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WORKSHOP W7 SUMMARY

BIOLOGICAL SURVEYS AND RESERVE DESIGN

by

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Introduction

Reserve systems are an essential part of our conservation strategy. Biological surveys describe the "*what and where*" of the environment. These are the data required to design reserve systems that are (1) representative for biodiversity and (2) in which reserve manageability is enhanced by the position and content of the component reserves (Margules 1989).

The quantitative data provided by carefully designed surveys are amenable to numerical analysis, and allow more explicit, objective conclusions that take into account the needs of a wide variety of organisms (invertebrates as well as vertebrates and plants). Thus, ecosystem complexity can be more accurately modelled, allowing the representativeness of reserve networks to be optomised.

Quantitative survey data are also useful for other conservation purposes that are peripheral to the terms of reference of this workshop, such as monitoring and reducing the subjectivity of conservation priorities. "It is one of the tasks of biological survey to provide a strategic setting for population studies" (Elton 1966).

For survey biologists, "reserve design" has two facets:
1 Regional reserve system design to maximise the representation of biodiversity. The design is influenced by the extent, bias and type of previous land alienation or exploitation across the region, and by the amount of justification required because of competition for available land.
2 Reserve manageability factors that determine a reserve's ability to sustain its biota.

Workshop discussion was divided into two parts:
1. Methods for identifying reserve needs -- the inputs.
2. Mechanisms for getting reserves established and the need for a nation-wide commitment for a reserve system that is representative of Australia's biodiversity -- the outcomes.

More than 150 people attended the workshop, a significant section of Australia's community of conservation biologists. About 80% indicated that they had been involved in biological surveys for nature conservation at some time during the previous two years. There were too many people to allow exhaustive discussion; consensus on many of the issues had to be addressed by canvassing opinion on a show of hands.

Some workshop participants felt that the terms of reference implicit in the title of the workshop were too narrow. The workshop specifically addressed the design of reserve networks and of individual reserves although, obviously, land-care outside of reserves is also important if regional nature conservation values are to be sustained. The need for improved management of the entire landscape (not just in reserves) was stressed, and the view expressed that in very fragmented landscapes, Australia can now ill-afford not to protect remnants, corridors and other elements of such landscapes.

This workshop also concentrated on terrestrial environments rather than the marine, although appropriate databases are also necessary to facilitate the identification and planning of marine biogeographic regions and for marine park management.

Reserve System Design

Representing What? The Environmental Attributes Recorded During Surveys.

There was overwhelming agreement that a reserve system should represent the nation's biodiversity. Further discussion indicated that it should also specifically protect rare or threatened species and ecosystems, although priorities among these were expected to be influenced by cost and management needs. In addition, human needs such as tourism should be taken into account.

A need for ongoing research into environmental attributes was recognised -- which biodiversity indicators should we measure? For instance, macro-organism patterns (perennial plants and vertebrates) are generally used for designing reserve systems, yet available data indicated that these are usually "coarse-grained" compared to the patterns of the organisms that drive ecosystem processes and maintain complexity -- the micro-organisms.

Mike Hopkins (CSIRO Atherton) presented a comprehensive position paper on the types of attributes, present and future, that can be used for designing reserve systems. No single type of attribute is appropriate for all purposes at all scales. He discussed the advantages that species composition data have over diversity indices for detecting patterns in the biota, then described the contexts in which plant functional characters, soil and stratigraphic attributes, and digital terraine and bioclimatic models, have been used to provide such insights at various scales. He also emphasised the importance of allowing for the dynamics of ecosystems in designing reserve systems (e.g. see also Weiss & Murphy in press, and Russell-Smith *et al.* in press). **(Mike, do you want to expand or rewrite this summary of your paper? Can you suggest a reference that sshould be cited here?)**

FFollowing considerable discussion, about 70% of people at the workshop agreed that species composition data, particularly if recorded as assemblages (the building blocks of ecosystems), were likely to be more sensitive for detecting patterns in the biota than any of (a) "functional groups" (e.g. generalist ants, foliage gleaners, litter gleaners etc) because of high redundancy found in ecosystem functions, (b) diversity indices (species richness etc), or (c) plant formations (structure dominant floristics). It was pointed out that data on intra-specific variability would further improve the resolution of species composition attributes.

However, most participants considered that, while surveys of species composition (and even population attributes) might be appropriate and cost-effective at district-level or more local scales, they were initially slower and more expensive. A hierarchy of surveys was required, including surveys at continental scales, to provide a broad context for reserve system design, and perhaps to set priorities among district-level and local studies. At these scales, climatic and geomorphic attributes such as BIOCLIM (Busby 1986, Nix & Gillison 1985) and digital terrain

models (Mackey *et al.* 1989) were likely to be particularly useful. In the context that biogeographic regionalisation of Australia would provide a consistent focus for conservation planning, this view was endorsed by the workshop.

Sampling Strategies

At the scale of biogeographic districts, three sorts of sampling strategies have been used in surveys of environmental attributes for reserve selection:

1. Opportunistic Strategies

The position, size and shape of reserves are selected on local values rather than on any regional context; their role in representing regional biodiversity is coincidental, often inconsequential. Reasons have included soil conservation priorities (e.g. protection of upper-catchment for erodible soils), the presence of particular species or ecosystems, outstanding scenery, and land useless for agriculture.

`Opportunism' did not prompt any comment from the workshop even though, historically, most of Australia's existing reserve systems have grown from single reserves declared on such narrow reasoning.

2. Land Class Strategies

Land classes derived from BIOCLIM, satellite images, and other indirect surrogates of biological patterns, were covered in the Symposium sessions (Mackey *et al.* 1989) and were not discussed further during the workshop. As pointed out earlier, they are also appropriate for continental scale surveys.

On the other hand, strategies based upon regional mapping of land systems, land units and/or vegetation formations (Stanton & Morgan 1977, Purdie *et al.* 1986) were considered in detail. Bob Pressey's (NSW National Parks and Wildlife Service) position statement outlined some of the advantages and limitations of these land class options from the perspective of the representativeness of derived reserve proposals. These strategies allow large areas to be surveyed quickly and are objective but assume that the classes are internally homogeneous and that the class boundaries are meaningfull for all the species in the region (McKenzie 1984, Margules *et al.* 1991; Pressey & Bedward 1991 and Pressey, in press). He also described some of the land-class selection algotithms that have been developed to optomise the cost-effectiveness of the reserve system derived using these survey strategies (Pressey & Nicholls 1989, Pressey & Nicholls 1991).

There was consensus that land classes provide, at best, only a first approximation of biological diversity, yet participants agreed that biological differences between the classes were certain to be significant. The workshop adopted the recommendation that land class strategies should be viewed as a "starting point"; the reserve network could be "in-filled" subsequently using the ecological realism offered by quadrat strategies of data acquisition.

3. Quadrat Strategies

Quadrat strategies provide the spatial resolution that is needed to compare sites quantitatively. Data from surveys in different study areas (e.g. districts) can be combined into a geographically more extensive data-base. These strategies allow species with similar responses to environmental attributes to be clustered so that patterns in species composition across landscapes can be modelled for reserve design. The models can be used for prediction, and tested; the quadrat data provide a basis for monitoring future changes (McKenzie *et al.* 1991).The cost-saving

offered by "gradsec" approaches to quadrat sampling strategies was mentioned during discussion (Gilleson & Brewer 1985, Austin & Heyligers 1989).

A.O. (Nick) Nicholls (CSIRO Division of Wildlife & Ecology) discribed statistical methods for modelling community patterns from quadrat data. These models use attributes of the physical environment that correlate with patterns in the biological data-set to derive reserve systems (Margules & Stein 1989, Nicholls 1991).

Norm McKenzie (CALM, Western Australia) outlined an alternative approach that contours the gradients in the species composition of assemblages (McKenzie *et al.* 1989, McKenzie & Belbin 1991). This is particularly useful in remote areas where quadrats are too sparse for the statistical models to be derived.

Conclusion.
It was agreed that both the more ecologically meaningful quadrat strategies and the more rapid land-class techniques were needed for reserve system design, with their use dictated by the geographical scale of the study, the availability of data, and urgency.

It was pointed out that our future task of maintaining biodiversity would become much harder if the choice was determined only by the urgency. We need to improve quality of data bases, reserve selection proceedures, and our understanding of ecological patterns and processes at landscape level. Ideally, we need to find attributes that can provide an accurate reflection (model) of ecological/compositional gradients for the entire biota, yet be cost-effective so that the data can be collected quickly, at minimum cost and without requiring years of specialist training. It was clear from the discussion that projects to investigate survey attributes, sampling methods and reserve selection strategies need further development.

Individual Reserve Design

Richard Hobbs (CSIRO Division of Wildlife & Ecology) presented a position paper on the factors that are known to affect the persistence of a reserve's indigenous biota, and ecological and evolutionary processes. These factors include size, shape, diversity, persistence and quality of corridors, position of reserves in the landscape (e.g. inclusion of drainage catchments), use of surrounding lands, and recognition of minimum viable population sizes (species' mobility etc) (Saunders *et al.* 1991). Among the attributes that should be recorded to guide the above decisions, he listed:

- isolation from, and context of, other patches (distance, nature of intervening land, expected duration of the isolation)
- expected disturbances (fire barriers, exotic species such as weeds, predators and herbivores)

Conclusion
There was no dispute that these factors determine a reserve's long term viability, particularly the cost of its management. The workshop noted that we should protect all remaining remnants in very fragmented landscapes. Further, the factors that influence reserve viability also need to be identified for the "unfragmented" districts of Australia and Oceania. Pastoral districts are a good example.

Resources for Collecting Survey Data

The workshop agreed that surveys are scientifically fashionable and easy to get published. Most people also agreed that funds for surveys are easy to obtain compared with other conservation research proposals, but there was general concern that sufficient funds to carry out "good" surveys are hard to attract, and that data

collection has been overshadowed by the emphasis on data manipulation and modelling.

About 80% of people at the workshop believed that too few people are actually collecting quantitative survey data, and that university courses do not prepare biologists for resource survey studies. It was agreed that tertiary courses should be modified to integrate training for resource survey as well as modelling, but the problem may be that graduates in this area have only limited opportunities for employment. Ninety per cent agreed that community ecology should be taught from secondary school.

In an earlier conference session, a strong case was made that taxonomic studies of invertebrate groups should be staffed and funded as a priority if they met certain conservation-orientated criteria, such as local endemism, low mobility and manageable assemblage richness. About 70% of the workshop participants agreed that we need to train more people in alpha taxonomy, especially of invertebrates.

It was emphasised that biological surveys are fundamental to the conservation future of Australia and Oceania and should be encouraged.

Implementation: Getting Areas Declared as Nature Conservation Reserves

Norm McKenzie outlined the history of reserve declaration in Western Australia. He concluded that the process has essentially been a political process; success has usually depended on support from senior public servants and the public (Australian Acadamy of Science 1965, Ride 1975, Burbidge 1984):

> From 1890 AD onwards, reserves were declared following recommendations by the public, by overseas or local experts, or by the bureaucratic system. The declarations were generally ad hoc, and the declared reserves usually involved land considered to be useless. The justification usually had a local context, involving pretty scenery, soil conservation or a flagship species.
>
> From 1962 onwards, reserves were increasingly recommended in a regional context as environmental maps and systematic survey data became available. The recommendations of the Academy of Science (an expert committee) and more enlightened Government policies (Conservation Through Reserves Committee 1975) yeilded many reserves, although they still involved lands considered otherwise useless.
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> Since 1984, there has been a hardening of attitudes, with more competition for land throughout the State and increasingly active non-Government conservation movements. Methods of getting reserves declared have become more varied and sophisticated. Successes have followed Departmental mergers (e.g. Forests + Conservation), reducing the level of protection afforded conservation reserves (Mining Policy), and land purchase (as economic recession has reduced the value of pastioral properties).
>
> Experience in Western Australia's Great Sandy Desert indicates that opportunities to define and recommend reserves should be seized as soon as they present themselves. Since the time that the recommendations were detailed and refined (Burbidge & McKenzie 1983), other potential land-uses have emerged that confounded even the major reserve proposals.

The workshop recognised a variety of competing land-uses that inhibit reserve declarations throughout Australia. These have traditionally included agriculture, pastoral activities, timber and mining. Concern was expressed that extensive competition now also exists with Aboriginal land claim interests. The topic was

significant and of obvious concern to many workshop delegates but, unfortunately, there was not enough time to pursue this discussion.

At the level of biogeographic districts, there are major gaps in the nature conservation reserve system throughout Australia. This view was unanimous. The need to fill these gaps as quickly as possible was strongly endorsed. The workshop rejected the suggestion that either Australia or Oceania have reached the political limit for getting reserves declared. When participants were canvassed on recent trends in reserve gazettal, there was agreement that Queensland, Western Australia, Tasmania, New Zealand and, recently, Papua New Guinea are currently expanding their reserve systems.

The workshop agreed that more reserves would be declared if the issues were presented in clear, non-technical terms through daily papers, popular magazines, radio and television. Communication needed to reach the decision-makers and public in a palatable form. Furthermore, communication needed to be increased in country areas, where reserve recommendations usually had the most direct affect.

In addition to the publication of the conference proceedings, various popularised articles as well as other media releases, were suggested. A colour companion to the proceedings was endorsed to enable wide circulation of a summary document based upon the conference outcomes.

Paul Sattler discussed the implementation of a nation-wide agenda to develop a more representative conservation reserve system. It was proposed and accepted by the workshop that, as a starting point, governments should adopt IUCN Resolution 18/47, approved by the General Assembly in Perth during 1991. The IUCN resolution emphasised the protection of biodiversity as a prime reason for establishing national parks and other protected natural areas.

The workshop recommended that the Commonwealth consider means of assisting the States to achieve a systematic nation-wide reserve system as a major component of the biodiversity programme and as an adjunct to current negotiations on Australia possibly becoming a signatory to the International Biodiversity Convention. To achieve this focus it was proposed that ANPWS, in conjunction with the States, establish a regional biogeographic framework for Australia to allow rapid identification of the major gaps in the reserve system at the level of biogeographic districts. In addition, such a framework should be used as a basis for focussing the conservation agenda for all levels of government on the major regional nature conservation problems facing Australia. This would balance the "single issue" conservation agenda that often receives disproportionate political attention.

To expedite action towards a nation-wide reserve system, it was agreed that the methodologies adopted should allow rapid assessment of initial reserve needs within a two year time frame. In addition, it was recognised that ongoing resource assessment and research should continue so that quantitative databases were acquired for each district. These are necessary to optimise the representativeness of the reserve system, and to provide a basis for long-term monitoring of regional trends in Australia's biota.

The workshop recommended that ANZECC's role should be supported and enhanced to develop and establish strategic direction and policy guidelines for the nation-wide nature conservation agenda.

Nature conservation legislation and policy development outside reserve boundaries was considered necessary to facilitate the regional focus. To be most effective in this regard, it was agreed that the legislation and policy should extend beyond the endangered species concept, encapsulating critical habitat and protected landscape

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concepts. These concepts include biosphere reserve strategies as well as mechanisms for further protecting the remaining elements of fragmented landscapes. Such measures were considered essential to optimise the sustainability and biodiversity of the reserve network.

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