NATURE CONSERVATION :

THE ROLE OF REMNANTS OF NATIVE VEGETATION

BUSSELTON, W. A. 22 - 27 SEPTEMBER 1985

NATURE CONSERVATION: THE ROLE OF REMNANTS OF NATIVE VEGETATION

Workshop to be held at Busselton, Western Australia
22-27 September 1985

Contents:

ORGANISING COMMITTEE:

Convenor Dr D. A. Saunders, Commonwealth Scientific and Industrial Research Organisation

Members Dr G. W. Arnold, Commonwealth Scientific and Industrial Research Organisation
Dr A. A. Burbidge, Department of Conservation and Land Management
Mr A. J. M. Hopkins, Department of Conservation and Land Management
Mr D. P. Smith, Commonwealth Scientific and Industrial Research Organisation

Acknowledgements

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ALCOA

ANSETT AIRLINES OF AUSTRALIA

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Workshop Program

Sunday September 22

Participants travel to Busselton.

4.00-6.00pm Registration at "The Geographe" Motel.

6.00pm Welcome drinks at venue.

Monday September 23 CHAIRMAN ANDREW BURBIDGE

DAY'S THEME : ECOLOGICAL STUDIES AS THE BASIS FOR MANAGEMENT

9.00 am Welcome and opening address.

9.30 am Workshop sessions begin.
Review paper: Ecological studies as a basis for management. Angas Hopkins and Denis Saunders.

10.10 am Contributed paper: Persistence of invertebrates in small areas. Barbara York Main.

10.30 am Morning tea.

11.10 am Contributed paper: Conservation of the Long-nosed Potoroo Potorous tridactylus within a remnant forest environment: the contributions of insular biogeography and autecology. Andrew Bennett.

11.30 am Contributed paper: Local decline, extinction and recovery - relevant to mammal populations in vegetation remnants. Tony Friend.

11.50 am Contributed paper: Birds in patches of fragmented forests in south-eastern Victoria. Richard Loyn.

12.10 pm Contributed paper: Conservation values of native vegetation remnants in New Zealand. Colin Ogle.

12.30 pm Contributed paper: Assessing the conservation values of remnant mallee patches on the Eyre Peninsula, South Australia. C.R. Margules.

12.50 pm Lunch.

2.00 pm Workshop session 1. Topics will be:

1. Relevance, accountability and efficiency of research for management. Richard McKellar.

2. Achieving a balance between long and short-term research. Ken Tinley.

3. Nutrient cycles; their value in devising management strategies. Bert Main.

4. Invertebrates as indicators for management. Jon Majer.

5. Modelling - its role in understanding ecosystems and the development of management strategies. Greg Beeston.

3.00 pm Afternoon tea

3.30 pm Workshop session 2. Topics as for Session 1.

4.30 pm Break to re-assemble for plenary session.

4.45 pm Plenary session. Brief report from each workshop session and general discussion.

Tuesday September 24 CHAIRMAN BARRY WILSON

DAY'S THEME: FRAGMENTATION AND POPULATION GENETICS

9.00 am Review paper: What are the effects of fragmentation on population size and genetic diversity? Michael Usher.

9.45 am Contributed paper: Responses of breeding birds to forest fragmentation. James Lynch.

10.05 pm Contributed paper: Optimal design of nature reserves : consequences of faunal collapse and genetic drift. William Boecklen & G.W. Bell.

10.25 am Morning tea.

11.00 am Contributed paper: Population size, genetic diversity and conservation strategies in trees. Gavan Moran & Stephen Hopper.

11.20 am Contributed paper: Grassland insects : biogeographic considerations. Robert Whitcomb.

11.40 am Contributed paper: Retaining unlogged corridors and patches for nature conservation in forests managed for woodchip production at Eden, N.S.W. Harry Recher.

12.00 noon Contributed paper: Connectivity: an Australian perspective. Peter Bridgewater.

12.20 pm Lunch.

2.00 pm Workshop session 1. Topics will be:

1. Value of corridors (and design features of same) and small patches of habitat. Tim Dendy.

2. Many small reserves versus few large ones. Chris Margules.

3. Ecotones, patchiness and reserve size. Eleanor Russell.

4. Edge effects and long term viability of remnants. Geoff Park.

5. Viability of small populations of plants and animals and the value of introductions/translocations. Jack Kinnear.

3.00 pm Afternoon tea.

3.30 pm Workshop session 2. Topics as for Session 1.

4.30 pm Break to re-assemble for plenary session.

4.45 pm Plenary session. Brief report from each workshop and general discussion.

Wednesday September 25

9.00 am Buses depart for mid-workshop tour.

5.30 pm Buses return to "The Geographe".

7.00 pm Workshop dinner at "The Geographe".

Thursday September 26 CHAIRMAN JOE BAKER

DAY'S THEME: MEASURING AND MONITORING DYNAMICS OF REMNANTS

9.00 am Review paper: Measuring and monitoring dynamics on remnants of native vegetation. Paul Ehrlich.

9.45 am Contributed paper: The effects of fires on a population of small insectivorous birds Malurus splendens in kwongan vegetation. Ian Rowley & Michael Brooker.

10.05 am Contributed paper: Problems of monitoring population densities of the Western Grey Kangaroo in remnants of native vegetation. Graham Arnold.

10.25 am Morning tea.

11.00 am Contributed paper: Three decades of habitat change: Kooragang Island, N.S.W. Rod Buckney.

11.20 am Contributed paper: Disturbance regimes in remnants of native vegetation. Richard Hobbs.

11.40 am Contributed paper: Characteristics of problem weeds in New Zealand's protected natural areas. Susan Timmins & Peter Williams.

12.00 noon Contributed paper: Monitoring populations of Carnaby's Cockatoo in remnants of native vegetation. Denis Saunders.

12.20 pm Lunch

2.00 pm Workshop session 1. Topics will be:

1. The use of surveys and data bases for conservation of regional remnant vegetation. Mike Austin.

2. Monitoring of management practices. Gordon Friend.

3. Types of organisms that should be monitored - why and how. James Ridsdill-Smith.

4. Timescales for monitoring - is there any quick answer? David Hamilton.

5. The integration of survey and monitoring. Dick Braithwaite.

3.00 pm Afternoon tea

3.30 pm Workshop session 2. Topics as for session 1.

4.30 pm Break to re-assemble for plenary session.

4.45 pm Plenary session: Brief report from each workshop and general discussion.

Friday September 27 CHAIRMAN BRIAN WALKER

DAY'S THEME: MANAGEMENT

9.00 am Review paper: Management of vegetation remnants for nature conservation. Ken Wallace & Sue Moore.

9.45 am Contributed paper: Habitat management for birds. Graeme Smith.

10.05 am Contributed paper: Management of disturbance in an arid remnant - the Barrow Island experience. Harry Butler.

10.25 am Morning tea.

11.00 am Contributed paper: Yellingbo State Nature Reserve - problems of managing an endangered species in a developing area. Gary Backhouse.

11.20 am Contributed paper: Planning control versus reservation in the conservation of remnant communities in N.S.W.: are they both viable options? Warwick Giblin & S. King.

11.40 am Contributed paper: Planning for fire management in Dryandra forest. Neil Burrows & W.L. McCaw.

12.00 noon Contributed paper: Conservation strategies for native vegetation remnants. Sandy Taylor.

12.20 pm — Contributed paper: The use of prescribed fire as a management tool in fauna conservation reserves. Per Christensen and Karen Maisey.

12.40 pm — Lunch

1.30 pm — Workshop session 1. Topics will be:

1. The role of government and the community. Geoff Syme.

2. Is maximum diversity a useful or attainable objective? Peter Goodman.

3. Management options, practical constraints and establishment of priorities. Andrew Burbidge.

4. Creation of ecotones and management to control patch size. Libby Mattiske.

5. Management theory and optimum feedback. Angas Hopkins.

2.30 pm — Afternoon tea

3.00 pm — Workshop session 2. Topics as for Session 1.

4.00 pm — Break to re-assemble for plenary session.

4.15 pm — Plenary session. Brief report from each workshop and general discussion.

4.45 pm — Final plenary session. Closing address. Brian Walker

Saturday September 28. Participants leave Busselton.

REVIEWS

0930 Monday 23 September

ECOLOGICAL STUDIES AS THE BASIS FOR MANAGEMENT.

A.J.M. Hopkins and D.A. Saunders

Ideally, decisions on the management of areas for nature conservation should be based on a sound knowledge of the resources and the processes (geomorphological, ecological, evolutionary, etc) sustaining them. Ecological studies are thus fundamental to good management and should follow a logical sequence. But management is often carried out in the absence of most, if not all, of the necessary information. Ecological studies must then become a part of management in addition to being a precursor - every management activity must be planned and performed in a manner that incorporates information gathering to provide for a gradual improvement in decision making. Monitoring and re-evaluation are basic to this. An experimental approach to management should also be adopted. These procedures will contribute to a better integration of research, planning and management.

0900 Tuesday 24 September

EFFECTS OF FRAGMENTATION ON POPULATIONS: ACTION, REACTION AND APPLICATION TO WILDLIFE CONSERVATION.

M.B. Usher

Conservationists have been obsessed with surveys. These give 'snapshots' of ecosystems, and hence many techniques used by ecologists and conservationists could be labelled 'static' since they describe the ecosystem at one instant in time.

Repeat surveys allow for an assessment of changes in measurable features of populations and communities: numbers of species, sizes of populations, successional states of communities, genetic effects, etc. Analyses of repeat surveys, and of other research results, recognise the 'dynamic' nature of ecosystems. However, can a knowledge of the 'statics' and 'dynamics' be used to predict what might happen in the future under conservation management?

Although the paper will be illustrated with examples drawn from a variety of species groups, it will concentrate on the flora of limestone pavements in northern England. These are naturally fragmented habitats that can be viewed as islands in a sea of relatively intensively grazed grassland. Since they occur in upland massifs, the pavements of any massif can be viewed as an archipelago. Hence, they provide a useful model for considering the man-induced fragmentation of natural ecosystems.

EFFECTS OF FRAGMENTATION ON COMMUNITIES AND POPULATIONS: ACTIONS, REACTIONS AND APPLICATIONS TO WILDLIFE CONSERVATION.

M.B. Usher

Abstract

Conservationists have been obsessed with surveys. These give 'snapshots' of the community, and hence many techniques used by conservationists could be labelled 'static' since they describe the ecosystem at one instant in time. Repeat surveys allow for an assessment of changes in measurable features of the community, recognising its 'dynamic' nature. As an example, the results of two surveys (in 1973/4 and 1985) of the limestone pavement flora of Ingleborough, northern England, are discussed. The results clearly demonstrate the dynamic nature of these communities on naturally fragmented habitats, though the summary, represented by the species-area relationship, changed little.

The community is one level in the ecological hierarchy: it is argued that the conservationist needs to concentrate more on the species or population level. The review picks out four features of population dynamics that have application in the management of habitat fragments for wildlife conservation. How are populations initiated by immigration and establishment processes? How are populations maintained, paying due regard to their regeneration and to any essential spatial processes? What are the genetic effects, particularly in the long term, of small population sizes and their isolation? What causes populations to become extinct?

The literature is full of contradictions, due partly to confusion about levels in the ecological hierarchy, partly to inherent biotic variability, and partly to the historical development of the present communities. Should conservationists accept the dire warnings of species extinctions when population sizes become small and of unfavourable genetical consequences, or should they ask for evidence of such effects in habitats which have been fragmented for a long period of time (such as the semi-natural woodlands and lowland grasslands in Britain)?

0900 **Friday 27 September**

MANAGEMENT OF VEGETATION REMNANTS FOR NATURE CONSERVATION.

A) THE OPERATIONAL PERSPECTIVE

K.J. Wallace

Within the Wheatbelt Management Region of the Department of Conservation and Land Management, land for wildlife conservation is largely restricted to 626 reserves ranging from 0.4 to 309 000 ha in size, and with a median area of 120 ha. Acquisition of land for wildlife conservation in the Region is now almost complete, and management of the resource has become the most important consideration. Currently, management is largely by reactive, "crisis" management. If the objective of retaining the maximum diversity of wildlife in the longer term is to be achieved then management must be planned and forward looking. To successfully implement this change in emphasis the following are required:

a) an adequate, research data base;
b) an adequate, technical data base;
c) an informed, sympathetic public and local communities; and
d) adequate resources.

The above requirements can most effectively be drawn together by the development of management plans.

B) THE ROLE OF PLANNING IN MANAGEMENT

S.A. Moore

Management plans are documents containing resource information, a statement of management objectives, strategies to achieve these objectives, and operational prescriptions. Three case studies are used to illustrate the role of planning in management - The first, a management plan for nature reserves in the Shire of Wyalkatchem, provides an example of one way in which a lack of management resources can be overcome. The second case study, a management plan for nature reserves in the Shire of Toodyay, demonstrates how the planning process can both inform the public and make them more sympathetic to nature conservation. The third, a management plan for Mooradung Nature Reserve in the Shire of Boddington, emphasises the value of planning for biological management. Each of these plans also fulfils additional requirements, such as detailing the history of management and placing the reserves in a regional context.

CONTRIBUTED PAPERS

1010 Monday 23 September

PERSISTENCE OF INVERTEBRATES IN SMALL AREAS.

B. York Main

Persistence of invertebrates (as demonstrated from spider researches) in small areas and conversely the role of small reserves in maintaining invertebrates are discussed. Attention is drawn to the distribution of relic populations: on southcoastal headlands and seemingly unlikely sites, e.g. Kings Park. Certain such taxa have affinities elsewhere with rainforest species. Persistence is discussed in the light of biological requirements and management. Survival of mygalomorph (trapdoor) spiders in artificially restricted areas in the Wheatbelt is demonstrated at N. Bungulla reserve and disturbed bushland on a farm. Trapdoor spiders are predisposed to persist in small (favourable) areas due to characteristics of their life history. Nevertheless, their presence indicates a cohesive ecosystem. Theoretical biological disadvantages for these restricted populations are contra-indicated by persistence of naturally confined populations on offshore islands.

1110 Monday 23 September

CONSERVATION OF THE LONG-NOSED POTOROO *Potorous tridactylus* WITHIN A REMNANT FOREST ENVIRONMENT : THE CONTRIBUTIONS OF INSULAR BIOGEOGRAPHY AND AUTECOLOGY.

A.F. Bennett

Two approaches to the conservation of fauna within remnant habitats are the application of principles derived from insular biogeographic studies and the formulation of strategies based upon autecological studies. In this paper both of these approaches are considered and compared in relation to the conservation of the Long-nosed Potoroo within a fragmented forest environment in south-western Victoria.

A survey of the mammals present in 39 forest remnants found *P. tridactylus* to be locally common and present in most remnants larger than 10 ha. Distribution and abundance were assessed in relation to forest size, isolation, habitat attributes and land management practices. Autecological study of *P. tridactylus* involved a 25 month grid-trapping programme during which data concerning habitat preference, population dynamics, home range utilisation and reproduction were obtained.

Both approaches provided useful information relevant to the conservation of this species, but it is concluded that autecological studies are particularly important in the preparation of sound conservation strategies.

1130 **Monday 23 September**

LOCAL DECLINE, EXTINCTION AND RECOVERY - RELEVANCE TO MAMMAL POPULATIONS IN VEGETATION REMNANTS.

J.A. Friend

The surviving populations of a number of species of mammal in Western Australia are limited to isolated remnants of native vegetation. It is postulated that in pre-European times, sharp declines, and sometimes extinctions of species occurred in local areas, due to climate-related events (including wildfire). Population recovery was due to immigration as well as reproductive increase by the remaining individuals.

Today, the opportunity for immigration after local declines (and extinctions) is often effectively lost, so recovery is limited to reproductive increase. The long-term survival of populations in some of these remnants may depend on manipulation of gene pools. Before decisions in this area may be made, it is necessary to have certain minimum biological information about the species involved. The case of the Numbat Myrmecobius fasciatus is used to illustrate this problem.

1150 **Monday 23 September**

BIRDS IN PATCHES OF FRAGMENTED FOREST IN SOUTH-EASTERN VICTORIA.

R.H. Loyn

Bird populations were studied over three years in 56 forest patches isolated by clearing for agriculture and pine plantations in a region of Gippsland, Victoria. The patches ranged in size from less than a hectare to 1771 ha. Most patches of less than 10 ha had been badly degraded by grazing stock and had been taken over by farmland birds including noisy minors Manorina melanocephala which aggressively excluded other species. Such patches supported few leaf-gleaning insectivorous birds and often showed signs of dieback. Larger patches supported a selection of forest birds depending on the habitats represented. Numbers of forest bird species (and densities of individuals) were similar in groups of medium-sized patches and single larger patches. This suggests that reduction of habitat had more effect than fragmentation per se. Numbers of species increased with size of patch, though even the largest patch did not contain all local habitats and hence some species were absent from it. Few if any species appear to have been lost from the region, where about 30% remains as forest. Only the powerful owl Ninox strenua was confined to the largest patches.

1210 Monday 23 September

CONSERVATION VALUES OF NATIVE VEGETATIION REMNANTS IN NEW ZEALAND.

C.C. Ogle

New Zealand's native vegetation cover, modified over 1,000 years or so of Maori settlement, then largely reduced to remnants in 150 years of European presence, is assessed for conservation values of remaining patches of various sizes. Both large and small patches of forests, wetlands and grasslands are shown to have values, and even advantages, for species conservation.

Findings on the variety of species in patches of forest and wetlands of different sizes are summarised. Large patches appear necessary for some species such as kokako Callaeas cinerea and Australasian bittern Botaurus stellaris poiciloptilus, but small patches may be more suitable for others such as mistletoes and Paryphanta snails. Species able to survive in small patches might be conserved in a national pattern of representative reserves, but the survival of certain rare species which were once widespread (e.g. the skink, Cyclodina whitakeri) may depend upon habitat features which occur in very few patches.

Values of vegetation remnants, previously isolated by geological or other processes, should be recognised in any reserve system for the actual or likely occurrence of local endemics.

1230 Monday 23 September

ASSESSING THE CONSERVATION VALUES OF REMNANT MALLEE PATCHES ON THE EYRE PENINSULA, SOUTH AUSTRALIA.

C.R. Margules

The problem is to compare the conservation values of remnant vegetation patches in a given region to select a set of patches for a nature reserve network. Conservation value is defined by how representative a patch is of the range of regional vegetation variation.

A survey and numerical classification of the mallee vegetation in remnant patches on the Eyre Peninsula, South Australia, revealed six floristic groups. The probability of finding each of these groups in each of the remnant patches was estimated from statistical models relating the groups to two mapped environmental variables, age of calcium carbonate layer and distance from the coast. Thus, a uniform set of information about the floristic composition of each patch was generated so patches could be compared validly. The problem of determining adequate representation is discussed and the minimum set of patches required to represent all communities for a variety of definitions of adequate representation is determined.

0945 Tuesday 24 September

THE ROLE OF FOREST PATCH GEOMETRY IN THE DETERMINATION OF BREEDING BIRD POPULATIONS.

J. Lynch

The responses of breeding birds to forest fragmentation was studied by surveying birds and measuring habitat characteristics in 270 upland forest patches in the Atlantic coastal plain area of Maryland (USA). In this region, which is characterized by a relatively high proportion of forested land and low inter-patch distances, the occurrence and local abundance of most of the 31 commonest breeding bird species are determined mainly by within-patch habitat characteristics (eg forest stature, canopy closure, density of trees and shrubs, development of herbaceous ground cover), with interpatch isolation also playing an important role. The data suggest that the regional configuration of forested land, rather than any single inter-patch distance, is the most important aspect of forest isolation from the viewpoint of breeding land birds. Patch area per se played a statistically significant role in determining the occurrence of only a few of the 31 species examined, and was the primary predictor of abundance in only one instance. In general, highly migratory bird species are more sensitive to forest fragmentation and habitat degradation than are permanently resident forms.

It is emphasized that these results, while based on a reasonably large data set compared with most similar studies, may not hold true for other landscapes where forest fragmentation is more extreme. One would predict that as average patch size decreases, and forest isolation increases correspondingly, area and isolation will come to play increasingly important roles as determinants of bird occurrence.

1005 Tuesday 24 September

OPTIMAL DESIGN OF NATURE RESERVES: CONSEQUENCES OF FAUNAL COLLAPSE AND GENETIC DRIFT.

W.J. Boecklen and G.W. Bell

We examine the mathematical properties of faunal collapse models and demonstrate that these models are neutral with respect to single large reserves versus several small reserves as the better design strategy. Depending on the slope of the extinction coefficient-area relationship and the degree of faunal similarity among small reserves, an archipelago of refuges may actually preserve more species longer than would a single large refuge of equal total area. We also compare through computer simulations rates of genetic drift in populations occurring in single large reserves to those in populations occurring in several small reserves. Populations subdivided into several small refuges maintain heterozygosity better than do intact populations of equal total numbers of individuals, so long as there are occasional inter-refuge migrations among the small refuges. Even relatively rare inter-refuge migrations (1 migration/50 generations) are

sufficient to increase heterozygosity in an archipelago of reserves relative to a single large reserve.

1100 Tuesday 24 September

POPULATION SIZE, GENETIC DIVERSITY AND CONSERVATION STRATEGIES IN TREES.

G.F. Moran and S.D. Hopper

The genetic conservation strategy for a species will depend on the number, size and distribution of populations. In eucalypts, as in many plant taxonomic groups, there are a diverse array of population sizes and distributional ranges among species. The extent and distribution of genetic diversity were determined in a comparative study of relict and recently evolving species consisting of very small populations and widespread species with primarily large populations. Electrophoretic techniques were used to assess the genetic diversity in a series of populations of six monocalypt species. For a number of small populations a total genetic census was achieved. In the common species e.g. jarrah, E.marginata and alpine ash, E.delegatensis samples of the populations were assayed.

A series of questions relating to optimal genetic conservation strategies for in situ conservation and management were addressed. For instance, is genetic diversity correlated with population size in rare eucalypts? Are the minimum population sizes required for long term conservation of genetic resources similar in these species? Do outlier populations of species such as jarrah have similar levels of genetic diversity as small populations of rare species in the same ecological niches?

1120 Tuesday 24 September

GRASSLAND INSECTS: BIOGEOGRAPHIC CONSIDERATIONS.

R.F. Whitcomb

The grassland insect fauna, especially leafhoppers (Homoptera Cicadellidae), represents a speciose assemblage of strategists that differ widely in habitat utilization, host selection, dispersal potential and escape from seasonal adversity. As such, they represent a good model system for the study of evolutionary ecology, including changes induced by recent landscape alterations. Many species are specialized, and decline or disappear with disturbance. Specialization of grassland cicadellids has apparently been effected by host transfer and is maintained and reinforced by phenological and nutritional differences between host species. Evidence for interspecific competition and/or coevolution of insects and host is scanty or lacking. Certain species tend to increase in disturbed circumstances, including agricultural ecosystems: the emergence of such pest species results from the nature of the available species pool of insects, and the patch structure of the newly modified habitat.

1140 Tuesday 24 September

RETAINING UNLOGGED CORRIDORS AND PATCHES FOR NATURE CONSERVATION IN FORESTS MANAGED FOR WOODCHIP PRODUCTION AT EDEN, NEW SOUTH WALES.

H.F. Recher

At Eden, New South Wales, eucalypt forests are managed for the production of pulp (woodchips) and sawlogs. Alternate coupes are clear-felled on an appoximate 40-50 year rotation with mature forest retained along creeks, in gullies, and on steep or rocky slopes. These retained corridors and patches have been used as the basis for developing plans of management for nature conservation. Such plans have been directed primarily at maximising diversity and conserving species sensitive to the effects of logging. Although corridors and patches of mature forest have benefits for wildlife, their shape and size limits their use in sustaining viable populations of some species. In this paper, I discuss the benefits and limitations of corridors and patches for wildlife management at Eden and suggest modifications which may improve their long-term effectiveness for nature conservation.

1200 Tuesday 24 September

CONNECTIVITY: AN AUSTRALIAN PERSPECTIVE.

P.B. Bridgewater

Connectivity, a concept used by mathematicians to describe the number and types of links in space, is being increasingly applied to Landscape Ecology. Modern landscapes are the product of natural process and human influences. In much of the northern hemisphere human use has profoundly modified the landscape in many ways, particularly by creating corridors for and barriers to the flow of biota. Modification by man of Australian landscapes has been extensive for the last 40,000+ years and both extensive and intensive for the last 150-200 years. Such modifications have enhanced many aspects of connectivity between elements of the landscape matrix, while effectively destroying or altering

others. Special features of the Australian landscape (e.g. large internal drainage basins, infertile soils, old eroded geological surfaces) provide quite different links from the hedgerows and other modifications of the decidious forest biomes of America, Europe and Asia where connectivity has received much attention thus far.

Connectivity is a particularly valuable concept in determining the role of vegetation remnants in nature conservation, especially when linked with the influence of exotic biota on landscape dynamics. Patchiness appears to be a key element in determining faunal distribution, and to ensure that temporal vegetation phases are represented in spatial proximity. Practical management applications of connectivity result from a clearer understanding of the flows of biota, energy and mineral nutrients to and from patches in a landscape matrix.

0945 Thursday 26 September

THE EFFECT OF FIRES ON A POPULATION OF SMALL INSECTIVOROUS BIRDS Malurus splendens IN KWONGAN HEATHLAND.

I. Rowley and M. Brooker

The dynamics of a colour-banded population (presently c. 120 adults in 34 territories) of Splendid Wrens Malurus splendens on Gooseberry Hill, W.A. have been monitored since 1973. During this 12 year period, five minor fires (1974, 1976, 1977, 1978, 1981) and one major fire (1985) have impinged to varying degrees on the study area.

The influence of the minor fires on the subsequent social organization and productivity of the wren groups in burnt areas is examined. The preliminary results on the survival of all wrens following the major (95% of study area burnt) fire of January, 1985 are presented together with some information on other sedentary species of birds present before the fire.

1005 Thursday 26 September

PROBLEMS OF MONITORING POPULATION DENSITIES OF WESTERN GREY KANGAROO IN REMNANTS OF NATIVE VEGETATION.

G.W. Arnold

The densities of Western Grey Kangaroo in remnants of native vegetation in the farming areas of the south-west of Western Australia were estimated from faecal transects. Relationships between faecal weight per m^2 and area and vegetation characteristics were examined. Average vegetation life forms were estimated for each remnant using the Muir index.

The remnants varied in size from 8 to 2039 hectares. Many of the small remnants had no evidence of use by kangaroos, and these were nearly all ones which were subject to sheep grazing. They were omitted from the regression analyses. In the multiple regression size was not selected as a variable that contributed significantly to regression. Pellet density was positively related to density of sedges, grasses and herbs and of shrubs <2 m in height, and negatively related to density of shrubs >2 m in height. These variables accounted for 30% of the variation in pellet density.

A principal co-ordinate analysis showed that high pellet densities were not always associated with the same vegetation characteristics.

This was a preliminary examination of the 37 remnants. In future work it is hoped to find out what elements in a remnant make it suitable for the Western Grey Kangaroo. Taking average values for life forms may be inappropriate because it is quite clear that within the remnants, use by the kangaroos varies enormously.

1100 Thursday 26 September

THREE DECADES OF HABITAT CHANGE: KOORAGANG ISLAND, NSW.

R.T. Buckney

Aerial photographs dating from 1954 show that mangroves have invaded saltmarsh areas of Kooragang Island in the Hunter estuary, NSW. In recent years the areas colonised by mangroves have shown a marked loss of vigour in virtually all cases and spectacular deterioration in some areas. These facts are interpreted in terms of published data which identify an increase in annual precipitation in the region from about 1946 and in terms of the recent drought in eastern Australia. The relevance of these changes to the avifauna of the Island are analysed. The importance of long-term climatic change in determining the variability of habitat characteristics in a proposed reserve centred on the island are considered, as are the nature and effect of concurrent artificial changes. The general problem of the effect of climatic change on the viability of reserves of this type is discussed.

1120 Thursday 26 September

DISTURBANCE REGIMES IN REMNANTS OF NATIVE VEGETATION.

R.J. Hobbs

Natural vegetation is subject to a variety of disturbance types, ranging from periodic acute disturbance such as fire or drought to continuous disturbance, for instance, from herbivores. Fragmentation of natural vegetation during land clearance may alter markedly both the nature and intensity of disturbances and the ability of the vegetation and fauna to recover from disturbance. For instance, frequencies and season of occurrence of fires may alter and the abundances of major grazing animals may change. In addition, the creation of isolated vegetation patches surrounded by agriculture introduces new forms of disturbance, including invasion by weeds, grazing by livestock and altered hydrologic and nutrient regimes.

In this paper I discuss the disturbance regimes found in vegetation remnants, with reference to current research in Western Australia and elsewhere. I emphasise the need for process-oriented research and management decisions aimed at the long-term maintenance of viable systems within isolated remnants.

1140 Thursday 26 September

CHARACTERISTICS OF PROBLEM WEEDS IN NZ PROTECTED NATURAL AREAS.

S. Timmins and P.A. Williams

Weeds of remnant protected natural areas in New Zealand are characterised. Features such as life form, dispersal mechanism, seed viability, growth rate, life span, and invasiveness are discussed. Many weeds are early successional shrubs or trees, often of the Leguminosae, Rosaceae or Compositae, which colonise disturbed sites and require a high light intensity for germination and/or growth. Commonly they have a rapid growth rate but a relatively short life span. This characterisation could well be different if New Zealand had a broader spectrum of reserves which more accurately represented the diversity of natural ecosystems.

The small group of weed species which can invade stable native communities and suppress native growth long term, pose the greatest threat to remnant reserves.

1200 Thursday 26 September

MONITORING POPULATIONS OF CARNABY'S COCKATOO IN REMNANTS OF NATIVE VEGETATION.

D.A. Saunders

The breeding biology of the short-billed white-tailed black cockatoo or Carnaby's cockatoo was studied intensively at Coomallo Creek and Manmanning between 1970 and 1976. This species was also studied less intensively at Nereeno Hill, Tarwonga and Moormaning. By 1977 it had become extinct at Manmanning as a result of food shortage caused by habitat fragmentation. The population at Coomallo Creek was monitored twice each breeding season from 1977 to 1984 (with the exception of 1979 and 1980) and the area had been subject to clearing for agriculture in the mid-1970s. The population fell by half but breeding success and nestling growth rates remained at levels existing before the population decline. Comparison of breeding results from all five populations studied and the areas of native vegetation remaining in each area showed that Carnaby's cockatoo can breed successfully in areas of extensive clearing providing there are corridors of native vegetation connecting patches of remnant vegetation. A mosaic where the remnants are not visually isolated from neighbors will enhance the prospects for Carnaby's cockatoo.

In areas where extensive development has been undertaken, it will be necessary to protect remaining nesting habitat (woodland) and feeding habitat (heath and shrubland) to ensure its continued survival.

0945 Friday 27 September

HABITAT MANAGEMENT FOR BIRDS.

G.T. Smith

An increasing number of species are being confined to small reserves whose integrity is constantly being threatened by both internal amd external factors. If the species in these reserves are to be maintained in the wild it is essential that their habitats be managed. Management needs to counter two sets of factors. Firstly, those operating in the surrounding areas which have some impact on the reserve, e.g., fire, nutrient input, salinity etc. Secondly, intrinsic factors that lead to the loss of particular habitats, e.g., internal fire, vegetation succession, growth etc.

Some of the problems of habitat management (fire, topography, vegetation growth and heterogeneity) are discussed using the Two Peoples Bay reserve as an example. This reserve is unique in Western Australia in that it has three rare birds (Atrichornis clamosus, Dasyornis longirostris and Psophodes nigrogularis). While the extreme rarity of A.clamosus gives it top priority in management decisions, the presence of the other species illustrates some of the problems in managing a reserve for more than one species.

1005 Friday 27 September

THE BARROW ISLAND EXPERIENCE.

W.H. Butler

Because it has never been stocked, Barrow Island represents a remnant desert vegetation closely allied to North West Cape and the Pilbara. Its Class "A" status since 1910 has inhibited introduction of exotics as well as reducing other human effects. The declaration of a commercial oil field on the island in 1966 and the subsequent and current development has presented significant challenges to management, both of environment and of workforce.

The recognised nine vegetative systems (twenty-nine sub-types) support approximately two hundred vertebrate species, some of which are endemic, or rare and endangered. Management has had to consider utilisation of various ecosystems with subsequent restoration to original condition to ensure preservation of the entire reserve and its life forms. The success of this program to date is evidenced by the presence of all of the original life forms, animal and plant, in the same proportions as pre-oilfield development.

Barrow Island is a classic example of industrial development and conservation as a planned integrated program.

1100 Friday 27 September

YELLINGBO STATE NATURE RESERVE - PROBLEMS OF MANAGING AN ENDANGERED SPECIES IN A DEVELOPING AREA.

G. Backhouse

The Yellingbo State Nature Reserve is an area of 450 ha set aside for the conservation of the last remaining population of the endangered Helmeted Honeyeater, Lichenostomus melanops cassidix, Victoria's bird emblem. The Reserve lies in the Dandenong Ranges, 50 km east of Melbourne, and contains remnants of the bird's former habitat.

The preferred riparian habitat of the Helmeted Honeyeater has been greatly reduced and fragmented, being largely reduced to narrow frontages along streams in the area. The Reserve is of a narrow extended nature, stretching along three creeks, and is surrounded by rural, semi-urban, and intensive agricultural land, which is mostly cleared. The large frontage to this private land leads to complicated management problems in attempting to conserve and enhance the bird's habitat. Altered run-off patterns and extensive clearing have led to increased stress factors on the remaining vegetation. Invasion by plant and animal pests and pressures from surrounding activities all lead to continued habitat degradation. The difficulties in conservation of the area are highlighted, and management options and solutions examined.

1120 Friday 27 September

PLANNING CONTROL VERSUS RESERVATION IN THE CONSERVATION OF REMNANT COMMUNITIES IN NSW: ARE THEY BOTH VIABLE OPTIONS?

W. Giblin and S. King

The environmental planning legislation introduced in NSW in 1980 has the protection of the environment as one of its objectives, and the National Parks and Wildlife Act, 1974, gives the National Parks and Wildlife Service specific charter to conserve representative examples of natural environments.

This paper addresses the issues of (i) planning control as a means of conserving certain ecosystems and its effectiveness, and (ii) whether or not reservation, with its associated acquisition and management costs, can be satisfactorily replaced by planning control. The paper focuses on the western slopes and plains of NSW, where native environments have largely been destroyed. Examples of natural environments are now reduced to mere remnants surrounded by vast areas of cultivated land. If NSW is to retain these remnant communities, it is imperative that adequate conservation measures be adopted. In pursuing this theme the paper examines: (a) the relative merits of reservation versus planning control; (b) the constraints on these options; (c) the experience to date in planning control, especially the response by local government; and (d) case studies pertaining to wetlands, brigalow and native grasslands as they relate to these options for implementing the Service's nature conservation objectives.

1140 Friday 27 September

PLANNING FOR FIRE MANAGEMENT IN DRYANDRA FOREST.

N.D. Burrows and W.L. McCaw

Effective fire management is a fundamental step in the management of nature reserves in the southwest of W.A. Fire management must take account of the surrounding land owners and those who visit the reserve but should also allow natural ecological processes within the reserve to continue. This requires a sound understanding of the fuel and vegetation characteristics of the reserve which will determine the behaviour and effects of fire, either planned or unplanned.

This paper discusses some of the factors which should be taken into account when preparing a fire management plan for a reserve, using the Dryandra forest as an example. Dryandra is a particularly important area as it is one of the largest and most diverse reserves in the central and southern wheatbelt, and contains many rare species of flora and fauna which can be affected by fire. This approach to data collection could be applied to any similar reserve.

1200 Friday 27 September

CONSERVATION STRATEGIES FOR NATIVE VEGETATION REMNANTS.

S.G. Taylor

Assessments of conservation value are used to select native vegetation remnants for inclusion in reserves and to determine the management priorities for these reserves. An examination of the procedures used to assess conservation value indicates that there are three basic strategies for reserve siting and management; namely, a biogeographic, a biocentric, and an anthropocentric strategy. If applied in isolation, each of these strategies would produce a different kind of reserve system with different management priorities. In practice, elements of the three strategies usually are combined to produce multi-purpose reserve systems characterized by management conflicts. It is suggested that many of these management conflicts could be resolved by a procedure for assessing conservation value which clearly distinguishes the three strategies. This procedure is illustrated using the example of South Australia's Mt Lofty Ranges reserve system.

1220 Friday 27 September

THE USE OF PRESCRIBED FIRE AS A MANAGEMENT TOOL IN FAUNA CONSERVATION RESERVES.

P. Christensen and K. Maisey

The Perup Fauna Management Priority Area (MPA) is a fauna conservation area within State Forest. The area was set aside in 1972 for conservation of rare and endangered fauna including, Bettongia penicillata, Macropus eugenii, Myrmecobius fasciatus, Dasyurus geofroii, Pseudocheirus peregrinus.

There were two management objectives; (a) Conservation of the rare and endangered fauna - maximize populations whilst at the same time attempting to cater also for other species of fauna and flora. (b) Research - use the area for biological research with particular emphasis on species biology and habitat requirements in relation to fire.

It has been demonstrated that fire can be a useful management tool. A simple fauna management plan which is both practical and effective whilst providing acceptable levels of fire protection for the reserve and the surrounds, has been achieved. The plan consists of two levels of fire management, a system of broadscale burning carried out using aerial ignition together with a system of smaller hand lit burns carried out for special objectives.

The implementation of this plan has not been without its problems. Despite protective burning in the surrounds, unburnt control areas have three times caught fire through lightning strikes and arson. The smaller hand burns, carried out during dry conditions have also proved difficult to implement.

A number of principles relating to the management of reserves have emerged from the work. Information on the minimum size of reserves required for effective management is emerging. Gregarious species such as the tammar M. eugenii which lives in small colonies can be managed in relatively small reserves. Solitary species such as the woylie B. penicillata and the numbat M. fasciatus need large reserves. It has been possible to extend the present range of the woylie by establishing colonies in new area outside the reserve. This may also be possible with the tammar and artificial planting of 'tammar thickets' of Gastrolobium bilobum is being carried out.

There are indications that some species undergo long-term fluctuations in numbers and that predation by the fox Vulpes vulpes can be a critical factor when populations are at low levels. A programme of continuous monitoring is necessary to alert managers of critical periods.

Selective grazing by macropods following fire has been identified as an important management problem. Certain species of plants particularly legumes, may be eliminated by grazing after fire if burns are too small.

The application of these findings has direct relevance to other reserves and remnant areas.

POSTERS

RED DATA BOOKS: THEIR VALUE IN CONSERVATION PLANNING AND MONITORING.

A.A. Ferrar and P.G.H. Frost

Red Data Books (RDBs), subjectively compiled, provide a primary justification for establishing or managing a protected area. Their content strives for scientific respectability but lacks the necessary scientific rigour to survive more than a cursory evaluation. Their widely accepted popular use confers an obligation on conservation scientists to evaluate their role, and if possible enhance their value, as a tool for conservation planning and management.

RDBs form the basis of conservation laws, are used in land use planning and EIA and contribute significantly to public awareness. The strengths and weaknesses of these roles, together with others less obvious, are examined.

RDBs focus on perceived rarity of species; the implications for habitats and management being left for others to elaborate. Rarity is complex, being a function of population density, geographic range and habitat specificity. The pitfalls of not appreciating these weaknesses include the setting of unsound conservation goals. The implications for conservation theory (island biogeography and minimum population size) as well as for improving the value of RDBs as a conservation tool are discussed. Recommendations on the collection and use of RDB data for a variety of purposes are made.

CONSERVATION OF INVERTEBRATES IN REMNANTS OF NATIVE VEGETATION.

J.D. Majer

The consideration of invertebrates is not generally given high priority in the management plans for conservation areas. This paper will review the benefits of including invertebrates in such plans. These include the need to conserve the highly diverse taxonomic groups of invertebrates, the role of such animals in pollination, seed dispersal and survival, in influencing plant diversity and growth and also because of their position as a food source for certain vertebrates.

The exclusion of invertebrates from reserve management plans is often justified in terms of their high diversity, the lack of taxonomic knowledge about them and the difficulties involved in sampling. A standardised sampling schedule and a set of guidelines for naming invertebrates is proposed which should enable invertebrate surveys to be performed in a cost effective manner.

BIRD DYNAMICS OF FOSTER ROAD RESERVE, NEAR ONGERUP, WESTERN AUSTRALIA.

B.J. Newbey and K.R. Newbey

A 20m wide by 2.2km long road reserve of senescent low woodland, within cleared farmland, was censused 52 times over 12 months. Forty four species were recorded: 27 were dependent on low woodland; 15 on low woodland and pasture, and 2 on pasture only. Monthly numbers of species varied from 19 (March and September) to 29 (August); 10 were present every month. Individuals per recording ranged from 35 (March) to 146 (December). Lowest mean monthly number of individuals was 44.0 (March); highest 101.8 (June). Variation in species and population numbers was positively correlated with eucalypt flowering e.g. Red Wattlebird 0 to 27. A few species were restricted to certain variants of low woodland. Species used the road reserve as shelter (41), food supply (44), breeding (9) and corridor (33). Narrow road reserves of senescent low woodland are important to maintaining avifauna heterogeneity in farmland.

NATURE CONSERVATION AND ECOSYSTEM RESILIENCE: THEIR RELEVANCE TO MINING REHABILITATION.

O. Nichols

Mining in Australia affects about 0.01% of the total land area. However, the ecological impact of mining can be important in some localised regions. Conservation of these habitats is determined by which areas are mined, and the subsequent rehabilitation process. On a larger scale, resilience of the ecosystem determines the extent and rate of recovery after disturbance.

Alcoa mine bauxite in the Darling Range of South - Western Australia. Although the open-cut mining may eventually require clearing of only 3-4% of the south-western forest area, conservation can be important in particular areas. Pre-mining floral and faunal studies form part of the mine planning process which determines where mining will occur. Detailed studies on rehabilitation ecology assess the effectiveness of re-establishing conservation values. Long term research is examining successional trends, and developing management practices with the aim of better integrating rehabilitated sites into surrounding, unmined forest. The overall research and management programme is discussed and provides an example of the interaction between ecosystem resilience, mine planning and mine rehabilitation in the conservation of a native ecosystem.

VEGETATION REMNANTS IN THE NEW ZEALAND LOWLANDS: INVENTORY AND EVALUATION FOR LONG-TERM CONSERVATION.

G.N. Park

In its dependence on the fertile lowlands New Zealand's agricultural economy has reduced many classes of vegetation to

very small and isolated remnants, most to less than 50 ha. Many faunal species are confined to these remnants or seasonally dependent on them. Most remnants are still unprotected. The New Zealand Protected Natural Areas Program was established in 1983 to inventory and evaluate all remaining areas of unprotected vegetation. The Program's aim is to improve the representativeness of New Zealand's protected area network. Much of the procedure for inventory and evaluation is directed at assessing the qualify of the buffer zone, the distance to the nearest area of indigenous vegetation, and the proportion of indigenous habitat in the surrounding landscape.

The paper will describe and illustrate the small scale of the ecological patterns in the New Zealand lowlands, with a variety of examples. It will outline the use of scientific criteria for assessing their long-term conservation potential with emphasis on the Protected Natural Areas Program.

AN INDEX OF ECOSYSTEMS OF AUSTRALIA.

R. Thackway

Australian National Parks and Wildlife Service is developing an index of Australian ecosystems, which are defined as mappable parts of the biosphere whose components (climate, terrain, geology, soils and biota) are interacting. The index will be in the form of a geographic data base developed in cooperation with State/Territory agencies, and incorporating the considerable work already done in this field. The index will provide the national context for reserving an adequate sample of all major ecosystems and will describe their status, whether intact or fragmented, and whether inside or outside nature conservation reserves.

Data already available from the project are used to show the relationship between reserves and ecosystem diversity in each State/Territory and to illustrate priorities for conservation.

SHRUB WEEDS IN EASTERN SOUTH ISLAND, NEW ZEALAND.

P.A. Williams and R.P. Buxton

Modified native vegetation in New Zealand is susceptible to invasion by adventive woody plants. Their population age structures based on ring counts and growth characteristics are useful in interpreting their invasion patterns, particularly where the original seed source is known, and the nature of the vegetation trends.

The examples shown are from eastern South Island (mean annual temperature 10 C, mean precipitation 900mm). Where seed sources from tall native hardwoods with shade tolerant seedlings are close by, adventive species may be succeeded by native forest, provided fire and grazing animals are excluded, e.g. the bird-dispersed Sambucus nigra and Crataegus monogyna may have followed the legumes Ulex europaeus or Cytisus scoparius but the native bird-

dispersed Melicytus ramiflorus and Griselinia littoralis are the next stage. Where native trees are absent or poorly dispersed, or disturbance continues, adventive species may replace early successional native shrubs with no immediate prospect of native vegetation returning, e.g. Discaria toumatou being replaced by Ribes sanguineum or C. monogyna. These circumstances require different management.

THE IMPACT OF RURAL DIEBACK ON REMNANT FARM WOODLOTS.

F.R. Wylie and J. Landsberg

Tree decline in rural areas, and the associated hazards of soil erosion and salinity, are among the foremost conservation issues in Australia. About 30% of Australia's forests and woodlands have been cleared or severely modified since European settlement. Since the late 1960's and early 1970's there has been a marked increase in the rate of decline of remnant native vegetation on farmland in many parts of Australia. This accelerated tree decline - rural dieback - affects many different species of trees of all ages, in most states. Its causes are little studied and poorly understood. Many factors have been implicated, but few have been researched. Current understanding of the problem is outlined briefly in this paper. Excessive tree clearing and certain farm management practices exacerbate dieback of remaining trees. There is considerable variation in the degree of susceptibility of individual trees to dieback. This is due more to differences in their local environments than to inherited differences. Rural tree decline has major consequences for conservation of biota, soil and water, at a scale which affects both rural and urban communities. Successful maintenance and rehabilitation of existing farm woodlots, and the establishment of new ones, require an understanding of the dynamics of rural dieback, if its spread is to be arrested and its resurgence prevented.

COMPOSITION OF WORKSHOP GROUPS

Monday September 23: ECOLOGICAL STUDIES AS THE BASIS FOR MANAGEMENT

	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
1.	R. Adams	J. Alford	M. Austin	J. Baker	G. Arnold
2.	K. Atkins	G. Backhouse	D. Bell	R. Buckney	J. Blyth
3.	R. Braithwaite	A. Bennett	D. Bennett	T. Dendy	L. Boscacci
4.	J. Brown	M. Brooker	W. Boecklen	A. Ferrar	P. Bridgewater
5.	An. Burbidge	H. Butler	N. Burrows	I. Gorrie	Al. Burbidge
6.	P. Ehrlich	P. Ferrar	A. Ehrlich	J. Howell	P. Christensen
7.	T. Friend	P. Goodman	G. Friend	G. Keighery	W. Giblin
8.	C. Harris	J. Havel	P. Greenslade	K. Maisey	G. Hall
9.	D. Kabay	T. Henzell	D. Hamilton	Z. Mazanec	A. Hopkins
10.	B. Y.Main	S. Hopper	R. Hobbs	J. McLennan	M. Justin
11.	A. McDonald	R. Loyn	J. Kinnear	K. McNamara	J. Landsberg
12.	M. McGrath	J. Lynch	L. Mattiske	S. Moore	C. Margules
13.	H. Recher	B. Masters	N. McKenzie	S. Mopper	O. Nichols
14.	E. Russell	G. Moran	C. Ogle	V. Read	G. Park
15.	G. Smith	K. Newbey	J. R-Smith	N. Sheppard	D. Saunders
16.	K. Wallace	I. Rowley	D. Simmons	R. Thackway	J. Shields
17.	G. Whisson	S. Taylor	S. Timmins	M. Usher	G. Syme
18.		P. Williams	B. Walker	R. Whitcomb	B. Wilson

Workshop Topics and Workshop Leaders

1. Relevance, accountability and efficiency of research for management.
RICHARD McKELLAR. 2.00-3.00 pm - GROUP 1: 3.30-4.30 pm - GROUP5.

2. Achieving a balance between long and short-term research.
KEN TINLEY. 2.00-3.00 pm - GROUP 2: 3.30-4.30 pm - GROUP 1.

3. Nutrient cycles: their value in devising management strategies.
BERT MAIN. 2.00-3.00 pm - GROUP 3: 3.30-4.30 pm - GROUP 2.

4. Invertebrates as indicators for management.
JONATHAN MAJER. 2.00-3.00 pm - GROUP 4. 3.30-4.30 pm - GROUP 3.

5. Modelling - its role in understanding ecosystems and the development of management strategies.
GREG BEESTON. 2.00-3.00 pm - GROUP 5. 3.30-4.30 pm - GROUP 4.

Tuesday September 24: FRAGMENTATION AND POPULATION GENETICS

	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
1.	J. Alford	G. Arnold	K. Atkins	M. Austin	R. Adams
2.	J. Baker	G. Beeston	D. Bell	D. Bennett	G. Backhouse
3.	A. Bennett	J. Blyth	R. Braithwaite	P. Bridgewater	W. Boecklen
4.	L. Boscacci	Al. Burbidge	An. Burbidge	M. Brooker	J. Brown
5.	R. Buckney	H. Butler	A. Ehrlich	P. Christensen	P. Ehrlich
6.	N. Burrows	G. Friend	W. Giblin	I. Gorrie	A. Ferrar
7.	T. Friend	G. Hall	J. Havel	D. Hamilton	P. Ferrar
8.	P. Greenslade	S. Hopper	T. Henzell	C. Harris	P. Goodman
9.	A. Hopkins	J. Landsberg	R. Hobbs	G. Keighery	M. Justin
10.	D. Kabay	B.Y. Main	J. Howell	J. Majer	J. Lynch
11.	B. Main	A. McDonald	R. Loyn	M. McGrath	B. Masters
12.	L. Mattiske	K. McNamara	K. Maisey	S. Moore	R. McKellar
13.	Z. Mazanec	K. Newbey	J. McLennan	S. Mopper	N. McKenzie
14.	G. Moran	D. Saunders	O. Nichols	V. Read	I. Rowley
15.	C. Ogle	G. Syme	H. Recher	N. Sheppard	J. Shields
16.	J. R-smith	R. Thackway	S. Taylor	G. Smith	D. Simmons
17.	K. Tinley	S. Timmins	M. Usher	K. Wallace	B. Walker
18.	R. Whitcomb	G. Whisson	P. Williams	B. Wilson	

Workshop Topics and Workshop Leaders

1. Value of corridors (and design features of same) and small patches of habitat.
TIM DENDY. 2.00-3.00 pm - GROUP 1: 3.30-4.30 pm - GROUP 5.

2. Many small reserves versus few large ones.
CHRIS MARGULES. 2.00-3.00 pm - GROUP 2: 3.30-4.30 pm - GROUP 1.

3. Ecotones, patchiness and reserve size.
ELEANOR RUSSELL. 2.00-3.00 pm - GROUP 3: 3.30-4.30 pm GROUP 2.

4. Edge effects and long term viability of remnants.
GEOFF PARK. 2.00-3.00 pm - GROUP 4: 3.30-4.30 pm - GROUP 3.

5. Viability of small populations of plants and animals and the value of introductions/translocations.
JACK KINNEAR. 2.00-3.00 pm - GROUP 5: 3.30-4.30 pm - GROUP 4.

Thursday September 26: MEASURING AND MONITORING DYNAMICS OF REMNANTS

	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
1.	R. Adams	J. Alford	G. Arnold	K. Atkins	G. Backhouse
2.	J. Baker	G. Beeston	D. Bell	A. Bennett	D. Bennett
3.	J. Brown	L. Boscacci	P. Bridgewater	W. Boecklen	J. Blyth
4.	H. Butler	M. Brooker	R. Buckney	An. Burbidge	N. Burrows
5.	P. Christensen	Al. Burbidge	A. Ehrlich	P. Ehrlich	A. Ferrar
6.	P. Ferrar	T. Dendy	T. Friend	I. Gorrie	P. Greenslade
7.	G. Hall	W. Giblin	C. Harris	T. Henzell	A. Hopkins
8.	S. Hopper	P. Goodman	J. Havel	R. Hobbs	G. Keighery
9.	R. Loyn	J. Howell	D. Kabay	J. Kinnear	M. Justin
10.	B. Masters	J. Lynch	B. Main	J. Landsberg	B.Y. Main
11.	A. McDonald	K. Maisey	C. Margules	J. Majer	L. Mattiske
12.	K. Newbey	J. McLennan	M. McGrath	Z. Mazanec	N. McKenzie
13.	G. Park	K. McNamara	G. Moran	R. McKellar	S. Mopper
14.	V. Read	S. Moore	C. Ogle	O. Nichol s	H. Recher
15.	D. Saunders	J. Shields	I. Rowley	E. Russell	N. Sheppard
16.	R. Thackway	D. Simmons	G. Syme	S. Taylor	G. Smith
17.	G. Whisson	S. Timmins	K. Tinley	M. Usher	B. Walker
18.	R. Whitcomb	K. Wallace	P. Williams	B. Wilson	

Workshop Topics and Workshop Leaders

1. The use of surveys and data bases for conservation of regional remnant vegetation.
MIKE AUSTIN. 2.00-3.00 pm - GROUP 1: 3.30-4.30 pm - GROUP 4.

2. Monitoring of management practices.
GORDON FRIEND. 2.00-3.00 pm - GROUP 2: 3.30-4.30 pm - GROUP 1.

3. Types of organisms that should be monitored - why and how.
JAMES RIDSDILL-SMITH. 2.00-3.00 pm - GROUP 3: 3.30-4.30 pm -GROUP 5.

4. Timescales for monitoring - is there any quick answer?
DAVID HAMILTON. 2.00-3.00 pm - GROUP 4: 3.30-4.30 pm - GROUP 2.

5. The integration of survey and monitoring.
DICK BRAITHWAITE. 2.00-3.00 pm - GROUP 5: 3.30-4.30 pm - GROUP 3.

Friday September 27: MANAGEMENT

GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
1. G. Arnold	K. Atkins	R. Adams	J. Alford	M. Austin
2. G. Beeston	D. Bell	G. Backhouse	J. Baker	P. Bridgewater
3. J. Blyth	W. Boecklen	A. Bennett	D. Bennett	R. Buckney
4. Al. Burbidge	L. Boscacci	H. Butler	R. Braithwaite	T. Dendy
5. P. Christensen	B. Brooker	A. Ehrlich	J. Brown	W. Giblin
6. A. Ferrar	P. Ehrlich	P. Ferrar	N. Burrows	R. Hobbs
7. I. Gorrie	G. Friend	D. Hamilton	T. Friend	G. Keighery
8. C. Harris	P. Greenslade	J. Howell	G. Hall	B. Main
9. J. Havel	T. Henzell	M. Justin	D. Kabay	B. Masters
10. J. Kinnear	S. Hopper	J. Landsberg	J. Lynch	Z. Mazanec
11. B.Y. Main	R. Loyn	C. Margules	J. Majer	R. McKellar
12. A. McDonald	K. Maisey	N. McKenzie	M. McGrath	S. Mopper
13. K. Newbey	J. McLennan	H. Recher	K. McNamara	G. Moran
14. G. Park	O. Nichols	D. Saunders	S. Moore	J. R-Smith
15. I. Rowley	E. Russell	S. Taylor	C. Ogle	N. Sheppard
16. J. Shields	D. Simmons	P. Williams	V. Read	R. Thackway
17. M. Usher	S. Timmins	G. Whisson	G. Smith	K. Tinley
18. B. Walker	R. Whitcomb	B. Wilson	K. Wallace	

Workshop Topics and Workshop Leaders

1. The role of government and the community.
GEOFF SYME. 1.30-2.30 pm - GROUP 1: 3.00-4.00 pm - GROUP 4.

2. Is maximum diversity a useful or attainable objective?
PETER GOODMAN. 1.30-2.30 pm - GROUP 2: 3.00-4.00 pm - GROUP 1.

3. Management options, practical constraints and establishment of priorities.
ANDREW BURBIDGE. 1.30-2.30 pm - GROUP 3: 3.00-4.00 pm - GROUP 2.

4. Creation of ecotones and management to control patch size.
LIBBY MATTISKE. 1.30-2.30 pm - GROUP 4: 3.00-4.00 pm - GROUP 5.

5. Management theory and optimum feedback.
ANGAS HOPKINS. 1.30-2.30 pm - GROUP 5: 3.00-4.00 pm - GROUP 3.

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