Planning the Move to Mosaics -

An assessment, planning and practical phased approach to protecting and restoring indigenous ecosystems in production focused landscapes.

A paper presented to the Nature Conservation in Production Landscapes - Managing the Matrix Conference, Taupo, 30th November to 5th December 1997.

GRANT B. ROSOMAN[1] and DIANE LUCAS[2],

The rationale and context for why farmers, foresters, and developers should be concerned about protecting and restoring indigenous ecosystems is discussed. This includes, society values and expectations, productivity benefits, social and ecological benefits, legislative requirements, local action on meeting New Zealand's international responsibilities under the Biodiversity Convention, and the impact and potential of `green' markets. The need for identifying ecosystems is introduced, and a process outlined for Landscape Assessment that identifies underlying ecosystems and their current status. It is proposed that land use can maintain a productivity focus and incorporate biodiversity restoration and conservation back into the fabric of the production dominated landscape. Nature conservation and conservation biology principles are drawn on in a planning approach that involves step by step phases of protection and restoration. Practical examples are used: of a plantation forestry development to show what can be achieved if a commitment is made and phases through tree crop rotations used to implement ecosystem restoration and protection; and an urban development that has involved protection and restoration. It is concluded that the step by step process within a restoration planning framework allows economic activity to continue and provides a realistic pathway to ecosystem restoration.

Key words: Biodiversity, Landscape, Ecosystems, Restoration, Assessment, Planning, Mosaics, Nature Conservation.

[1] ***Forests Campaigner, Greenpeace New Zealand, Private Bag 92507, Auckland, New Zealand. email: grant.rosoman@dialb.greenpeace.org***

[2] ***Landscape Planner, Lucas Associates, Marokapara, 351 Manchester St, Christchurch, New Zealand. email: lucasdi@xtra.co.nz***

1.0 Introduction - the Task of Conserving Biodiversity

"The last word in ignorance is the man who says of an animal or plant: `What good is it?' If the land mechanism as a whole is good, then every part is good, whether we understand it or not. If the biota in the course of aeons, has built something we like but do not understand, then who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first precaution of intelligent tinkering."
(Aldo Leopold 1953)

1.1 The Urgent Need

Around the middle of this century the human race reached a profound point - we humans had developed the power to dominate, alter and manipulate all life on Earth. The degradation of unique landscapes and ecosystems, the extinction of species and loss of genetic material has occurred like no other period in the history.

Aotearoa's biota is unique. We have a high level of endemism, matched only by islands like Hawaii and Madagascar, with more than three quarters of higher plants, and all reptiles, amphibians and mammals (bats) endemic to New Zealand. We have a number of taxa that are 'missing' such as terrestrial mammals, snakes, turtles and salamanders (Diamond 1990). We also have animals that have evolved to fill the niches of those missing, such as large ground herbivorous birds (moa, takahe etc), and giant wetas behaving like mice. The inherent vulnerability of Aotearoa's biodiversity is illustrated by 43 terrestrial birds becoming extinct since the arrival of humans.

We may still have 24% indigenous forest cover but this statistic tells us nothing of either its representativeness, distribution, or its condition. It is largely the areas of land that were left as they had the lowest economic value for agriculture. Lowlands forest systems are only around 10% of their original area and wetlands now less than 5%. Areas of our native grasslands such as red tussock are now below 5% of their original range. By the proposed Australian national reserves system criteria any ecosystem occupying less than 10% of its former range or area, is considered endangered (JANIS 1996).

Although the voluntary NGO/industry agreement, the 1991 New Zealand Forest Accord, has stemmed much of the conversion of native forest to plantations, significant areas (thousands of hectares, including regenerating closed-canopy manuka/kanuka that may be required for protection) are still being cleared for plantation establishment. This is particularly in Northland, and the East Coast including 530 hectares under the government subsidised East Coast Forestry Scheme (Minister of Forestry 1995). The collapse of thousands of hectares of forest in the Ruahine Range due to possum and deer browsing is the tip of the iceberg in terms of ecosystem degradation due to exotic pest impacts.

1.2 Focus on the Lived in Lowlands

In Aotearoa the lowland systems in particular were cleared for farming, to the point where most are now represented only by small remnants. The destruction of the great kahikatea plains forests or Nga Uruora (groves of life) has been well documented by Park (1995). A 'Gap' type analysis carried out by Harding (1997) showed that for the rich dense lowland podocarp ecosystems within the Waikato Dept of Conservation Conservancy (excluding the volcanic plateau regions), of the estimated original extent of 349,180 ha, only 2.1% remains, and 0.15% is protected. Lowland wetlands in general have fared even worse, where society has favoured draining them to farm and live on.

Given the high biodiversity values of lowland systems and degree to which they have been modified, it is here that the task of conservation of biodiversity will need to focus. It is only through protecting, expanding and restoring remnants in lived in landscapes that a representative network of protected ecosystems can be completed. Conservation through protecting and creating publicly-owned natural areas will be insufficient. A

process and mechanisms for working within private ownership will be key for achieving this protection and restoration in the lived in landscape.

Society is now in a position where it can make a choice on whether to try to go on living in the land with an impoverished biodiversity, or actively seek a path of restoring former systems. Humans have the power to destroy and alter, but with it also carries a mantle of responsibility to protect, restore and renew.

This paper sets out some of the rationale for protection of Aotearoa's ecosystems, an approach for assessment, identification, design, and planned phases to achieve adequate biodiversity protection in the lived in landscapes.

2.0 Summary of Values Attached to Biodiversity[1]

Underpinning the protection and restoration of indigenous communities lie values that are part of the rationale for nature conservation in production focused landscapes. These values will vary from the purely mechanistic view of utilitarian values, where the language of resources in terms of the 'ecomachine' , to appreciating nature for its own sake, including herein the thoughts of intrinsic value (Jackson 1992)

2.1 Direct Use Values

People rely on plants and animals for much of their food, medicine, clothing, and in some parts of the world almost entirely for fuel and building materials. There is hardly a dwelling in New Zealand that does not contain some native timber. Wild genes have been used repeatedly to provide particular characteristics or disease resistance for the main food plants such as rice, potatoes and corn. The potential for new food crops and improving the viability of current crops is huge.

Medicinal value also provide a strong argument for the protection of flora and fauna. It is a source of compounds and cures to cancer and other ills. Although indigenous peoples have knowledge of the medicinal uses of most plants, it has been estimated that only about 2% of vascular plants have been screened for their chemical compounds (WWF 1991). A simple New Zealand example is Tea tree or manuka *(Leptospermum scoparium*), has recently been 'discovered' as a valuable medicinal oil and honey producing plant in parts of New Zealand. Previously manuka was largely viewed as a woody weed only good for firewood.

Tourism and the recreation sector is now a major part of the New Zealand economy. Behind this is New Zealand's natural heritage. The active use and enjoyment of the natural environment by 'paying users' is increasing, in recognition of Aotearoa's unique natural features.

---

[1] From the Convention on Biological Diversity, this is defined as "the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which there are part; this includes diversity within species, between species and of ecosystems."

2.2 Ecosystem Services

The evolution of thinking in terms of the construct 'ecosystem' has allowed us to encompass the broader values that biodiversity contain : to see interconnections, processes, landform as well as the individual parts or species, and even former functions in degraded areas. Biodiversity and natural ecosystems provide a range of indirect uses for society, or as Paul and Anne Ehrlich (1981) termed them "ecosystem services". It has been found that biodiverse systems are more efficient at harnessing sunlight, consuming CO2 and are more productive than simple systems with few species (Cherfas 1994). Other ecosystem services include; maintaining air quality and gas ratios, stimulating local and regional rainfall, regulating water quality and quantity, cycling of nutrients and absorbing waste, and pest and disease control processes. These largely 'hidden' services are little known but are none-the-less equally important as any direct or economic benefits. It may be that many of these services can be performed by human-created ecosystems (Noss and Cooperrider 1994: 21). However, for whatever reason natural ecosystems have evolved into their current form and function over millions of years. Once ecosystems or species are destroyed they are impossible to create. The opportunity cost of this loss through extinction is inestimably high (Ehrlich and Ehrlich 1981).

2.3 Recreational and Aesthetic

Recreational and aesthetic values are based around people's experiences of biodiversity, with an appreciation and valuing following this. These experiences can be passive or active, and may relate specifically to a component, such as being indigenous. However, areas set aside for recreational and aesthetic objectives may not necessarily meet biodiversity conservation goals (Noss and Cooperrider 1994).

2.4 Cultural Importance of Biodiversity

For some people biodiversity may have immense significance in their lives. For Maori, notable landscape features are viewed as ancestors and have living form. Maori recognised that their existence depended on the diversity of species and the sustainability of these species (Te Puni Kokiri 1994). The Treaty of Waitangi lays the foundation for both Pakeha and Maori cultures with respect to biodiversity through the concept of the kaitiakitanga. For many New Zealanders some species such as kiwi, tuatara and Hector's Dolphin, and ecosystems such as kauri forest, harakeke (flax) and ti kouka (cabbage tree) wetlands, are icons that are identified with strongly

2.5 Ethical, Moral, Spiritual and Intrinsic Values

With the capability for control and modification comes the moral responsibility for conservation. Our ethical obligations must encompass more that our fellow human beings, as was nicely expressed by Leopold (1949) is his essay on the land ethic (Noss and Cooperrider 1994). The concept of species or ecosystem right is debatable but refers more to the modern idea of intrinsic value, where "... the species which evolved

here have a basic right to be here, whether we need them or not." (Ministry for the Environment 1997)

3.0 Going Beyond Government to Conserve Biodiversity

3.1 Legal requirements and the Resource Management Act

While there is a number of Acts that cover conservation of biodiversity, such as the Reserves Act 1977, Conservation Act 1987, National Parks Act 1980, and Wildlife Act 1953, these are primarily instruments used by the Crown for public lands. With the key issue of protecting and restoring remnants in the production focused land matrix and private land, the primary piece of legislation is the Resource Management Act 1991.

The RMA's purpose (Section 5) is *"to promote the sustainable management of natural and physical resources".* 'Sustainable management' includes the *protection* of natural and physical resources as well as their "*..potential...to meet the reasonably foreseeable needs of future* generations (5.2.a); *and safeguarding the life supporting capacity of air, water, soil and ecosystems* (5.2.b)." The definition of "Protection" comes from the Conservational Act 1987, and includes "*its restoration to some former state*".

Section 6 concerns Matters of National Importance, including "a)*The preservation of the natural character of the coastal environment, wetlands and lakes and rivers...*", "b)*The protection of outstanding natural features and landscapes*", and "c)*The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna.*" The preservation of natural character in (a) requires the maintenance of the viable functioning of natural processes and systems together with the visual or perceived attributes of "naturalness" (Lucas 1994).

3.2 International Responsibilities under the Convention for Biological Diversity

The Convention on Biodiversity was signed by New Zealand in 1992 and since ratified by the NZ government. It clearly recognises the importance to society of protecting and restoring biodiversity. More than 140 other nations have signed the CBD. It is legally binding on New Zealand and has a range of articles that lay out the requirements to meet the CBD. Article 8 on in situ conservation is particularly relevant where for example the requirements are:
"a) establish a system of protected areas where special measures need to be taken to conserve biological diversity;
d) promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings;
f) rehabilitate and restore degraded ecosystems and promote the recovery of threatened species."

As part of the New Zealand governments obligations under the CBD a *New Zealand Biodiversity Strategy* is under development. It will need to lay a framework for a protected area system that adequately protects and restores Aotearoa's biodiversity. The challenge will be in finding mechanisms and a process for dealing with completely

modified lowland ecosystems that are in production focused landscapes on privately owned lands. As yet, there is no broad strategy for enhancing native biodiversity in lowland areas (Ministry for the Environment 1997).

3.3 Existing Mechanisms for Voluntary Protection and Restoration on Private Lands

There are a number of existing mechanisms for landowners to protect biodiversity on their land. They are primarily to address the costs associated with setting aside areas for conservation and they have made a substantial contribution to the national conservation estate. However, they are focused on protection of existing areas rather than restoration of threatened or critically under-represented ecosystems. Nearly 50 years ago Aldo Leopold raised these issues in his essay on "the land ethic", and they are equally relevant today.

"When the private landowner is asked to perform some unprofitable act for the good of the community, he today assents only with outstretched palm. If the act costs him cash this is fair and proper, but when it costs only forethought, open-mindedness, or time, the issue is at least debatable." (Leopold 1949:213)

3.3.1 Forest Heritage Fund and Nga Whenua Rahui

Both are government contestable funds to assist protection of indigenous forests and associated ecosystems that represent the full range of natural diversity originally present in the New Zealand landscape. Since 1990 the FHF has protected over 100,000 hectares through either direct purchase, legal covenanting or assistance with fencing. Nga Whenua Rahui is dedicated to assisting Maori owners protect their indigenous forest, largely through kawenata, covenants, and assisting with costs of protection. More than 50,000 hectares of forest have been protected.

3.3.2 Queen Elizabeth II National Trust (QEII)

The QEII Trust provides assistance for landowners in establishing open space covenants to protect particular natural features in the landscape. Over 1000 landowners have entered into QEII open space covenants protecting some 45,000 hectares, predominantly indigenous forest remnants.

3.3.3 New Zealand Forest Accord

An agreement signed in 1991 between the plantation forest industry and environmental non-governmental organisations restricting the clearance of native forests for plantations. The forest industry has largely followed this although considerable areas of regenerating indigenous forest continue to be cleared.

3.3.4 Local and Regional Council Initiatives

A recent review of local councils found that one-third intended to offer rate relief on application for protected areas, and one-quarter some form of financial assistance for conservation such as legal protection and fencing (Froude 1997). Several councils propose or offer development privilege incentives in return for landowner conservation actions. Some Regional councils offer assistance also such as Environment Waikato's Environmental Initiatives Fund, and Environment Bay of Plenty's Environmental Farm Plans.

3.3.5 Other

There are many other initiatives that in particular support restoration of indigenous ecosystems, such as the NZ Native Forest Restoration Trust, many community and conservation organisation restoration and replanting projects, and the Lottery Environment and Heritage Fund.

3.4 Certification and Market Incentives

The market is one channel for society to express preferences. Forest management certification and performance standards cover biodiversity protection and restoration in response to consumer concerns. Agricultural certification is moving towards recognising biodiversity eg. Project 98. Also, in many cases there is considerable market benefits through increased prices and demand for semi-rural subdivisions that have a component of native area protection and restoration.

3.4.1 Forest Management Certification

Most international non-governmental organisations (NGOs) working on forests are supporting certification as a way of providing credible product information for the buyer on the environmental and social performance standards of the forest operation and the chain of custody of the product. NGOs view certification as an important market tool that can reward producers who address environmental and social concerns, including protection of indigenous ecosystems. And the demand for certified wood is on the increase.

Over the past five years international NGOs have developed some clear requirements for certification. In New Zealand, environmental NGOs view that at the moment certification is only appropriate for plantations. Certification must be based on clear environmental and social performance standards, which;
-have explicit support from ecological and social groups,
-are credible and understandable to consumers,
-are based on objective and measurable criteria,
-have been independently assessed,
-are transparent and not set by parties with vested interests (eg industry-set standards),
-are implemented at the forest management unit level, and
-are linked to a chain of custody and product lifecycle verification.

Greenpeace is supporting credible certification around the world, such as in Germany, Canada, Austria, Switzerland and Solomon Islands. The first New Zealand certification assessment under the FSC for plantations in Southland is nearing completion and includes standards for biodiversity protection and restoration. Greenpeace has also established its criteria for plantations.

The Forest Stewardship Council (FSC) is currently the only credible international certification framework. It is supported by the major international NGOs working on forests including Greenpeace, WWF and Friends of the Earth, but also the timber trade such as a UK buyers group of 70 retailers with a market of over NZ$15 billion who have committed to FSC certified products. The FSC has accredited five certifying

organisations that are now around the world certifying forests to the agreed set of Principles and Criteria for Forest Management.

Examples of FSC Criteria for Forest Management that refer to biodiversity:
6.1 "... Assessments shall include landscape level considerations...."
6.2 "... Conservation zones and protection areas shall be established..."
6.4 "Representative samples of existing ecosystems within landscapes shall be protected in their natural state..."
10.2 "...Wildlife corridors, streamside zones and a mosaic of stands of different ages and rotation periods, shall be used in the layout of plantations,..."
10.5 "A proportion of the overall forest management area [plantation]...shall be managed so as to restore the site to a natural forest cover."

4.0 Landscape Assessment and Planning

4.1 Reading the Stories in the Land

To plan for change people need to understand a landscape to assess it. Assessment needs to consider the physical land as well as people's relationship with it. It is important to read the site together with its context, particularly in relation to the adjoining lands and the rest of the catchment. Assessing the landscape thus involves attempting to understand something of the layers of nature and layers of culture that together make that place. Ecosystem and landscape assessments (vs species inventories) are an efficient (fast) tool for designing protected ecosystem networks as it is easier to deal with dozens or hundreds of ecosystems rather than thousands or millions of species (Noss and Cooperrider 1994:106).

It is limiting to just read the land surface and the vegetative cover that currently exists. With so much of the production and lived in landscapes of Aotearoa New Zealand simplified to just pastoral or plantation or scrub cover, the underlying natural diversity and potential can easily be overlooked. Also, merely identifying the remnants of nature, the remnants from fire, browse and clearing may be inadequate as they may not be typical of the vegetation of the past.

To plan the move to a richer landscape, one planning technique involves firstly seeking to understand "what nature intended" for that place - the type of forest or grassland ecosystem that would occur there naturally if there wasn't intervention. Getting an idea of the nature of the past, both pre-people and pre-European, will help understand something of the natural potential of the place. Knowing what types of vegetation probably existed, and what caused the changes that lead to the vegetation of today, provides useful information for exploring options for future vegetation. Provide friendly data for people to understand the nature of a place.

By identifying the underlying ecosystems, and something of their dynamics - the seral stages, the conditions for establishment, the vulnerability - will provide information for the community of interest to plan for potential restoration opportunities.

Thus putting together an assessment involves mapping the lands on aerial and oblique photographs and topographic maps to identify site diversity and patterning in terms of landform, soils, past and present vegetation, hydrology/drainage, and also for land use, productivity and amenity. Identify areas that have productivity limitations.

Identify and map catchments as possible planning units. Habitat values both on-site and beyond, and any indication of trends in their expansion or reduction, need to be identified. Special niches, linkages and corridors need to be noted.

Provide supporting information, but encourage the community of interest to input their knowledge and understanding. Landscape assessments are integrative of the social elements in the landscape and act as a process for land managing communities to learn more of the rationale behind biodiversity protection, to participate in it, and create their own version of a network of protected systems.

4.2 Identify what is Valued

Rather than planning by "experts" alone:

- Encourage the community of interest to articulate what is valued, what is important and special about a place - perhaps particular wildlife, vegetation, outcrops or waterfalls.
- Identify the physical, the utility, the historic, the spatial and other amenity values such as key views and vistas.
- Seek to identify consensus on what is important, whilst recognising that values will have different weighting's for everyone and will change.

4.3 Identify the Issues

- Have the community of interest articulate the issues as they perceive them - eg. that stream health may be threatened; a visually dominant monoculture may emerge; indigenousness may be scarcely evident.
- Identify the common ground, a consensus on what is of real concern - but don't ignore minority concerns.
- Investigate the extent, triggers, implications and seriousness of these issues for resource sustainability, including for sustaining utility, landscape and amenity values.
- Where concerns appear unfounded, provide additional information and work through with the community perceived concerns and seek resolution.

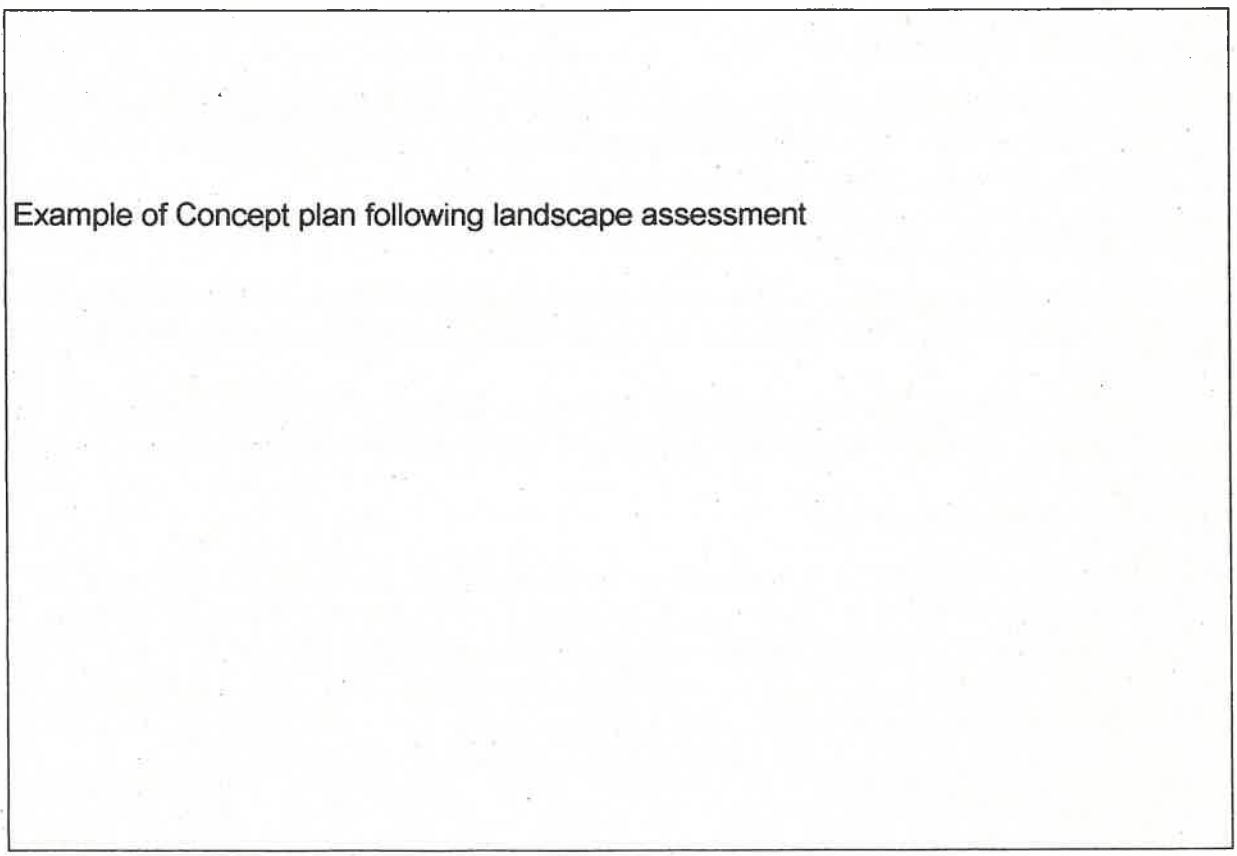
4.4 Articulate their Vision

- Have the community of interest explore opportunities for the land - perhaps, to sustain the tui and the rata in the catchment; to have highly indigenous stream corridors; to maintain shrubland feeding areas for birds.
- Ensure technical and design assistance is available to encourage constructive and creative exploration of solutions and opportunities.
- Encourage the community to articulate their conceptual vision and seek a consensus on directions.

4.5 Concept Plan Development

- Pool the information
- Provide technical and design input to develop practical development and management plans that recognise the nature and culture of the place
- Recognise what is valued
- Address the issues
- Explore the visions, the potential core areas and linkages for nature. Identify the potential as well as the problems for restoration.
- Ensure a diversity of natural values will be protected and/or restored - not all steep dark faces, that have the thinner soils, limited species ranges and of little appeal to birds in winter!
- Provide a concept (quickly) that is friendly and easy to read, use and identify with.
- Seek an interactive and/or iterative process to develop consensus in order to produce the community of interest's plan, not just the expert's plan.
- Identify opportunities for trialing and staging new management styles.
- Ensure the style of plan responds to local nuances, language, landscape, etc.
- Develop an action plan or programme and consider allocating tasks.
- Provide further guidance for developing and managing areas and stages over time, or for reviewing directions.
- Seek to ensure their concept plan is readily available and regularly referred to - a living document.

Figure 1: example of a Concept Plan following a landscape assessment



5.0 Phased Planning for Protection and Restoration - moving to mosaics

5.1 Scientific Criteria for Designing a Protected Ecosystem Network

There is a reasonably good consensus on the criteria used for selection of areas for nature conservation. Frameworks have emerged to both theoretically and practically weigh up the factors for protected area decisions. These include; New Zealand Protected Natural Area (PNA) programme, ecological evaluation for nature conservation such as in O'Connor et al (1990), Harding (1994) and Spellerberg (1992), Man and Biosphere Programme for designing integrated protected areas, Gap Analysis projects (Scott 1993 and 1996) and Sanjayan and Soule (1997), The Wildlands Project (Noss 1992), and a Focal/Multi-species approach (Lambeck 1997).

Following is a brief summary of criteria for evaluation and **selection** of areas for nature conservation (primarily after O'Connor et al 1990):

a) Representativeness and Representation - the principal criterion
Representativeness means protecting samples of the different natural ecosystems found in the landscape. Representation goes further to capture the full spectrum of biological and environmental variation (Noss and Cooperrider 1994).

b) Diversity
Most commonly measured by species richness but also community or habitat diversity. As diversity is unevenly spread across the landscape, it is useful to locate and protect concentrations or 'hot spots'.

c) Rarity and Distinctiveness
Rarity, or uncommon occurrence is complementary to representativeness, which identifies the typical (O'Connor et al 1990). Distinctiveness refers to being unique, and including whether endemic or not.

d) Naturalness
What is 'natural' is generally characterised by a lack of human disturbance or modification. Naturalness is a valuable criterion in New Zealands depleted and degraded ecosystems. O'Connor et al (1982) used an additional criterion of 'potential naturalness'.

e) Long-term Viability and Sustainability
Useful in selection of areas by determining areas most likely to retain their nature conservation values in the long-term (O'Connor et al 1990). Viability will relate to the minimum area requirement.

Social Criteria

f) Cultural Significance
Areas containing sites significant to Maori such as waahi tapu will be important for selection of protected areas. Aesthetic and spiritual values placed on sites and landscape features offer an important justification for selection of sites for protection.

g) Other Social Criteria
These include Scientific and Research significance, Educational and heritage significance, and importance for recreation (ibid).

For landscapes that have sufficient indigenous ecosystems remaining to be able to 'select' areas (mostly publicly owned lands), then the above criteria are adequate. However, for most New Zealand landscapes, and in particular the regions where native communities are most threatened, there are no intact areas to *select* from but rather fragmented remnants from which to restore and rehabilitate a network. Therefore the evaluation and selection for restoration, and *design* of a protected network becomes the key focus. This is particularly integrating restoration with other land uses, and working within the dynamics of fragmentation (eg. Saunders et al 1991).

5.2 Evaluation and Design Criteria for Restoration and Protection

To viably represent all elements of biodiversity within a network of protected ecosystems in the landscape could be seen as the goal. But just how much of all the different ecosystems is required to protect them is a key question that has no simple answer. The 10% figure (based on island biogeography (eg. MacArthur and Wilson 1967)) as a goal for protection has been used widely from the IUCN Bali Plan of Action in 1982, recommended here in New Zealand (Molloy etal 1980), to the slightly higher 12% recommended by the Brundtland Report in 1987 (Sanjayan and Soule 1997) and 15% for Australia (JANIS 1996). It is apparent that these figures have been chosen primarily for political reasons, not ecological. A recent survey of conservation scientist views confirms this and that these low percentages would not "maintain viable populations of species and adequately represent ecosystems in biologically heterogeneous areas" (Sanjayan and Soule 1997).

Given that 10 to 12% figure is seen as too low, then where between there and a 100% is adequate. The percentage chosen will involve weighing up many key conservation biology factors against the social, political and economic realities. Table 3.1 below from Sanjayan and Soule(1997) shows the proportions of regions recommended for protection motivated primary by ecological factors.

Table 3.1: Proportion of Regions Recommended for Protection (from Sanjayan and Soule 1997)

Source	Region	Area to be Protected
Odum 1970	Georgia	40%
Odum and Odum 1972	General	50%
Noss 1991	Oregan Coast	50%
Cox et al. 1994	Florida	33.3%
Mosquin et al. 1993; Kiester et al 1996	Idaho	8%
Ryti 1992	San Diego Canyons	65%
Ryti 1992	Island in Gulf of California	99.7%
Margules et al. 1988	Australian river valleys	44.9% - 75.3%
Noss 1996	General	25 - 75%

Sanjayan and Soule noted from the various studies above that:
- some degree of protection for about half of the terrestrial land and fresh water would be required to protect biodiversity,

- the proportion might be lower in temperate areas and higher in regions with high endemism and habitat heterogeneity, and
- not all of the % need be in strict reserves but would need to be managed with the objective of protecting ecological integrity and species diversity.

It should be emphasised that these percentages were determined largely on ecological criteria, without the compromise that socio-political aspects bring. They are useful as they give an indication of what sort of commitment it will take to maintain ecological integrity in the landscape in the long term, that it will vary considerably between landscapes, and that for most landscapes in Aotearoa the focus moves to protection and restoration of production areas.

Considering the studies above and New Zealand's temperate ecosystems, a generalised vision of the components of the mosaic can determine a draft proportion of the landscape to be in indigenous systems and under some form of protection. This is the planning goal. There is no 'right' figure that can be used for any landscape but it acts as a starting point for adjustment relevant to different factors. We know that if ecosystem integrity and biodiversity is to be taken seriously, then protected and restored areas are going to have to transcend the politically contructed lower and poorly representative percentages. This poses a significant challenge and effectively a land use transition for many landscapes. This will be especially so in our production dominated landscapes such as the Waikato, Taranaki and Southland lowland areas, and for ecosystems such as kahikatea flood plain, most wetlands, and coastal forest systems.

To guide the process of transforming the current land use matrix to include a restored network of protected ecosystems, adjustments can be made draft plan to consider key factors. These factors will influence the proportion of a landscape to be protected and restored, the design and the management of protected ecosystems. These factors are listed below in Table 3.2. and is based on Noss and Cooperrider (1994: 169). They range from the purer ecologic to the socio-political, and their impact on protected area requirements is noted.

Table 3.2: Factors Influencing Protected Ecosystem Design Requirements

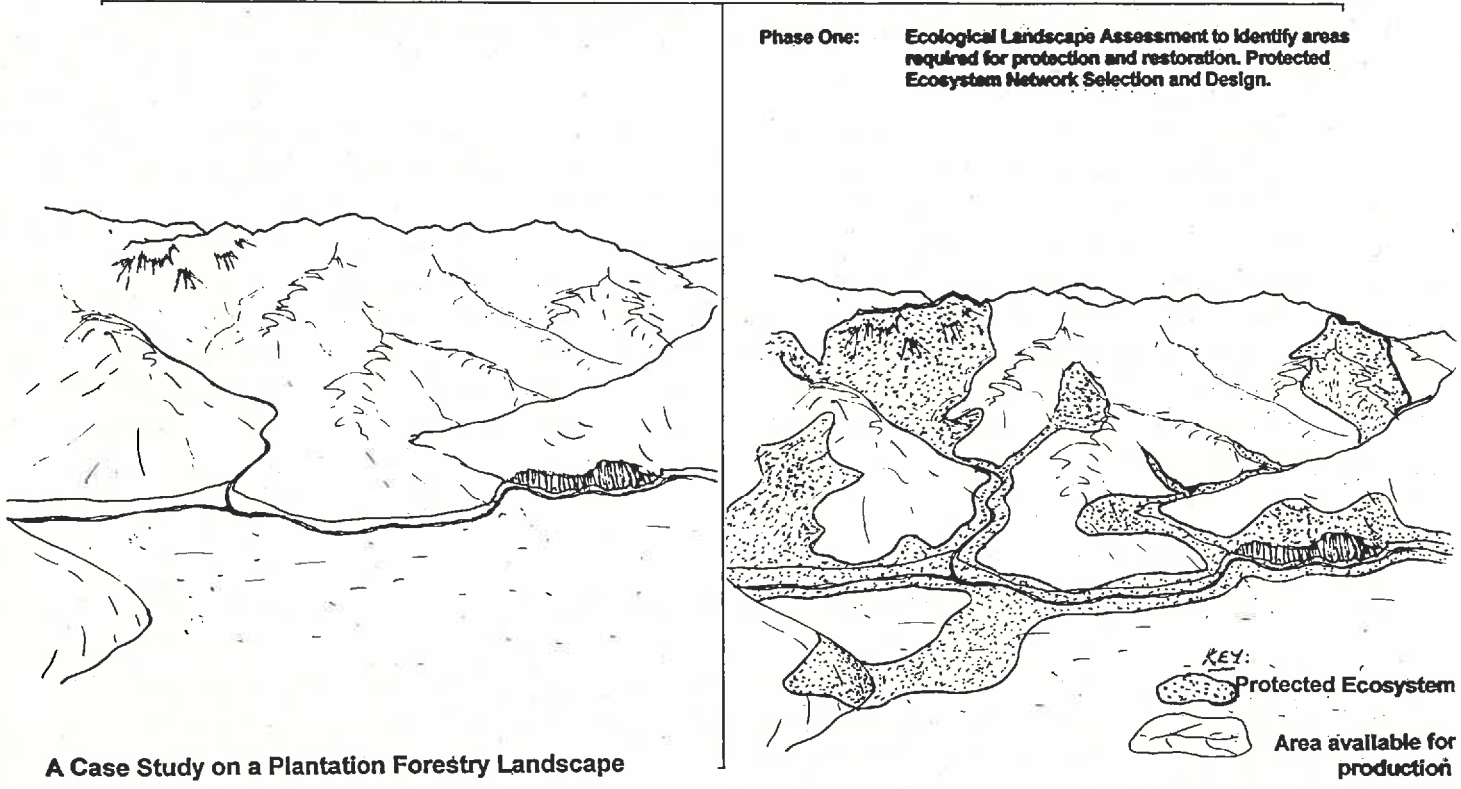
Factor	Influence
1. Scale of the landscape	Larger landscapes such as plains, may require less area than smaller 'micro' landscapes with uncommon or unique features
2. Degree of homogeneity	Landscapes with considerable diversity of species, habitat and ecosystems will require larger areas and range of sites
3. Proportion of Indigenous Ecosystems in a Landscape	In landscapes that have large areas of indigenous areas remaining, it will be easily to protect larger areas. In depleted and degraded landscapes any remnant will be significant. However, in production dominated landscapes with high degrees of private ownership, protection and restoration will face more barriers and take longer.
4. Connectivity	In fragmented landscapes with low connectivity, area increase required (see Saunders et al 1991), if remnants well connected then less. Position in the landscape may be important. A few large areas are better than many small remnants. It may be important to maintain mainland 'islands' for ease of predator control, and they may not need land corridor to protect key species and elements.
5. Natural Disturbances	Such as drought, catastrophic storms, volcanic eruptions, if the risk is high then area and range of sites higher.
6. Distribution of Species or Ecosystem	If widespread then lesser area, if rare or local endemic (due to human influence) then greater proportion required. Species that have a narrow range of movement will require less, whereas long-ranging species such as kaka (*Nester meridionalis*) and Karearea (*Falco novaeseelandiae*) will require a larger range across landscapes
7. Replication	Number of sites to provide an adequate and representative system (eg. JANIS 1996). Will depend on site viability and risks.
8. Quality of Habitat	Linked to predator and exotic weed/pest influences in New Zealand eg. for kokako (*Callaeas cinerea*) and kereru *(Hemiphaga novaeseelandiae*)densities, and area required may depend on the degree of management intervention.
9. Population Viability Criteria	Time scales and probability of persistence will influence target population size and area required. Estimates will vary depending on assumptions and parameters (Noss and Cooperrider 1994), especially whether evolutionary potential is included.
10. Degree of 'Unnatural' disturbance	Level of human use such as grazing or recreation, or pest species density and effects will effect the quality of the habitat. If effect high then larger areas may be required.
11. Adjacent Land Use	If management in areas adjacent to proposed protected areas has a negative impact on biodiversity, such as edge effects, spray drift, nutrient or sediment influx, then areas will need to be larger. If adjacent areas are managed to maintain and mimic indigenous components and structure, then the protected area requirement will be less, eg. light grazing of short tussock grasslands, long-rotation plantations, native tree plantations.
12. Cultural Values	If indigenous ecosystems prioritised for production by Maori, then pressure will be for smaller protected and restored areas. If landscapes contain many areas that are of significance to Maori and/or Pakeha then there may be a need for larger areas/degree of protection.
13. Public Support	If society or local population value indigenous areas as a key part of the matrix in a sustainable landscape, then areas required will be larger and more varied, compared with areas where there is little support and will therefore put pressure on area reduction.
14. Political Will	Generally lacking and erring on the side of compromising ecological priorities, so will in most instances put pressure for a reduced area.
15. Level of Support for Protection on Private Lands	If mechanisms and financial support are easily available (such as via local councils) then this will push area up, or not then there is a reduced incentive for private land holders to protect areas for the public good.

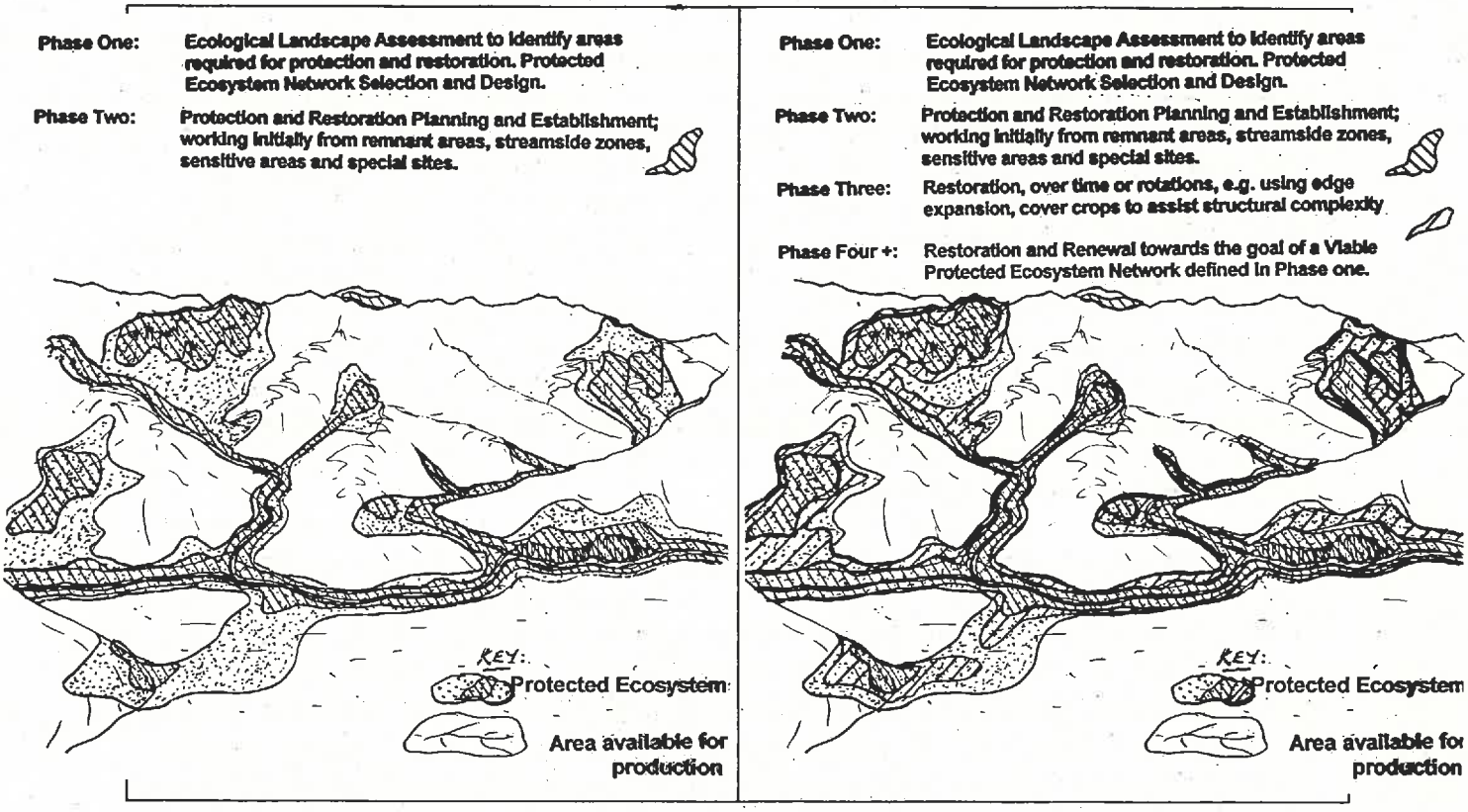
5.3 Phased Plantation Management for Restoration and Protection

The reasons for protecting and restoring biodiversity have been given above, as has the rationale behind the selection and design of a protected ecosystem network. Given that the fundamental purpose of plantation forestry is to make a profit, then meeting the biodiversity protection goals in a plantation dominated landscape will necessarily involve temporal and spatial steps that are economically viable. Most plantation managers believe that their commitment to biodiversity protection is fulfilled through meeting the NZ Forest Accord requirements of not clearing native areas and the conservation of threatened species that are known to occur in their plantations (Dyck 1997). It is very unlikely that plantation management will be able to make the leap to an adequate and viable protected ecosystem network over one tree crop rotation without considerable subsidisation from outside sources in recognition of the wider public benefits. Achieving certification such as the Forest Stewardship Council (FSC), would allow some compensation for restored production areas.

An achievable pathway to establishing an adequate and viable protected ecosystem network is using phases of protection and restoration (Rosoman 1995). Following on from an Ecological Landscape Assessment a Protected Ecosystem Network can be overlayed on the production landscape matrix to identify required protection and restoration areas. An implementation plan would create the transition pathways from production to protection areas over future rotations, and any management and renewal work such as pest control. It could be carried out as bands of restoration mimicking seral stages of the core area, gradually moving the edge out to increase the viability of the core and if necessary establishing greater linkages in the landscape. If this planning approach was carried out and its implementation begun, then baseline indigenous biodiversity protection would be met.

Figure 2: Phases of Plantation Restoration





Phasing to meet financial constraints and make restoration more adaptive and practically achievable could also be used in the farming situation. The trend in the pastoral landscape is for woodlot planting. These could be combined with mobile electric fence that move out with restoration phase. We have the obligation of restoring ecosystems that land management in the past have degraded and plantation growers and farmers to take some responsibility for past ecological mistakes and restore indigenous ecosystems back in the landscape.

Additional biodiversity benefits would be obtained from plantation management by planting a range of production species, including natives, by encouraging and retaining an indigenous understorey, using non-chemical methods of weed control (eg. Kintop 1992, MacDonald and Fiddler 1992), by increasing rotation length, by having full age range compartments and reducing stand size, converting monocultures into mosaics, and by carrying out pest control. Planning that takes into account landform and the indigenous component, can utilise patch planting, a range of species and their different growth forms to harmonise plantations into the visual landscape. Harvesting a mosaic of patches avoids the spectacle of large bare areas, and retains more forest structure and function in the land.

5.4 Rural Residential Restoration - Waiheke Island case study

This case study looks at the nature conservation benefits achieved by a shift to a higher value land use within a local planning environment that is supportive of protection and restoration. There has been considerable criticism of regulatory controls in district plans but some rules and incentives in parts of the Hauraki Gulf Islands Section of the

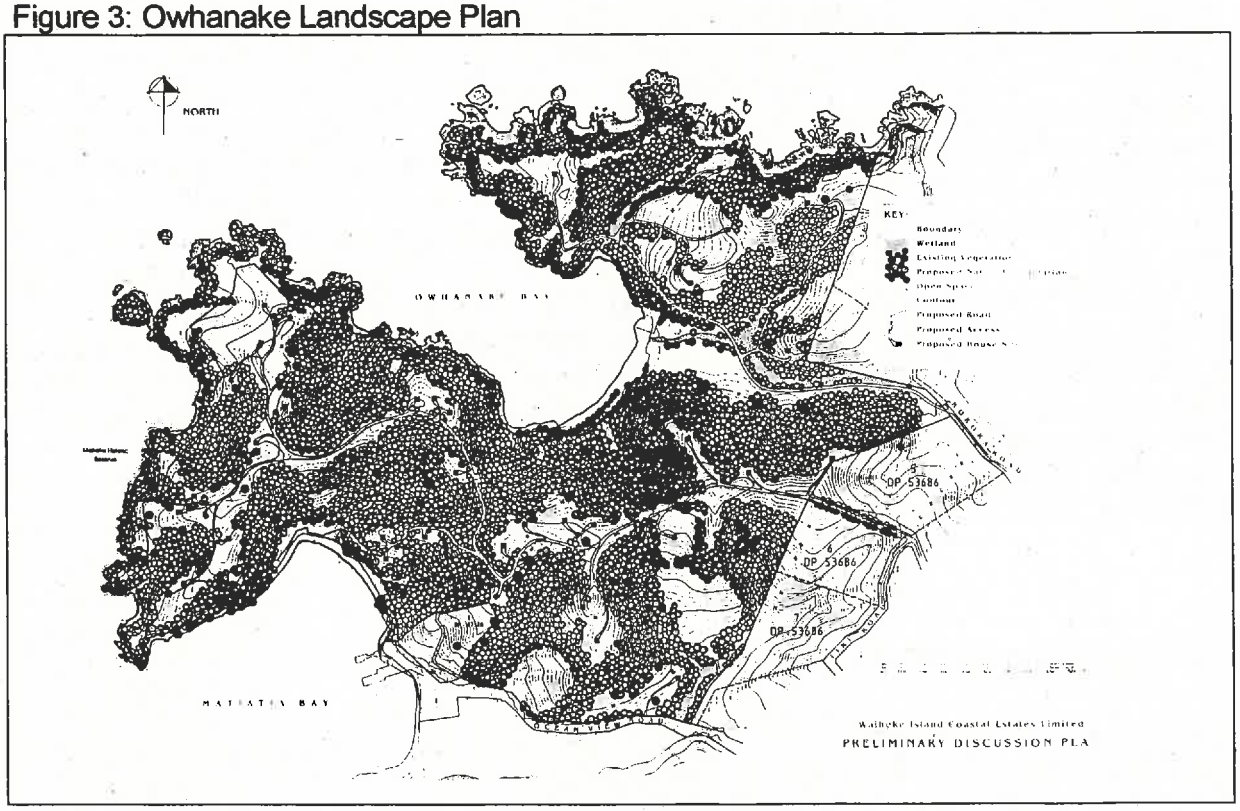
Auckland City District Plan have been working well for conservation on Waiheke Island. The Hauraki Gulf Islands Section (specifically for Land Unit 22) emerged following a community visioning process more than 10 years ago that identified community preferences for the western end of Waiheke Island. This laid the framework for subdivision development that has involved nearly 80% restoration of the landscape or approximately 450 ha.

For this case study we are largely reporting on the work of Denis Scott of Auckland, who has carried out the landscape planning for the subdivisions (Scott 1989, 1991 & 1996).

Waiheke Island is small island on the South western edge of the Hauraki Gulf, approximately 15 km from Auckland City. It has historically been largely cleared of it's indigenous cover for farming. However, the Waiheke soils proved to be poorly suited to pastoral farming and many areas are in the process of regenerating back to indigenous forest. Waiheke is also possum free. Many people moved to live on Waiheke for the seclusion and aesthetic values the bush regeneration offered.

Key components of the District Plan rules that have facilitated the protection and restoration are;
- *Dwelling Density*: ratio of one lot per 5 ha of gross land area, with a minimum of any lot of 1.5 ha
- *Bonus Density Provisions:* up to a maximum of 1 lot per 3.5 ha per gross land area, for each additional lot created 2 ha must be added to public open space, reserve, protected area or protected significant natural feature.
- *Subdivision Financial Contributions*: either cash equivalent to 10% of value of lots for reserve purchase by the Council, or between 2.5% and 5% gifting of land outside other reserve contributions.

Figure 3: Owhanake Landscape Plan



Scott used a land typing and catchment focus for assessment of the land areas, including topography, archaeology, geology, soils, hydrology, slope, and biotic/ecologic components. His analysis looked at ***'critical landscape elements'*** to determine appropriate land use. These focused around coastal margin, riparian areas, cultural sites, steep and sensitive sites, and existing remnant indigenous ecosystem areas. The design concentrated on representation to mimic former indigenous system patterns, including making property boundaries around natural landform patterns to create integrated units. As well, key social criteria such as access, visibility and shelter from winds, public access and walkways, and suitable house sites. A significant outcome of the assessment and design process is a learning and appreciation for those involved, especially the developers and Council staff, on the importance of the protection and restoration of the indigenous systems. This is carried through by further management and interactive work with the new land owners includes the development of a management booklet, weed and pest control, and followup successional planting.

Conclusions

There is an urgent need for the protection and restoration of a viable and adequate network of protected ecosystems in New Zealand. To complete this the focus for nature conservation must move beyond dedicated public protected areas to production focused landscapes and on private land. Society desires mosaics of indigenous biodiversity in production landscapes.

Biological systems are complex and there are major information gaps in both the current status of biodiversity and which path forwards will achieved the desired result. A conservation science basis exists for the selection and design of, and planning for restored reserve networks. Considerable areas within many production dominated landscapes are required to be restored if the indigenous communities represented as small fragmented remnants in those landscape are to survive. Landscape assessments are required to identify the underlying ecosystems, identify the 'community of interest's values, concerns and opportunities, and to develop multi-dimensional concept plans.

To reduce the financial burden of loss of production from restored areas, following a concept plan, a phased approach to restoration of an adequate network of indigenous ecosystems within plantation forestry management and agriculture offers a way forward. This could be supported by eco-certification market-based incentives, and local and national government financial incentives. The market for eco-subdivisions within a supportive local planning environment, offers a viable restoration pathway for rural residential areas.

Acknowledgments

Thanks to emeritus Prof. Kevin O'Connor and Dr Ian Spellerberg for comments on our draft, and to Dennis Scott for detailed information on the rural residential case study.

References Cited

Cherfas, Jeremy 1994: How many species do we need? New Scientist, 6 August 1994. p38

Diamond, J.M. 1990: New Zealand as an archipelago: An international perspective. In D Towns et al, *Ecological Restoration of New Zealand Islands.* Department of Conservation. Wellington.

Dyck, W. J. 1997: Biodiversity in New Zealand Plantation Forestry - an Industry Perspective. NZ Forestry, November. pp6-8

Ehrlich, P.R and A.H. Ehrlich. 1981: *Extinction: The causes and consequences of the Disappearances of Species.* Random House, New York.

Froude, Victoria 1997: Implementing the Biodiversity Protection Provisions of the Resource Management Act - a review of council progress to date. Pacific Ecologic Resource Management Associates. 116p

Harding, Mike 1997: Waikato Protection Strategy: a report to the Forest Heritage Fund Committee. Forest Heritage Fund, Wellington. March. 87p

Harding, Mike 1994: Implementing Biodiversity Conservation - an assessment of the strategic direction of the Forest Heritage Fund. Forest Heritage Fund, Wellington. 56p

Jackson, Laura L. 1992: The Role of Ecological Restoration in Conservation Biology. p434-451 in Fielder, Peggy L. and Subodh K. Jain, eds 1992: Conservation Biology: The theory and practice of nature conservation, preservation and management. Chapman and Hall.

JANIS 1996: Proposed Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia. A report by the Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-committee. July.

Kintop, Craig L. 1992: Paper mulches for Herbaceous Weed Control in Conifer Plantations of the Roseburg BLM District. Proceedings of a presentation at the workshop on Forest Vegetation Management without herbicides, Oregan State University, Corvallis, February 18-19.

Lambeck, Robert J. 1997: Focal Species: A multi-species umbrella for nature conservation. Conservation Biology, Vol. 11, No. 4: p849-856

Leopold, A. 1953: Round River. Oxford University Press, New York.

Leopold, A. 1949: A Sand County Almanac: and sketches here and there. Oxford University Press, New York.

Lucas, Di 1994: Landscape and Resource Management. Unpublished paper to Royal Forest and Bird Protection Society AGM?. Wellington.

MacArthur, R.H., and E.O. Wilson. 1967: The Theory of Island Biogeography. Princeton University Press, Princeton, NJ.

MacDonald, Philip M, and Gary O. Fiddler. 1992: Mulching and Grubbing Techniques in Forest Vegetation Management: A research synthesis. Proceedings of a presentation at the workshop on Forest Vegetation Management without herbicides, Oregan State University, Corvallis, February 18-19.

Ministry for the Environment 1997: State of the Environment Report. MfE, Wellington.

Minister of Forestry, 1995: Letter to M. Mackey dated 1st December.

Molloy, L.F. in association with B.F. Forde et al. (Compilers) 1980: Land Alone Endures: Land Use and the Role of Research. New Zealand DSIR Discussion Paper No. 3. Wellington. 286p.

Noss, Reed. 1995: Maintaining Ecological Integrity in Representative Reserve Networks. A WWF Canada/USA Discussion Paper. January.

Noss, R. F. 1992: The Wildlands Project: land conservation strategy. Wild Earth (Special Issue): 10-25.

Noss, Reed F, Edward T. LaRoe, and J. Michael Scott, 1995: Endangered Ecosystems of the United States : A Preliminary Assessment of Loss and Degradation. Biological Report 28. U.S Dept of the Interior, National Biological Service, Washington DC. 58p.

Noss, Reed F. and Allen Y. Cooperrider. 1994: Saving Nature's Legacy: Protecting and Restoring Biodiversity. Island Press, Washington DC.

O'Connor, K. F., F. B. Overmars, and M. M. Ralston. 1990: Land Evaluation for Nature Conservation - a scientific review compiled for application in New Zealand. Conservation Sciences Publication No. 3. Dept. of Conservation, Wellington.

O'Connor, K.F, G. W. Batchelor, and J.J. Davison. 1982: Mavora: development of a planning process for reconciliation of interests in wilderness. Tussock Grasslands and Mountain Lands Institute, Lincoln College, Lincoln. Papers in Resource Management No. 4. 199p

Park, Geoff. 1995: Nga Uruora - the groves of life. Ecology and History in a New Zealand Landscape. Victoria University Press, Wellington.

Rosoman, Grant 1996: Beyond the Monoculture: An environmental and social perspective on alternative approaches to forestry. Proceedings of the New Zealand Institute of Forestry Conference "Alternative Approaches to Forestry - time for a review", Invercargill, April 30th to May 1st 1996.

Sanjayan, M.A. and M.E. Soule 1997: Moving Beyond Brundtland: The conservation value of British Colombia's 12% protected areas strategy - A Preliminary Report. Unpublished report to Greenpeace. May. 28p.

Saunders, Denis A., Richard J. Hobbs, and Chris R. Margules. 1991: Biological Consequences of Ecosystem Fragmentation : A Review. Conservation Biology, Vol. 5, No. 1. p18-32.

Scott, Dennis 1996: Owhanake - Assessment of Environmental Impact. D. J. Scott Associates. Unpublished report.

Scott, Dennis 1991: Church Bay Resource Consents Documents. Unpublished contract reports for N. & A Johnstone.

Scott, Dennis 1989: The Waiheke Landscape. Waiheke County Council.

Scott, J. M., F. Davis, B. Csuti, R. Noss, B. Butterfield, C. Groves, J. Anderson, S. Caicco, F. D'Erchia, T. C. Edwards, J. Ulliman, and R. G. Wright. 1993: Gap Analysis: A Geographical approach to protection of biological diversity. Wildlife Monographs 123: p1-41. Cited in Noss et al. 1995.

Spellerberg, I.F. 1992: Evaluation and Assessment for Nature Conservation. Chapman and Hall.,

Te Puni Kokiri 1994: Te Ara o Te Ao Turoa: Biodiversity and Maori. Te Puni Kokiri (Ministry of Maori Affairs), Wellington. 20p

World Wide Fund for Nature 1991: The Importance of Biological Diversity. Yale Press, New Haven, CT. Cited in Noss and Cooperrider 1994.