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PLANNERS AND THE CONSERVATION OF BIOLOGICAL HERITAGE

Implications for New Zealand and Australia

The aim of this paper is to encourage greater attention by planners to conservation of native or indigenous biodiversity, and to the skills and knowledge required for this endeavour. This paper argues that, in order to be effective, planners need to develop methods and principles of planning that support the long-term survival of native species and ecosystems. To do so, they will need to work with ecologists, biologists, and land managers, and bring new areas of ecological understanding to their traditional skills. They will also have to demonstrate that they have the skills they claim to have. Moreover, since conservation of biodiversity frequently requires the maintenance or restoration of ecological processes a change in the common focus of planning on development approval with limited monitoring or enforcement, is required.

The paper begins by explaining the meaning of biodiversity and its implications for conservation approaches. It outlines some recent national and international policy developments and the background to them that provides the justification for planning involvement. It then reviews examples of biodiversity provisions in plans within New Zealand reconsiders the strengths and weaknesses of planning practice in order to point to the directions for change and improvement. Although the discussion focuses mainly on New Zealand, Australian examples are used to amplify some points.

Biodiversity and its implications for conservation

The concept of biodiversity is of recent origin and its popular meaning belies some difficulties in definition. For the purposes of this paper the following is sufficient. Biodiversity or 'biological diversity' is the variety of life in all its forms, levels and combinations, including ecosystem diversity, species diversity and genetic diversity (IUCN, UNEP, WWF, 1991:210). The latter is an important but often overlooked component. Whilst the concept is usually applied to native species and ecosystems that are purely or predominantly native in their composition, it can be extended to systems and species within environments substantially altered by human activity. Conservation then involves developing ways to enable native plants and animals to survive in landscapes wherever they are.

Ecosystems are dynamic and enriched when they are able to respond freely to environmental change. Traditional concepts of succession and climax in ecosystems, which imply that mature ecosystems are both stable at maximum diversity, have been discarded (Fairweather , Cardew). Conservation then does not mean attempting to retain the existing form of any ecosystem as it is but allowing the natural processes to operate freely, and that might result in significant change to the structure and appearance of the ecosystem over time.

Whilst diversity within and between species is widely thought to be important for general ecosystem resilience in the face of change, it should not be assumed that this is universally true. Some very simple systems are very resilient whilst some very complex ones are fragile. Scientists are continuing to debate the relationship between species richness and stability and by implication sustainability. Conservation then needs to be based on reliable knowledge of the character of the ecosystem under consideration.

Services provided by natural ecosystems and the species within them are numerous. They include production of raw materials (food, fuel, building materials, fodder, genetic resources, medicines etc.), pollination, biological control of pests and diseases, water supply and regulation, waste recycling, pollution reduction, nutrient cycling, soil building and maintenance, climate and atmospheric regulation, and recreation (Abramovitz 1997, Jeffries 1997). Hence the benefits of conservation are wider than may be recognised and from time to time may generate significant benefits, recognised and valued in the marketplace.

Biodiversity loss

Globally as well as regionally and locally, current rates of biological extinction are estimated to be several times higher than they have been in the last 65 million years (Jeffries 1997, Ministry for the Environment, 1997), and raised serious concerns about the long-term consequences.

Loss of biodiversity is a particular problem within both Australia and New Zealand because of the high rates of endemism characteristic of New Zealand and Australian species, and their vulnerability to habitat loss and the

effects of introduced competitors. "Endemism" means species that are peculiar to an area and like species are not found elsewhere. Examples include the platypus and koala of Australia and the kiwi and tuatara of New Zealand. Some 76% of New Zealand's vascular plants are endemic and 100% of its amphibians and reptiles (Department of Conservation, 1994:11). In Australia 93% of marsupials and 88% of its rodents are endemic, and more than 500 species of eucalypt are uniquely Australian. (SEAC, 1994:2-13). The long isolation of New Zealand (at least 80 million years) and Australia/New Guinea (40 million years) from other landmasses has meant that their plants and animals have evolved with limited competition from species of other continents. Although wonderfully adapted to the conditions of their evolution, some have proved fatally vulnerable to the disturbances and competition caused by human activities and introduced species. And others of course have proved remarkably successful in adapting to new environments within and beyond these islands, eg the Australian possum in New Zealand.

Australia's State of the Environment 1996 report notes that, "loss of biological diversity is perhaps our most serious environmental problem. Whether we look at wetlands, or saltmarshes, mangroves or bushland, inland creeks or estuaries, the same story emerges. In many cases, the destruction of habitat, the major cause of biodiversity loss, is continuing at an alarming rate." (SEAC, 1996: ES-8).

Similarly "Biodiversity decline is New Zealand's most pervasive environmental issue, with 85 % of lowland forests and wetlands now gone, and at least 800 species and 200 subspecies of animals, fungi and plants considered threatened" (Taylor et al. 1997)

The plants, animals and ecosystems of both Australia and New Zealand have evolved gradually over a very long time period to suit conditions of soil, climate, hydrology, and other natural characteristics (eg. solar radiation, light conditions) that are uniquely those of the two respective land masses. The New Zealand flora and fauna, for example, are survivors of a highly dynamic geological history, that has seen successive periods of mountain building and erosion, marine incursions, and dramatic variations in weather and climate (Fleming 1979). In contrast to New Zealand, Australian flora and fauna have evolved on one of the most geologically stable landmasses on the planet. This geological stability has contributed to a general infertility of Australian soils and limitations on the nutrients available to native plants. Moreover, Australia has experienced a long history of climatic cycles characterised by droughts and flood. As Flannery has argued, "Australia's infertile soils and the trials of ENSO (El Nino Southern Oscillations) have forced some unusual adaptations on its plants and animals. These adaptations ...share... parsimony born of resource poverty, low rates of reproduction and strict obedience in following and exploiting brief windows of opportunity as they open erratically over the land." (1994:85).

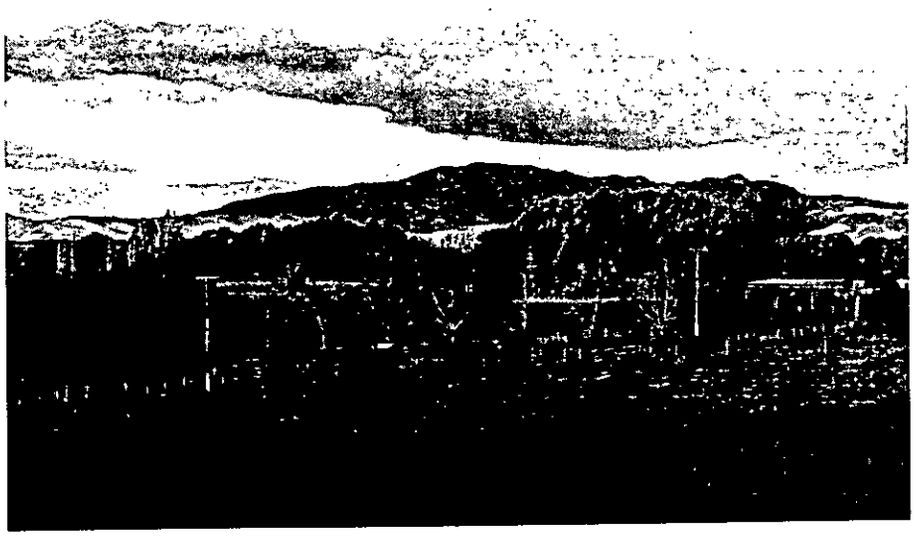

PHOTO 1: THE LIGHT EVERGREEN TREES COMPRISE NATIVE FOREST REMNANTS IN THE DAIRY HEARTLANDS OF WAIKATO, NEW ZEALAND

We are currently living in a time of great biological change, such that it is very difficult to predict what the world will be like 100 or 200 hundred years from now. But certain events and trends seem almost inevitable. A near doubling of the human population is expected within the next 50 years (UN 1994). Fossil fuel resources will be greatly reduced and more expensive. Water shortages for agriculture will occur as aquifers are depleted by overuse or water is diverted to other uses. Widespread soil degradation of arable land and rangelands is anticipated. And the climatic effects from global warming could be profound, especially on ecosytems that could be subjected to accelerated rates of change. Given the fact that Australian plants and animals have evolved for conditions of soil and water poverty and climatic uncertainty, they may provide important clues for environmental management.

The need for protection of biological diversity was articulated by the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, Agenda 21, Chapter 15. Further political and diplomatic recognition of this concern resulted in the signing of the UN Convention on Biological Diversity by 157 countries in 1992.

As signatories of this convention, Australia and New Zealand have been obliged to prepare "national strategies, plans or programmes for the conservation and sustainable use of biological diversity" (Convention on Biodiversity, 1992, Article 6). New Zealand has incorporated this principle within the government's Environment 2010 Strategy. The Strategy includes as one of its aims,

"To protect indigenous habitats and biological resources by:

- maintaining and enhancing the net area of New Zealand's remaining indigenous forests and enhancing the ecological integrity of other remaining indigenous ecosystems;
- promoting the conservation and sustainable management of biological diversity so that the quality of our indigenous and productive ecosystems is maintained or enhanced". (Ministry for the Environment, 1995:34)

New Zealand is also developing a national biodiversity strategy. It was released for public consultation in early 1999.

Australia published its National Strategy for Ecologically Sustainable Development in 1992. This strategy provided the basis and justification for a series of initiatives throughout Australia, including the preparation of a National Strategy for the Conservation of Australia's Biological Diversity, published in 1996.

PHOTO 2: THE FLOOR AND MIDDLE CANOPY OF THIS FOREST REMNANT IS UNPROTECTED FROM THE EFFECTS OF GRAZING FARM STOCK.

Biodiversity conservation and habitat protection

New Zealand's State of the Environment report summarises the causes of NZ biodiversity loss as: loss of lowland habitat ..., declining quality of remaining land and freshwater habitats, impacts of pests and weeds, and, in the case of some marine species and ecosystems, human overexploitation (1997:10.6).

Australia's 1996 National State of the Nation report identifies habitat loss as the single most significant cause of biodiversity loss in Australia (SEAC 1996), followed by habitat degradation and the introduction of pests and weeds. The Report claims that from 1788 to 1995:

- Seagrass beds in temperate areas have declined significantly;
- About 43% of forests have been cleared;
- More than 60% of coastal wetlands in southern and eastern Australia have been lost or degraded;
- Nearly 90% of temperate woodlands and mallee have been cleared;
- More than 99% of temperate lowland grasslands in south-eastern Australia have been lost;
- About 75% of rainforests have been cleared (SEAC, 1996: 4-26).

In the view of the National Biodiversity Council, the emphasis of this assessment of Australia's biodiversity is misplaced. According to Professor Recher, Councillor of the National Biodiversity Council,

"*In my opinion... the SOE report conceals the huge local and regional losses and declines in species which have occurred over the past two centuries. Over much of southern Australia, significant declines in the abundance and distribution of species affect more than half of all species, and in such important ecosystems as box-iron bark woodlands it could be said that the entire ecosystem along with all its populations of all its species is endangered – probably irreversibly so. By taking a narrow view of biodiversity (by and large equating it to species) and by using extinction as the most important (final) event instead of weighting status by the loss and decline of regional populations, the SOE report on biodiversity conceals the full extent of continental loss and environmental degradation from the Australian public.*" (Glanznig, Andreas, 1996).

With this comment, Recher is pointing out the essentially spatial nature of biodiversity loss. Biodiversity loss occurs because of on-the-ground losses repeated over and over again, but not inevitably and always so, from locality to locality, and region to region.

Habitat conservation must be seen against a broader backdrop. In New Zealand and Australia, agriculture, including pastoral agriculture, has been one of the greatest causes of land use change and habitat destruction. The areas in New Zealand of highest biodiversity before European contact were the flood plains and coastal lowlands of the North and South Islands. These have also been the areas of closest human settlement and greatest conversion to agriculture. Not only did these include the greatest diversity of ecosystems (coastal and low altitude forest of various structure and species composition, bog, swamp, flood plain, estuaries, dunelands, lakes, rivers, and streams); they were critical for the year-round ecology of many birds. Today, most of the land below 300m is privately owned and supports little more than fragments of the original native vegetation. Such fragments suffer ecological disturbance and continued biodiversity loss. However, they remain as the seed banks of a depleted biological heritage and the genetic resources require urgent protection to enable development of hybrid landscapes in which exotic and native species coexist.

The general tendency for areas of greatest production potential to also be areas of highest ecological potential means that the areas of greatest habitat value for conservation of native biodiversity also tend to be the areas of greatest human value for production for food or forestry. This is not always so. In Australia the most species rich sclerophyll communities are on the least fertile soils. But Australia has lost conservation opportunities provided by more fertile soils as the controversies about protection of land on the Cumberland Plain on which much of Sydney is located (Adam pers comm 1998). Increasing pressures for production are also impinging upon less fertile soils thereby increasing potential for conflict of use.

Conservationists now recognise that protection of biodiversity will have to occur within cultivated and pastoral landscapes rather than national parks or areas especially set aside for such purposes (Western 1989, Western et al 1989). McIntrye, Barrett and Ford (1996, p156) comment that while reserves will continue to be important for the protection of biodiversity, the opportunities to extend or create new reserves are decreasing as pressures on land resources increase. Thus, "conservation in areas between reserves may be integrated with other land uses". In similar vein, Recher (1996, p340) argues that, "on the assumption that the commercial exploitation of Australia's forests will continue for the foreseeable future, the long-term survival of Australia's forest biota can only be assured by fully integrating the management and conservation of wildlife with logging and other forest management practices".

Examples of biodiversity conservation planning

Planning specifically for conservation of biodiversity is a recent concern among planners, but there are New Zealand and Australian examples of plans and policies that have included biodiversity

conservation, or some related objective, such as habitat, scenic or landscape protection.

In New Zealand, the *Conservation Act 1987* (as amended by the *Conservation Law Reform Act 1990*) incorporated a requirement that within five years, all land administered by New Zealand's Department of Conservation be managed in accord with a Conservation Management Strategy. Consequently, all New Zealand's public conservation estate (nearly 30% of the land area of the country) is administered in accord with a plan or management strategy (under the *National Parks Act 1980*, the *Reserves Act 1977*, the *Conservation Act 1987* or similar protected areas legislation). Seventeen conservation management strategies have been or are in the process of being developed (DoC, 1996a: Output Class 9).

These strategies outline the natural and historic resources of the areas administered by the Department and the priorities and measures by which the various conservancies intend to manage the resources under their responsibility. For example, the Waikato Conservation Management Strategy for Waikato conservancy, south of Auckland, identifies 11 "strategic management clusters", and indicates what management priorities will apply to these areas. A follow-up document, Conservation Progress in the Waikato, 1995-1997, (DoC, 1998b) provides a report and evaluation of progress in relation to the objectives outlined in the conservation management strategy.

Because of the timing of this amendment, when ecosystems and habitat types were increasingly valued in their own right, rather than as habitat areas for threatened species, most of the conservation management strategies have specifically included provisions for habitat protection, ecosystems protection or protection of threatened species.

In development of these plans relevant stakeholder groups (departmental staff, the general public, particular interest groups, and communities) and all administrative levels of the Department came to be coordinated in relation to specific natural resources (eg. wetlands) and places (Waikato wetlands). Policies were developed that allowed for integrated management (eg. in relation to pest control, restoration programs, and recreational or other use by the public), and funds prioritised on an annual planning basis.

Unfortunately these conservation management strategies applied only to land administered by the Department of Conservation, which meant that the funds allocated to protection were significantly (but not entirely limited) to those allocated by the Treasury. They did not seem to be sufficient to stop or reverse the impacts of introduced plants and animals. The Department's Strategic Business Plan of 1998-2002, for example, identified 700,000ha of possum control and 700,000ha of goat control if there were more funding available (DoC, 1998a p58).

Moreover, ecosystems, landforms, and the like that are not well represented within the conservation estate (eg. those associated with lowlands and coastal and marine areas) fall largely outside the Department's protective mandate. Neighbouring private land use can also adversely affect conservation land, especially remnant lowland or coastal forest, and wetlands that are subject to hydrological cycles that fall outside land administered by the Department. It also means that land administered by the Department may be perceived by local communities as the responsibility of the Department rather than an area deserving of local stewardship.

A growing number of plans prepared under the *Resource Management Act 1991* and its attendant New Zealand Coastal Policy Statement, provide for biodiversity conservation. These include an as yet small number of district plans (which apply to territorial authorities) and regional coastal plans (which apply to New Zealand's 17 regions).

The Act states, as a matter of national importance, that, "persons exercising functions and powers under it...shall recognise and provide for...the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna." However, the Act provides no definitions or criteria for "significance", and the extent to which district councils have followed through on their responsibilities varies in accord with interpretations of what is deemed to be "significant" (Froude, 1997:17-18). Is an area of early successional regrowth "significant"? How large or how unmodified must a wetland or patch of remnant lowland native forest be to deserve protection?

In some cases, protection of indigenous vegetation and habitat is hindered by lack of baseline information. Councils may be too poor, or politically unwilling to fund up-to-date surveys that identify and establish areas of significant indigenous vegetation or habitat. Even if the information is available, they may be unwilling to restrict the rights of private landowners to use their land as they see fit (Froude 1997). Politically, the identification of sites of ecological significance may be fraught with difficulty and conflict (Froude 1995).

The introduction of the *Resource Management Act 1991* prompted widespread consideration of techniques that could be used to encourage protection of native vegetation, particularly at district and regional levels. Froude (1997) has summarised some of the techniques used. At the district council level (applying largely to land use), they include:

- the use of schedules of ecologically significant sites;
- restrictions on clearing of native forest;
- provisions for encouraging protection or restoration of riparian margins;
- criteria for identifying significant indigenous vegetation and significant habitat (considerable variation between councils);
- policies for rehabilitation; and
- development requirements and development incentives, eg. developers receive a development entitlement in return for extending a legal protective covenant over areas of indigenous vegetation.

Regional councils have included the identification of regionally significant sites for wildlife and botanical values within regional policy statements (Auckland region). They have specified active management of ecologically significant sites within a regional parks framework (Auckland and Wellington regions), and education programs that are tied to the implementation of regional planning objectives (Waikato and Bay of Plenty region, see Froude 1997).

Despite the initiatives many planning provisions do not ensure on-going ecosystem management of the kind that will enable the continuation of indigenous ecosystem processes. For example, in New Zealand, fencing requirements may be imposed on a development consent application, but unless these are enforced, there is no protection of native forest against the intrusion of domestic livestock or introduced or feral wildlife. There are seldom, if ever, provisions made to manage invasive weeds, or sustain the nutrient and hydrological cycles that were

typical of or necessary for native ecosystems and species to flourish. Within the former flood plain of the Waikato river (now mostly drained and developed for dairy production), a significant proportion of the remaining wetland is threatened by eutrophication from agricultural run-off from adjacent farms, or lowering of water tables as adjacent farmers try to reduce boggy conditions on their land. Tension exists between conservationists who want to maintain or return to hydrological cycles, which involve annual flooding, and farmers who want to increase pasture production by lowering their water table.

The *Resource Management Act* includes a set of national policies for coastal areas that apply to regional coastal plans. Policy 1.1.3 of the New Zealand Coastal Policy Statement states that it is a national priority to protect features which in themselves or in combination, are essential or important to the natural character of the coastal environment, including landscapes, seascapes and landforms, while Policy 1.1.4. states that it is a national priority to preserve the integrity, functioning, and resilience of the coastal environment in terms of the dynamic processes and features arising from the natural movement of sediments, water and air; natural movement of biota; natural substrate composition, natural water and air quality; natural biodiversity, productivity and biotic patterns, and intrinsic values of ecosystems (DoC, 1994a:5].

Regional coastal plans can specify Areas of Significant Conservation Value. Within these areas, development proposals must be consistent with the preservation of the values identified, eg. Waikato Regional Coastal Plan Appendix IV, (Environment Waikato 1997).

For coastal areas biodiversity management is, however, divided between different statutes and different administrative authorities. District councils are responsible for land-use under the *Resource Management Act*; regional councils are responsible for marine and freshwater bodies under the *Resource Management Act;* and the Ministry of Fisheries is responsible for commercial fisheries under the *Fisheries Act*. Marine pollution is dealt with under the Resource Management Act and the *Maritime Transport Act*. Marine farming is controlled through regional councils (for the location of structures), the Ministry of Fisheries (under the *Marine Farming Act* 1971) for permits to collect spat and harvest shellfish) and the Marine Safety Authority (for navigation and safety). These administrative and legislative divisions make the chance of integrated ecosystem or multi-species management difficult, if not remote.

A recent Australian example of a plan, which include provisions for the protection of biodiversity is the South East Queensland Regional Framework for Growth Management, published in May 1998. (South East Queensland Regional Coordination Committee, 1998). It is based on a comprehensive and co-operative assessment of the region's nature conservation areas, economic resources, environmental constraints, and infrastructural priorities. It recognises that the natural characteristics of the area are a key component of the region's attractiveness, and must be protected to retain existing 'quality of life ' characteristics.

The objective "To conserve areas of regionally significant nature conservation value" is reinforced by a series of principles and "priority actions". Each of the priority actions has been identified with a lead agency which is responsible for implementing the objective. Priority actions include the extension of "the area of national parks and Conservation Parks to include examples of all the region's landscape elements and vegetation communities which are poorly conserved" (Department of the Environment), and to prepare a Regional Conservation Strategy (Department of the Environment in cooperation with local government). Critical conservation areas are to be retained "together with the linkages connecting these". The document includes a map which highlights (the very considerable) areas of both economic resources and nature conservation values. By doing so, it shows up areas that are likely to experience conflict between development and nature protection, and require particular consideration and care.

The effectiveness of the plan as a mechanism for biodiversity conservation will depend on the extent to which the various agencies (local authorities and state government departments) can be persuaded to follow the policies of the plan. However, by providing an integrated overview of the region, any departures from the plan are likely to require a more forcefully argued justification than where there is no such comprehensive overview.

In both Australia and New Zealand, local or regional government relies not only on plans and policies for resource protection, but also the involvement of individual property owners and community groups. These groups can play important roles in long term conservation management.

The growing number of landcare programs in both Australia and New Zealand is an example of such local level action. Although few of them have biodiversity conservation as a particular objective, they sometimes have protection of indigenous vegetation. As a consequence for example, in New Zealand the Waikato regional council provides services and support to some 24 Care groups (including landcare, river care and beach care) (Environment Waikato 1998). One of these groups has been concerned with the reduction of soil erosion within the Waitomo river catchment. Retirement of steep land from farm production within this catchment has resulted in a resurgence of indigenous forest over significant parts of the catchment (Personal observation).

The role of local government in biodiversity conservation

As the above examples suggest, local and regional government is important for biodiversity conservation in a number of ways. It has legislative power and responsibility for environmental issues at local and regional level. It is accountable to individuals and communities for environmental conditions within their local area, and can harness their energies and commitment for environmental action. Finally it is potentially the level of government that can provide the ongoing care that is necessary for long-term ecological protection and restoration.

An additional element of biodiversity that is often overlooked is genetic diversity. A major source of genetic diversity is due to variations of local environment, and to spatial effects on population dynamics. Maintaining genetic diversity within species, therefore, often means maintaining sub-populations in different geographic areas. Local and regional levels of government potentially have most reason to maintain their own local species variants, and thereby the genetic variation within species nationally.

The role of planners in biodiversity conservation

Planners are the professional group with most experience with development consent. Usually the final recommendation for development approval rests with planners in local, regional government, or also in Australia, state government. They are used to consulting other agencies and including their advice in recommendations. And they are obliged to draw on a wide range of advice. Conservation of biodiversity extends the ambit of this advice. Until the *Resource Management Act* in New Zealand changed planning from an essentially prescriptive activity to effects based assessment, plans provided a framework for development approval. In Australia, land use planning in most states has not been subject to such radical change in approach, but concerns for integrated approval systems may shift planning away from prescriptive approaches.

It may be argued, therefore, that planners are well placed to provide the approaches to biodiversity conservation that area needed. Planners claim to have a combination of professional skills that qualify them to assist with the preparation and development of biodiversity plans and strategies. These include:

- analysis of spatial relations, including landscape phenomena;
- a holistic appreciation of context; planners tend to view places as parts within a larger whole, both spatially and in social, economic and environmental terms;
- integrative thinking; planners tend to be involved in bringing together information and objectives from different groups of people (engineers, ecologists, economists, experts, members of the public, special interest groups);
- awareness of political and cultural differences in the evaluation of environmental resources and how these influence the decision-making process;
- commitment to democratic community processes in decision-making about the use of those resources; and
- experience in public consultation and community involvement in decision making.

It is precisely the potential for environmental conflict between conservation and production that calls on skills in the areas of process, community consultation, and integrative thinking. But planners may not have demonstrated these skills as effectively as they have assumed. The scientific community has not been surveyed on this question, but perceptions of some raise sufficient doubt.

Second, most planners are trained in social science based programs that do not expose them to any extent to natural scientists whose knowledge is drawn upon for policy or project assessment. Often they do not appreciate the culture, or the nature of scientific knowledge. Consequently, planning policies can be based on poor, popularist or dated knowledge. Earlier in this paper, concepts in biodiversity were reviewed and the implications for practice identified. They were that conservation involves developing ways to enable native plants and animals to survive in landscapes wherever they are; allowing natural processes to operate freely, which might change ecosystems; and that management be based on reliable knowledge of ecosystems under consideration. To practise effectively planners may need to work with ecologists, biologists, and land managers, and bring new areas of ecological understanding to their traditional skills related to land use planning and public policy formulation.

Conservation of biodiversity frequently requires the maintenance or restoration of ecological processes. It is usually not sufficient to make 'one-off' provisions by legislative fiat or the imposition of development conditions that can be forgotten about once the development is in place. In most circumstances, maintenance of biodiversity requires activity over a period of years until ecological processes can be self-sustaining. Thus for planners, biodiversity conservation will often mean looking for resource management solutions that involve management of ecosystems and landscapes over time. The prescriptive heritage of planning, with its emphasis on management via consent condition, with variable commitment to enforcement is not sufficient. A fundamental change in approach is required.

Experience has also shown that lack of community involvement in nature conservation can often result in neglect of areas of native vegetation, indifference, or active opposition to conservation (Froude 1997). Where landowners and community groups have been consulted, on the other hand, acceptance of conservation measures is much more likely to be accepted. Planners can help make biodiversity conservation more effective by using their skills to enlist community support for conservation policies.

Although planners in New Zealand have by and large accepted the importance of biodiversity conservation, there has not yet developed an accepted body of knowledge about effective landscape planning techniques that will promote the on-going survival or restoration of native biodiversity. Planning policies so far remain very much within the ambit of the *Resource Management Act* as a statutory framework and depend largely on the imposition of planning controls when applications come in for development. In this respect they tend to operate reactively, rather than proactively, ie they kick into action only after a new development has been proposed, not in response to existing development. Similarly they often involve the application of 'once-off' solutions such as the imposition of a conservation covenant at the time of subdivision rather than on-going management, eg measures for on-going weed and pest control. And they tend to be incremental, even ad hoc, rather than systematic or related to ecosystem processes and conservation priorities.

Conservation ecologists and managers recognise that legal protection of habitat areas is not enough. Long-term maintenance of native biodiversity depends on maintaining the natural and physical conditions that are crucial to the survival of native species and ecosystems. This requires integrated ecosystem-based management within district or regional landscapes. Ecosystems, and the plants and animals they support, are not isolated or self-sufficient units; they are dynamic natural systems that change over time and involve relationships with other parts of the landscape. Ecosystem-based management involves an awareness of the relationships between elements of the landscape; and management of the processes that enable the plants, animals and natural conditions (eg. temperature, humidity, hours of sunshine, periodicity of fire or flood) which characterise the ecosystem to continue without undue disruption.

Ecosystem-based management presents crucial challenges to environmental and land-use planners. It introduces a new set of considerations in relation to landscape design (the interaction requirements and interdependencies of ecosystems and species on an on-going basis); and it requires planners to devise planning

policies (and approval systems that encourage appropriate long-term ecosystem management practices.

It follows from the preceding section that planners need all the planning techniques they claim to have (eg. of resource identification and analysis, public consultation, apolicy formulation) to assist with biodiversity conservation. But they also need an understanding of ecological and biological processes in the landscape.

Despite the strength of Australian research in relation to nature conservation, McIntyre, Barrett and Ford (1996:169) rightly point out that "Although the general ecological principles for maintaining biological diversity have been developed over the last 20 years, loss of species and communities continues unabated. It is now widely recognised that without community involvement and cooperation, conservation management plans will be ineffective." It is in this respect that planners may have most to contribute to the conservation enterprise.

Conclusion

Biodiversity conservation has been accepted as an important component of environmentally sustainable development. The governments of Australia and New Zealand are both signatories to the UN Convention on Biological Diversity, and, as such, have pledged a commitment to promote biodiversity conservation. Both governments have produced or are in the process of producing strategies for biodiversity conservation.

Plants, animals and ecosystems are subject to biological processes that require integrated management over time. In addition, in New Zealand as well as Australia, the existing network of protected natural areas is deficient in terms of size, distribution and representativeness to assure the conservation of even a representative collection of native species. Therefore, it is not sufficient to leave the conservation of native biodiversity to the existing network of parks and reserves. Conservation of biodiversity must include the private landscapes of farm and forestry. Private land managers must become aware of how their actions can impact on native ecosystems and species, and if possible, they must be motivated to assist with long-term measures for conservation management. Planners at local and regional government level are well placed to develop strategies and methods that will gain the support of local communities and landowners. QUESTION

Local and regional government are particularly important for preventing the loss of native biodiversity because they are the levels of government that most directly influence actions of private landowners and managers and are most directly accountable to local communities.

To the extent that planning, as a profession, takes up the concepts of sustainability and sustainable development as goals of professional practice, the issue of biodiversity conservation is a matter of importance for the profession. And in a world where environmental conflict and pressures for production increases are likely to grow, planning for biodiversity conservation requires not only a widened application of existing planning skills, but new knowledge and fundamental changes in approach. ■

REFERENCES

Abramovitz J M (1997) Valuing Nature's Services. in Brown L R et al *State of the World 1997* Earthscan Publications Ltd, London, pp95-114.

Adam P, Associate Professor, School of Biological Sciences, UNSW, referee.

Department of Conservation (DoC) (1998a) *Restoring the Dawn Chorus, Department of Conservation Strategic Business Plan 1998-2002*. Department of Conservation, Wellington

Department of Conservation (DoC) (1998b) *Conservation Progress in the Waikato, 1995-1997*. Waikato Conservancy, Hamilton, New Zealand.

Department of Conservation (DoC) (1996a) *Greenprint, Conservation in New Zealand – a guide to the Department*. Department of Conservation, Wellington, New Zealand.

Department of Conservation (DoC) (1996b) *Waikato Conservation Management Strategy. Visions, Principles and Strategic Objectives 1996-2006*. Waikato Conservancy, Hamilton, New Zealand.

Department of Conservation, (DoC) (1994a) *New Zealand Coastal Policy Statement*. Department of Conservation, Wellington, New Zealand.

Department of Conservation, (DoC) (1994b) *New Zealand's Biodiversity, an Overview*. Department of Conservation, Wellington.

Environment Waikato (1998) *Annual Report, 1997-1998*. Waikato Regional Council, Hamilton, New Zealand.

Environment Waikato (1997) *Regional Coastal Plan, Revised as per Council Decisions*. Waikato Regional Council, Hamilton, New Zealand.

Environment Waikato (1996) *Regional Policy Statement*, Waikato Regional Council, Hamilton, New Zealand.

Flannery T (1994) *The Future Eaters, an Ecological History of the Australian Lands and People*. Reed Books, Port Melbourne, Victoria.

Fleming C A (1979) reprinted 1989: *The Geological History of New Zealand and its Life*. Auckland University Press: Auckland.

Froude V (1997) Biodiversity Protection Provisions, *Planning Quarterly*, 126:17-20.

Froude V (1995) Significant Natural Features Gain Protection. *Planning Quarterly* 119:20-23.

Glanznig A (1996) How fares Australia's biodiversity? Not well says national report card. http://www.peg.apc.org/~bdnet/Soe.htm 13/04/98.

Heywood V H (Exec. Ed.) (1995) *Global Biodiversity Assessment* Published for the United Nations Environment Programme by Cambridge University Press, Cambridge

IUCN, UNEP, WWF, 1991: *Caring for the Earth, A Strategy for Sustainable Living*. Published in partnership by The World Conservation Union (IUCN), United Nations Environment Programme (UNEP) and WorldWide Fund For Nature (WWF), Gland, Switzerland.

Jeffries M J (1997) *Biodiversity and Conservation* Routledge, New York.

McIntrye S, G W Barrett & H A Ford (1996) Communities and Ecosystems. In Spellerberg I F (Ed) *Conservation Biology* Longman, England, pp154-170.

Ministry for the Environment (1997) *The State of New Zealand's Environment 1997*, GP Publications, Wellington, New Zealand.

Mooney HA, Lubchenko J, Dirzo R & Sala O E (1995) "Biodiversity and ecosystem functioning: basic principles", in Heywood V H & Watson R T (Eds.) *Global Biodiversity Assessment*, Cambridge University Press, Cambridge, pp275-326.

O'Byrne M (1997) Urban Conservation in the Perth Area Through the 'Ecoplan' Community Involvement Programme, Paper delivered to the conference on *Nature Conservation in Production Environment: Managing the Matrix*. November/December, 1997. Abstracts published by School of Environmental and Marine Sciences, University of Auckland, Auckland, New Zealand.

Recher H F (1996) Conservation and Management of Eucalypt Forest Vertebrates. In De Graaf R M & Miller R I (Eds) *Conservation of Faunal Diversity in Forested Landscapes*. Chapman and Hall, London, pp339-387.

South-East Queensland Regional Coordination Committee (1998) *South East Queensland Regional Framework for Grown Management*, Queensland Department of Local Government and Planning, Brisbane

State of the Environment Advisory Council (SEAC) (1996) *Australia: State of the Environment 1996*. CSIRO, Canberra.

Taylor 1997 State of Env NZ?

The Department of the Environment, Sport and Territories (1992) *National Strategy for Ecologically Sustainable Development*. Environment Australia, Canberra. (http://www.erin.gov.au/portfolio/esd/)

The Department of the Environment, Sport and Territories (1996) *National Strategy for the Conservation of Australia's Biological Diversity*. Environment Australia, Canberra. (http://www.erin.gov.au/portfolio/esd/biodiv.strategy/)

UN Population Information Network (1994) *Historical World Population Growth, World Population Growth From Year 0 to Stabilization*. World Population Prospects: The 1994 Revision. United Nations, New York.

Western D (1989) "Conservation without parks: wildlife in the rural landscape", in Western D & Pearl M (Eds.) *Conservation for the Twenty-first Century*, Oxford University Press, New York, pp158-165.

Western D, Pearl M C, Pimm S L, Walker B, Atkinson I & Woodruff D S (1989) "An agenda for conservation action", in Western D and M Pearl (Eds.) *Conservation for ...* pp304-324.

Wilson E O (1992) *The Diversity of Life*, Penguin Books, Harmondsworth.