affected, as well as the environmental perspective of preserving the ecosystem. Would the benefits of preserving the ecosystem outweigh the cost to the community of its quality of life or, perhaps, existence? Limitations of uses which are continued would also have to be identified and monitored to assure the continued viability of sub-ecosystems.

293 The West Coast Regional Planning Scheme (West Coast United Council) incorporates a series of objectives which are designed to ensure the sustainability or viability of existing communities. The overall objective states that the scheme's purpose is to "safeguard the interests, promote the unity and provide opportunities for the people of the West Coast as residents of the region and New Zealand."

294 To attain the overall objective, the scheme identifies 5 "sub"-objectives, among which a balance must be achieved. These objectives include maintaining the right to a regional and community identity; safeguarding of personal freedoms and initiatives; retaining the possibility of living in the region; extending the "benefits of advancements in civilisation" to residents; ensuring that residents meet a number of "obligations to society, the region, and the country" such as gainful employment, wise and prudent resource use, and contributing to the well-being of the region and nation.

295 The scheme also has a specified "community viability policy" which recognises the inter-relationship of community, economic, and environmental systems and provides that "effects of decisions or actions in one part of the system on other parts shall be identified and taken into account by all public and government agencies." Community viability is perceived as the "ability of individual communities to achieve their own objectives" as well as those of the planning scheme.

296 To achieve sustainability, the most important aspects of the West Coast Regional Planning Scheme are the statements which (1) acknowledge the inter-relationship of the environment and communities (including socio-cultural and economic aspects) and strive to have decisions or actions take account of effects on other parts of the overall system; (2) recognise the need for

"a physical environment planned and conserved to serve the needs of present and future generations"; and (3) ensure that demands on the environment are consistent with longer-term regional objectives.

297 It may be noted at this point that the goals and policy targets have been focussed on sustainability of the community and have not specifically dealt with the environment on which the community depends. Clearly, community viability will depend on environmental sustainability, and, thus, some objectives specifically related to the environment are required to "balance" the sustainability picture.

298 It is possible to list any number of objectives which would aid in achieving the goal of environmental sustainability. In view of this, a limiting factor of the community"perspective" shall be applied to the objectives named. This would imply maintenance of the forestry resource, in order that it could continue to provide livelihoods to residents, habitat to a variety of species, be they valued economically, socially, culturally or intrinsically, and recreational opportunities; management of the quality and quantity of the area's water resources, again for community needs, fisheries and wildlife habitat, general ecosystem requirements; sustaining existing agricultural uses, where seen as desirable; management of proposed, and yet to be explored, mineral deposits; management of future development of the communities and their associated infrastructure to take into account the effect on the environment. Obviously, this list is not exhaustive but serves to provide an example of the kinds of objectives required to ensure the sustainability of the South Westland south of the Cook River region.

299 Enunciation of the possible objectives required to achieve sustainability in the region should also serve to highlight the need to prioritise the objectives as well as the policy targets which derive from them. Setting of such objectives will have to take into account the different "communities of interest" present, particularly regional, national, and international interests. Recognition of the fact that local people may have an entirely different perception what will sustain their community than those from a different region or who have a national perspective is required. Clearly, not all objectives or targets may be achievable at the same time and some decisions regarding possible trade-offs will be required. Trade-offs will be further discussed below.

300 It should also be reiterated that the objectives are always considered in the context of the combined goal of achieving community and environmental sustainability.

Policy targets

301 Policy targets serve to operationalise the objectives and are required in order to judge the progress in goal achievement and to assist in the evaluation of the consequences of trading-off one goal or objective against another. Policy targets thus imply the need to set limits or thresholds of use or identify species population levels which can be maintained within a particular setting. Some examples of policy targets would be:

- community size and quality of life (and the subsequent provision of infrastructure to serve the community);

- optimal (as opposed to maximum) sustained yield in native timber production, regeneration goals (so many seedlings planted per year);

- limits on the amount of water removed from various sources for consumptive uses.;

- pollution or degradation limits of water for non-consumptive uses, including the provision of habitat;

- population targets for wildlife species;

- optimal sustainable sphagnum moss yields;
(etc)

302 "Maximum" yields or population levels will not be attainable in all cases if the resources are to be managed for sustainability. Instead, an "optimal" level will have to be defined and decisions made regarding acceptable trade-offs from both the regional and national perspective. For example, while it may be desirable to harvest a large number of native trees to maintain the existing forestry jobs in the region, this may be a level which results in the decline or decimation of the forests and, subsequently, vital habitat conditions for flora, birds, and fisheries. Ultimately, this harvesting activity would destroy the forestry jobs which served to justify it in the first place.

303 The loss of the forestry resource would be in conflict with the desires of other New Zealanders to have the area set aside as one of the few remaining examples of native wilderness. Internationally, it would conflict with the desire for the establishment of a World Heritage park. Jobs in other sectors may have to be substituted for forestry jobs in order to allow the continued existence of the forests. These alternate jobs may be found in the tourist and recreation industries, which have

requirements more suitable to sustaining both the community and environmental aspects of the South Westland. However, the nature of these alternate jobs would have to be considered - would a potentially seasonal job in tourism be a sufficient substitute for a forestry job or would it result in a lower quality of life for residents? Tourism-related jobs may also require a greater reliance on external inputs, thereby reducing community autonomy.

304 Clearly, undertaking a decision to increase or even continue the harvesting of timber in this region, requires consideration and resolution of a variety of issues. Alternate means of harvesting may need to be adopted, such as onsite milling, to reduce potential conflict with other forestry uses, reduce impact on forest habitat, and increase the likelihood of forest reproduction. Employing "value-added" techniques in the communities, such as furniture construction or milling wood for specialised markets, may lessen the quantity of wood demanded, provide jobs, and reduce conflict in forest uses.

Key indicators of unsustainability

305 Since the systems involved here are dynamic, symptoms of unsustainability will usually be reflected in "rate" phenomena. From a social perspective, such phenomena include declining population levels, increasing unemployment rates, closing down of businesses, greater racial tensions, and increased violence. From the environmental perspective, examples include failure of timber stands to regenerate after harvest, a long-term or persistent change in water quality, declining flows, increased flooding, decreased fisheries stocks, lower populations of bird and wildlife base (scrub replacing forest, "desertification" - where no vegetation is present at all - perhaps as the result of overgrazing, flooding caused by poor construction of roads, or any number of other reasons). Often such indicators are the result of the inability of a system to "bounce back" after being subjected to an extreme set of conditions, be they man or naturally induced.

306 The effect of causal cumulation should also be noted here. The interdependent nature of the social, environmental and economic systems means that the modification of one will have an effect on the other. For example, declining environmental value or environmental degradation has a marked impact on tourism (reflected in a reduction of tourists to a particular area), which, in turn, leads to a loss of jobs in the region. Overpriced goods, such as accommodation and foods may cause similar problems. Harvesting trees or

fish at a rate greater than that required for replenishing the stock can also lead to a loss in jobs. High unemployment rates may endanger the viability of the community itself.

Issues for sustainability and the role of government

307 The nature of the costs and benefits imply a function for government to establish institutional arrangements suitable to achieving the objective of community viability as it pertains to the overall goal of sustainability. While the costs of a decision are generally quite concentrated in a community or the region, the benefits are usually dispersed amongst the region, national and international interests. This is readily apparent in the proposal to establish a World Heritage park in the South Westland, an action of significant benefit internationally, nationally, and regionally (insofar as it may create jobs in tourism. The "costs" of this park would be concentrated in the region where jobs in the existing forest industry would be foregone, possibly affecting the stability of communities, and where other sacrifice may have to be made in agriculture and fisheries as well. Clearly, neither the communities concerned, private individuals or businesses, nor the central government could reach decisions regarding the region in isolation.

308 The government should establish the objectives and policy targets necessary to achieve the goal of community and environmental sustainability. In order to establish a clear set of attainable objectives and policies will require a thorough understanding of components of the systems involved (i.e. the requirements and lifecycles of podocarps and beeches, native birds, wildlife and fish species; knowledge of water resources and capacities, effects of different activities, such as grazing, hunting, logging, on the environment). Although this information may be gathered by the private sector, the government may be required to consolidate the material into a usable form. Such information is required so decisions regarding trade-offs can be made. The existence of policy targets also implies the need for on-going monitoring to ensure their adequacy and to maintain the flexibility to change the targets should conditions evolve, objectives change, or new knowledge be found.

309 The government also has the responsibility to ensure that all interests are represented in decision-making, including Maori, regional, national and international as well as other "communities of interest" which may be present. The central government may have to identify the appropriate roles for different government levels, as

well as the private sector, and may, in effect, establish the "autonomy" of regional and local governments. Establishing a goal of sustainability almost certainly engenders some form of conflict, particularly between different "communities of interest", therefore a mechanism for conflict resolution is required.

310 To ensure that the goal of sustainability is long-term (thus outlasting the short-term elected political interests), it must be well-established in legislation and regional plans. Such legislation, policies and plans should include a review and revision mechanism so that new information, changes in the systems (occurring because of their dynamic nature) and priorities, and increased knowledge and technology can be incorporated into the sustainability goal.

Appendix 6 - Energy

311 A precedent exists for legislation requiring that energy conservation and renewable energy resources be given the same consideration as conventional energy supply options.

312 The Pacific Northwest Electric Power Planning and Conservation Act (1980) has as its purpose:

"To assist the electrical consumers of the Pacific Northwest through use of the Federal Columbia River Power System to achieve cost-effective energy conservation, to encourage the development of renewable energy resources, to establish a representative regional power planning process, to assure the region of an efficient and adequate power supply, and for other purposes." (Bonneville Power Administration and U.S. Dept of Energy, 1980).

313 Part of the definition of "cost-effective" is that any conservation measure or resource must be forecast to: "meet or reduce the electric power demand ... at an estimated incremental system cost no greater than that of the least-cost similarly reliable and available measure or resource..."