Management of Spinifex Deserts for Nature Conservation

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Abstracts

COMPOSITION, CO-EVOLUTION AND CONSERVATION OF THE FLORA

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The flora of the region comprises over 2 000 species (*c.* 10% of the total Australian flora), comprising a mixture of temperate and tropical affinities. Monocotyledons are disproportionately represented in the flora. Few generic endemics are known, but some famous specific relicts occur e.g. *Livistonia alfredii, Macrozamia macdonaldii*. Weeds are also uncommon. Analysis of the phytogeography of major families (Amaranthaceae, Mimosaceae, Poaceae and Asteraceae) show species richness is closely linked to topographic relief and habitat diversity (salt lakes) within the area.

Studies on the Liliaceae of Central Australia has demonstrated that a suite of "recent" species, often not yet recognized, occurs in the region. The biology of the flora requires further study, as preliminary studies indicate numerous strategies exist.

The influence of phytogeography and biology on the adequate conservation of the flora will be discussed.

THE BATTLE BETWEEN GRASSES AND SHRUBS IN ARID AUSTRALIA

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Observations over much of central Australia indicate that spinifex-grass communities are advancing at the expense of shrub communities. Mulga (*Acacia aneura*) and Hill-mulga (*A. macdonnelliensis*) shrub-lands are particularly affected, especially when they occur on low fertility soils. It appears that spinifex replacement is often aided by the adverse effects of frequent hot fires on soil crusts and the subsequent loss of fertility by wind and water erosion. Fire-induced spinifex intrusion is also affecting rare plant species such as *Acacia undoolyana* and *Ricinocarpos gloria-media*.

It is suggested that large areas of the vast spinifex tracts now occupying arid Australia may have only become established in the recent past. If there have been large fire-induced vegetation shifts in the vegetation, animal populations must also have been severely affected. The demise of the Spectacled Hare-wallaby (*Lagorchestes conspicillatus*) after the loss of its preferred habitat (lancewood thickets) is given as a possible scenario if present fire regimes continue.

FIRE AND MULGA COMMUNITIES IN HAMERSLEY RANGE NATIONAL PARK A PRELIMINARY SURVEY.

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Hamersley Range National Park, in the Pilbara region of W.A. straddles the boundary between tree or shrub steppe dominated by hummock grasses (Triodia and Plectrachne spp.) and Mulga (Acacia aneura) woodlands. At their northern limit the woodlands occur as patches occupying specific sites. Southwards they become more extensive until they are more or less continuous towards the southern and south-eastern boundary of the Region.

Even at the margin of their occurrence the woodlands occupy a variety of very different sites supporting different understories. To the east of Mt. Bruce in Hamersley Range National Park, there is a large internally draining "flat" separated from surrounding ridges and mountains by alluvial slopes, typically at 1^{o} to 3^{o}.

On the "flat" itself there is considerable variation from low lying sites with cracking soils that support dense Themeda australis under a fairly uniform Mulga canopy to the margins where the woodland is very open or sparsely groved. Here, after rain, Aristida contorta may form swards and other annuals flourish but perennial shrubs are few and the ground is often bare. Throughout the "flat" occasional charred stumps are evidence of old fires but the woodland persists essentially intact.

The alluvial slopes consist of deep stony loams. They now support a Plectrachne grassland with hummocks frequently up to 0.75m high and contiguous. Charred Mulga stumps and young Mulga shoots occur throughout but there are only two very small (and doubtfully typical) remnants patches of live, mature Mulga trees. The likelihood of fires in the Plectrachne is high and fires before the regenerating Mulga matures may eliminate it from the slopes. A rapid survey of the northern half of the National Park showed that the Mt. Bruce pattern is typical and intact "slope mulga" communities are all but gone from that area.

Preliminary results suggest "slope mulga" had a relatively diverse understory rich in shrubs which are absent from the "flat". However we do not yet have a detailed knowledge of the faunal or floral components of intact "slope mulga" communities or their capacity to survive in Plectrachne hummock grasslands. However our preliminary observations suggest that some mulga dominated communities are significantly more vulnerable to fire than others and may be replaced by hummock grasslands.

MAINTENANCE OF PLANT DIVERSITY THROUGH BURNING SPINIFEX: WHAT ARE THE PARAMETERS?

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Some pastoralists in the Meekatharra-Wiluna area of Western Australia include spinifex burning in their program. For non-spinifex regrowth to be encouraged, the time of year and frequency of fire must be considered. If burning is so frequent that long-lived perennial plants do not have the chance to seed before being burnt, the range of post-burn species may be decreased to the detriment of the pastoralists.

Deferment of grazing is necessary for assured establishment of new seedlings of any species. For populations to be maintained of any short-lived palatable species, post-fire grazing must be deferred until seeds have been dropped.

Some consideration is given to what the non-spinifex plants may require to survive fire regimes and grazing.

A way to use the information in pastoral practice is then suggested, but the management of access and deferment need to be resolved.

RESPONSES OF VERTEBRATE ANIMALS TO FIRE-DRIVEN SUCCESSION IN THE TANAMI DESERT

S.R. Morton, Division of Wildlife and Ecology, CSIRO, Alice Springs, N.T. 0871.

It has been suggested that alterations to the pattern of burning in spinifex grasslands following the departure of Aboriginal people from their lands has disadvantaged many animals. Such species may have been dependent upon a tight mosaic of regenerating and mature patches, a pattern replaced now by large wildfire-driven patches. Thus, I ask what influence the spatial pattern of burning has on the diversity and abundance of animals. Birds and reptiles were studied in feathertop spinifex in the Tanami Desert. Data are not yet fully analysed, but suggest the following:

1: Birds and reptiles respond to fire-driven succession, but the species that move into regenerating country are habitat generalists with very broad distributions.

2: Edges between mature and regenerating spinifex are of marginal significance, if any, to birds and reptiles.

3: Birds and reptiles are not more diverse or abundant in small patches.

Thus, spatial patterns of burning are not important for persistence of birds and reptiles in this environment.

FIRE-DRIVEN SUCCESSION: THE EFFECTS ON SMALL MAMMALS AND LIZARDS AT ULURU NATIONAL PARK

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Fire is becoming increasingly important as a tool for managing conservation areas and maintaining species diversity. The objectives of this study were to provide information on the effects of fire driven succession on small mammals and lizards in spinifex grasslands.

I have sampled an area of *Triodia basedowii* at Uluru National Park for three years using Elliott and pitfall traps. One area was burnt in 1986 and the other area has not been burnt since 1976.

Within this period I caught a total of 42 species of lizard and eight species of small mammal. The lizards were grouped into *Ctenotus spp.*, terrestrial geckos, *Ctenophorus isolepis* and Goannas but the mammals were analysed separately.

On the sites burnt in 1976 the *Ctenotus spp*, goannas, *Ctenophorus isolepis*, three rodent species (*Pseudomys desertor, P. hermannsburgensis, Mus domesticus)* and three dasyurid species (*Dasycercus cristicauda, Ningaui ridei, Sminthopsis youngsoni*) were significantly more abundant.

On the sites burnt in 1986, *Notomys alexis* and *Sminthopsis hirtipes* were significantly more abundant. During the first year geckos were also more abundant on the 1986 sites but not in subsequent years. This could be a response to the changing vegetation states or the weather conditions.

SMALL VERTEBRATE RESPONSES TO A "MILD" AND A "HOT" FIRE IN THE SOUTHERN GREAT VICTORIA DESERT

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Areas of hummock grassland in Queen Victoria Spring Nature Reserve were subjected to three treatments to examine whether management intervention to alter existing fire regimes was necessary or beneficial for the conservation of small mammal and reptile assemblages. Plots were burnt under mild spring conditions resulting in a "patchy" burn; under hot summer conditions to simulate a wildfire; whilst others were left unburnt.

In the absence of fire, mature spinifex communities maintained high species diversity of small mammals and reptiles. Both fires led to a decline in diversity, with the summer fire having the greatest impact. The agamid, *Ctenophorus inermis* was the only vertebrate found only on areas burnt in summer. No species were found exclusively on areas burnt in the mild fire.

Some species which shelter and forage in spinifex were able to persist in severely burnt areas in very small patches of unburnt vegetation. Cover appears to be the major factor determining post-fire vertebrate assemblages. The season of fire *per se* appears unimportant, but summer fires tend to remove much more cover and so leave fewer refuges for spinifex-dependent species.

Fire and Mammals in the Gibson Desert - some preliminary results

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Work on the distribution and abundance of mammals in relation to fire frequency in their habitat has been in progress in the Young Range area of the Gibson Desert since 1987.

Number and species of mammal have been shown to relate closely to major site vegetation types in the area. The highest number and diversity being found on the most fertile sites on alluvial soils associated with the base of the ranges and in the vicinity of sand dunes.

There is also a relationship between numbers and species and time since fire in the more flammable habitats. In the fire prone spinifex habitat numbers and species of small marsupials declined immediately following fire. Rodent numbers, although declining, seemed more affected by drought than by fire. One species, *Notomys alexis* increased in numbers against this trend becoming more abundant in the first and second year following fire during a period of drought.

The only medium sized native mammal still surviving in the area *Macrotis lagotis* lives primarily in habitats where fire is a very infrequent event. Populations do occur however, in flammable spinifex habitat associated with sand dunes. Observations of digging activity on dune sites where fires have partially burned their home range suggests that Macrotis avoids recently burned areas. These observations together with information which has been obtained as the species biology suggest that there is no special relationship with fire.

Work is continuing to further elucidate the pattern of colonization of burnt areas by small mammals in the Gibson Desert.

EFFECTS OF FIRE ON BIRDS IN THE GIBSON DESERT: SOME PRELIMINARY RESULTS

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Four pairs of quadrats, each of 1 km², were selected to cover the range of habitats present in an area of the Gibson Desert Nature Reserve used for aerial burning experiments. Quadrats 1A and 1B were in sand dunes and swales with *Grevillea* spp. shrubs over *Plectrachne schinzii* and *Triodia basedowii* hummock grassland, Quadrats 2A and 2B were in *Acacia aneura* shrubland/low woodland, Quadrats 3A and 3B were in an alluvial plain with scattered eucalypts and patches of very open mulga shrubland over *P. schinzii* and *T. basedowii* hummock grassland, and Quadrats 4A and 4B were in lateritic rises with patches of very open mulga low woodland over *Triodia basedowii* hummock grassland. Six counts, each of one hour and spread over five to six days, were conducted in each quadrat, with each pair being counted simultaneously by two observers. Start times were rotated so each pair was counted at different times in the morning. Counts were conducted in autumn and spring. One autumn and one spring count was made before the 'A' quadrat of each pair was patch burnt in September 1988.

Matrices of species presence/absence and total count were analysed using the dendrogram routine of PATN. Quadrats of each pair were more similar to one another than to any other quadrat for both pre-burn counts. Rainfall since the fires has been low and there has been little plant regeneration. The results of the count conducted in the autumn after the burn showed that Quadrats 2A and 2B were most similar with all other quadrats in a second group. All counts since have produced a similar pattern to the pre-burn data.

MANAGEMENT OF AUSTRALIA'S SPINIFEX GRASSLANDS WITH FIRE

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The spinifex grasslands cover almost a quarter of Australia, characterised by very high levels of perennial grass fuels. Fire is frequent across the ecosystem, initiated by humans and lightning. There is strong debate about the role that Aboriginals have played in manipulating the biota of the grasslands with fire; the issue remains unresolved. Dramatic range reductions or extinctions of many small native mammal species have been witnessed in the grasslands, often attributed to changes in fire regimes since European occupation. Fires are believed to be larger now and have an homogenising effect on the biota.

A general pattern of vegetation change after fire has been documented in central Australia. A flush of short-lived grasses and forbs characterises the early post-fire vegetation composition, resulting in high species diversity. Structural change follows, accompanied by strong decline in compositional diversity. The vegetation is eventually dominated by spinifex and a few tree and shrub species, when it is able to carry another fire. The rate of change in these plant community attributes is best related to cumulative rain-since-fire.

The grasslands are very sparsely populated, with few human resources to manage with fire. New technologies have been developed to accommodate the required scale of management in these remote areas. Fuel maps derived from satellite images enable regional planning. Fire behavior models and low-cost, 'natural' fire management methods have been developed. The technology can be applied at any scale.

Crucial to the use of fire is the development of appropriate management objectives. How many fire-created patches, were to locate them, what size should each be, what organisms are to be managed? Is the fire-created patch-work intended to inhibit the spread of wildfires, enhance biological diversity, or both? A theory relating patch dymanics to core habitat areas is developed to enable management strategies to be implemented.

Regional Perspectives with NOAA Imagery

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Abstract

The Vegetation Management Program within the Land Conservation Unit of the CCNT is undertaking a new role in an advisory capacity to land managers in central Australia. The group will be responsible for both development and implementation of prescriptive techniques for sustained land use as well as monitoring programs to assess their effectiveness. With specific regard to fire management, we will act as a facilitator for the active use of fire in central Australia. A principle responsibility will be the transfer of techniques and technology developed as part of the recent CSIRO/CCNT Bushfire Research Project in central Australia.

The Bushfire Research Project developed a technique to use NOAA imagery to monitor the fire history of central Australia. Multi-temporal NOAA images can be manipulated with the microBRIAN image processing system to produce regular updates of the fire mosaic within the spinifex grasslands of central Australia. This technique is now being extended with a new link to the CCNT's ARC/INFO geographic information system. The status of the fire mosaic can be provided to the major land managers of central Australia, including the CCNT Park Rangers, the Bushfire Council and aboriginal organizations such as the Pitjantjantjara Council.

The regional view from the NOAA satellite can not meet all the information needs of fire management. We plan to develop a central registry of fire management information and take on the role of coordinating regular workshops to encourage the use of fire through improved distribution of information, demonstration of techniques and provision of support.

PATCH-BURNING SPINIFEX DESERTS USING AIRCRAFT

by
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Fire regimes in parts of the spinifex deserts of Western Australia have changed dramatically over the last 50 years. Prior to the departure of Aborigines from their traditional homelands, much of the desert landscape was probably maintained as a mosaic of patches of vegetation at varying stages of regeneration and maturity following fire. Today, large and intense summer wildfires sweep across remote desert nature reserves, placing additional stress on native fauna and flora. Current fire management of parts of these reserves aims to implement a patch-burn strategy to increase fire induced vegetation diversity and to minimise the spread of wildfires. Cost-effective techniques need to be developed to allow appropriate management of the large, remote and poorly accessible desert nature conservation reserves.

Aerial ignition is a procedure which is well suited to overcome the logistical problems associated with prescribed burning in remote areas. Preliminary fire behaviour studies enabled conditions of weather and fuel to be prescribed to achieve the desired range of sizes of burnt patches. As a first approximation, early black and white aerial photographs of remote desert areas were studied to determine the range of sizes of burnt patches during Aboriginal occupation. Aerial ignition trials under prescribed conditions in September 1988 and 1989 successfully emulated this range of sizes. A weather factor function, incorporating wind speed, temperature and relative humidity, related well to both the ignition rate of incendiaries and to the proportion of the area burnt. During trials described by this study, some 141 000 ha of spinifex in the Gibson Desert Nature Reserve was patch-burnt using aircraft at a total cost of $0.32 per hectare. Most burnt patches were less than 20 ha. In all, about 15 % of the trial area was burnt.

IMPACT ASSESSMENT OF OIL AND GAS WELLS ON REPTILES AND SMALL MAMMALS IN THE STRZELECKI DESERT, S.A.

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The impact of gas and oil wells on the small terrestrial vertebrate fauna in the Strzelecki Desert, S.A., is being assessed using pitfall traps.

A three-tiered sampling design has been employed. Ten replicates in each of the two dominant habitats, dune and interdunes, have been established at gas/oil wells, at 1.5 km distance from those same wells, and in a Control (i.e. no production) Field approximately 20 km distant.

Results, while preliminary, do not indicate a detectable impact on reptiles and small mammals in the immediate vicinity of the wells, nor in the peripheral zone of the Production Fields as a whole.

This case study is presented as an example of the type of research required to be undertaken in spinifex deserts and the Australian arid zone generally to assess impact on the environment of current land-use and management practices. Intensification of land-use within the arid zone is expected to occur, but with appropriate research, political will and ensuing management, impacts could be minimized so as to not further jeopardize long-term biogeographic and evolutionary processes.

HOW DO WE TRANSLATE ECOLOGICAL RESEARCH INTO USEFUL MANAGEMENT

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The Uluru National Park Vertebrate Fauna Survey was presented as an example of how research can assist land managers in decision making. The survey was designed and implemented by CSIRO researchers, Uluru National Park staff and Aboriginal traditional owners.

The survey was designed by a team of researchers and Park staff to ensure that its results were relevant to management. The field team was evenly comprised of CSIRO researchers and Park staff. The survey was conducted over three years and included 8 permanent sites sampled 7 times and 5 sites which were sampled once.

The survey reports will detail recommendations that address immediate management issues and recommend specific actions. They will also identify species and communities that require monitoring and future research. The recommendations will be given a priority listing and the order of priority justified. A management document which succinctly summarises the important findings but details the recommendations and justification for their order of priority will be produced as well as a detailed scientific report. The detailed scientific report will provide an invaluable resource document, while the shorter version will include only that material of most immediate relevance to wildlife protection and management.

The presence of a research/management position within the senior Park management, as is the case at UNP, is seen to be vital to the success of integrating research with management. The involvement of both researchers and park management throughout the survey has enabled a number of recommendations to be identified and implemented immediately.

ABORIGINAL ATTITUDES TO CONSERVATION IN CENTRAL AUSTRALIA

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Aboriginal land comprises about 32% of the Northern Territory, with a further 16% under claim. In the CLC area, which corresponds fairly closely to the "arid zone" the proportion would be higher, and most of it is spinifex desert.

Management in a practical sense has to come to grips with the Aboriginal Land Rights Act (1976), Aboriginal freehold land, and Landowners, and the role of Land Councils as set out in the Act.

Aborigines have a widely acknowledged spiritual and cultural affinity with land. It was also their economic base. In most areas it is still their only economic base, and many Aborigines may wish to use their land for pastoralism, tourism, mining etc.

Traditional Landowners do not regard their land as *de facto* National Park. European land managers and conservationists must acknowledge the right of Aborigines to make decisions about the use of their land.

If society wants conservation as a land use on Aboriginal land it will have to pay.

Research and management proposals must budget time and money for thorough consultations through the Land Councils, and commit funds for Aboriginal training and employment.

Management, including Spinifex management must come from the Traditional Landowners, and not be imposed by Governments or Conservation Agencies.

Warlpiri fire management

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Based on participation with senior Warlpiri in off-road travel in their country, I make some observations about how they view land management with fire. An ideal sequence of events for a burn begins with a senior man signalling by hand sign or radio from the lead vehicle that an area is to be ignited (**yingkirni**). Appropriate workers (**kurdungurlu**) get off the rear vehicle to burn, sometimes just dropping matches, but usually using a fire brush (**marlpi**) of a branch or bunch of grass ignited from the first patch of spinifex. The brush is trailed (**tiji-kanyi**) in the two directions across the wind. The vehicles.move upwind to the edge of the target area of dead grass with the lead vehicle paused even further ahead, and the two men would bring the line of fire along the lee side of the wheel tracks to the vehicle, then climb on as it drove off. The vehicle engine is left idling as the people remaining in it wait and keep an eye on the two men burning. The lead vehicle in turn waits ahead, further across the wind, and in sight.

This pattern of burning is underwritten by Fire Dreaming (**Warlu Jukurrpa**) events in the central 'Tanami Desert', wherein fire is made by two men using a fire-saw or fire-drill (and empowered by the correct songs), and two men carry the fire away from its source forming a double hunting fire (**lirramirni**) which joins up and has the potential of travelling a long way to the west and north-west. This accord with the prevailing winter easterly or south-easterly winds. On the west of a major Fire Dreaming area is a major Rain Dreaming area. A fire-produced cloud (**lirranji**) promotes rain, and the rainfall on the freshly burned areas (**wini**) brings green growth. Storms also bring lighting, which also is potential fire. Cleaning the country with fire is seen as work, and the Dreaming also emphasises its co-operative nature, with the involvement of both land-holding patrimoieties, **kirda** and **kurdungurlu**. Commonsense allowance is made for wind strength and direction, and fuel abundance. The spinifex cover is constantly being assessed during travel as to whether it will sustain a burn: it may be too patchy (**yarluyarlu**) or too much space between the hummocks. The various spinifex species are distinguished in Warlpiri vocabulary.

Fire is not used for large-scale hunting drives nowadays, and in any case most of the relevant small game is now gone. Nevertheless the Warlpiri are still keen on burning and do so at most opportunities. Though travel today is by vehicle and not on foot, and the Warlpiri use matches for ignition, the appreciation of country and the practices are still driven by the **Jukurrpa**.

Travel through country is related to burning in various ways. Memories of burns from previous winters play a part in plans for travel, partly as a navigation aid, partly because the scrub cover is reduced. The continual smokes show people moving openly around their country. This is 'Aboriginal radio', and the burned areas (**wini**) are a kind of calling-card.

Control is an apparent theme of the Warlpiri vocabulary relating to fire, in camp, or as a tool of various kinds. They follow certain constraints on burning of country and are quite safety conscious. There is a general impression that most Europeans do not like bushfires.

Warlpiri have on many occasions expressed a desire for the development of network of (graded) vehicle tracks. These allow access by vehicle for a multitude of purposes, including burning, and on the same trip hunting and food-gathering, and renewing contact with sites and Dreamings. Over the past decade or two, the Warlpiri have gained access to vehicles in their own control, and the network of tracks has grown remarkably. These tracks are all in sufficient use that burning along them is common. It is understandable then that the Warlpiri would prefer resources to be directed to facilitating their ground travel, rather than, say, aerial burning. Aerial burning is a single-purpose trip, with minimal contact with the country, and much control passed outside Warlpiri hands.

TOYOTAS AND BUSHTUCKER: LAND USE BY MARTU IN THE GREAT SANDY DESERT, WESTERN AUSTRALIA

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Many Aboriginal communities are situated in spinifex hummocklands where people continue to re-establish selected components of their traditional lifestyle. Hunting and, to a lesser extent, gathering activities are again becoming a part of daily life. Economic, health and educational benefits may accrue from hunting and gathering. Increasingly, these subsistence activities are encouraged by some government agencies and Aboriginal organisations.

Little is known of the extent of resource collection by Aboriginal communities in arid Australia. therefore, it is difficult to identify the influence of subsistence activities on wildlife populations. Recently, a data base that collates information on hunting and gathering was established. Twenty-eight parameters were recorded for foraging trips and events undertaken by Martu in the vicinity of two communities in Rudall River National Park. The location, route, habitat, distance, time, species returns and fires lit on trips were recorded qualitatively and quantitatively. Factors that influenced the frequency of trips were separately recorded. These factors ranged from the number of operating vehicles in the community to the motivations and objectives of individuals.

It is suggested that conservation and Aboriginal agencies consider the value of recording similar data because of its scope to:

1. Monitor the effects of Aboriginal activities on wildlife populations.
2. Provide biological information on wildlife populations.
3. Provide information relevant to the 'sustainable' use of resources.
4. Document Aboriginal mobility and activity patterns so they may be accommodated into appropriate management strategies.
5. Provide a topic on which meaningful cross-cultural collaboration may be based.

This information could be recorded on regular visits by suitably qualified employees who collaborate with community residents and, if possible, liaise with complementary programs operating within the community.

For this proposal to be effective it must be presented at workshops based in Aboriginal communities where people can then decide to reject it, modify it or develop alternatives that they consider appropriate.

COMBINING THE EFFORTS OF ABORIGINES AND LAND MANAGEMENT AGENCIES IN CENTRAL AUSTRALIA

Ken Johnson, Conservation Commission of N.T., P.O. Box 1046 Alice Springs, N.T. 0871

More than 885 000 km^2 of land in the Northern Territory, Western Australia and South Australia is vested as Aboriginal Freehold, leasehold or mission titles and most of this land is in the spinifex deserts. A further area of over 900 000 km^2 is held as vacant crown land. About 72 000 Aborigines live in or in association with these spinifex areas and the majority of people have a very strong attachment to the land. Approximately 1.8 million km^2 of the spinifex deserts have substantial traditional Aboriginal ownership or strong custodial claims and it follows therefore that Aborigines must play a prominent role in any well conceived programmes for nature conservation in these areas.

The challenge for nature conservation agencies is to demonstrate to Aborigines that important benefits can be derived from conservation programmes in their land and areas for which they have a cultural, if not legal, interest. It must be clear that nature conservation is a legitimate and relevant land use before any real Aboriginal commitment can be expected. Agencies must be prepared to modify programme methodologies to accommodate Aboriginal interests and cultural procedures.

Biological survey, species re-introductions and fire management programmes are readily understood and offer a "soft" first contact with Aboriginal groups while confidences are established. These programmes offer short term employment opportunities, enable people to return to country, "look after it", and return culturally significant species that have recently become extinct. Feral animal control, tourism, education and formal land management agreements are some of many programmes that might follow. Direct payment to communities might be applicable where formal conservation areas (e.g. Uluru National Park) are established on Aboriginal freehold land. Training and longer term employment benefits can accrue when formal agreements are entered into. Relevant employment is especially important in most communities because job opportunities are usually very rare.

Nature conservation agencies benefit from joint activities through harnessing the knowledge and skills of Aborigines. Participation in programmes greatly improves the extension of conservation objectives among a very significant body of land holders, and for freehold areas, extends the area in which the agencies can effect conservation effort.

Both groups benefit from the public recognition of the cooperative efforts and appreciable levels of funding can be secured for such activities, especially from Federal agencies. The Bureau of Rural Resources supports feral animal and weed control projects through funding employment, training, certain

capital costs and plant hire. DEET supports training programmes with funding for training, trainers and incidental costs, but requires guaranteed employment for people at the end of their course. The ANPWS provides funding to employ Aborigines in nature conservation but does not generally cover other programme costs. Thousands or several tens of thousands of dollars are available under the above schemes.

FIRE AND ROCK WEATHERING IN SPINIFEX DESERTS

JOHN CLARKE

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ABSTRACT

A series of experimental Spinifex Fires adjacent to granitic rock surfaces in the Pilbara region of Western Australia have demonstrated that very high temperatures (600 to 900°C) can be generated at the rock surface. These temperatures can be maintained for periods of time from 2 or 3 minutes to over 20 minutes depending upon the fuel load involved. Extensive exfoliation of the rock surface occurred when temperatures in excess of 600°C were maintained for more than 4 minutes. The experiments showed that damage was not dependent on rock moisture content.

The findings have implications for the management of rock art sites where there is a risk of wild fire. They also indicate that fire may be a major rock weathering factor in arid environments.

Endangered Mammal Research And Fox Predation

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The impact of fox predation is profound: mammal species can only survive in refuges where cover or shelter affords sufficient protection and where food is nearby. However, even when these requirements are met, depredations by foxes reduce prey populations to levels well below the carrying of the habitat.

On an island that is still relatively pristine i.e. no disturbing factors, fox control resulted in a dramatic increase in rock-wallaby abundance–a response that signifies that fox predation alone can have a strong impact on a mammal population.

To date seven species of marsupials have been shown to be heavily depredated. In NSW, research has shown that the mallee fowl is also threatened. More research is necessary to define the range of species affected.

Fox predation is insidious and pervasive, with an enormous scope for interacting with other factors. If it is ignored or dismissed as a factor, it is unlikely that little progress will be made towards understanding the impact of other disturbances.

RE-INTRODUCTION OF THE BILBY - RESEARCH IMPLICATIONS

Richard Southgate
Conservation Commission of the Northern Territory

Bilby re-introductions offer the potential to experimentally examine hypotheses proposed to explain the decline of medium sized native mammals in the spinifex lands. None of the hypotheses proposed by researchers: a) predation by Feral Cats and the Red Fox; b) altered fire regimes; and c) habitat degradation by the European Rabbit and stock, in isolation, fully explain the decline or present distribution of the Bilby. All are implicated, the degree to which the factors operate and interact vary in parts of the Bilby's range.

Successful conservation and management of the Bilby will require determining acceptable levels of predator activity, tolerable stocking rates and preferred fire regimes. Transplant experiments can provide this information and a relatively cheap and effective means of establishing and monitoring released Bilbies is being developed. The fate of released individuals, the production of young and use of native foods may be monitored in relation to natural or manipulated levels of predators, stock or rabbits and different fire regimes. Bilbies are well suited to re-introductions or transplant experiments. They are relatively hardy but docile animals to handle, they breed rapidly and are easily kept in captivity. Captive bred animals may be retrapped readily in the field.

A test of the habitat mosaic hypothesis

Jeff Short, CSIRO Division of Wildlife and Ecology, Perth

The habitat mosaic hypothesis suggests that medium-sized mammals in the spinifex deserts require a fine-grained mosaic of at least two habitats - one to provide shelter, another to provide food. The loss of this mosaic due to a change in fire regime in the 1940s - 1950s may have contributed to the regional extinction of many species of medium-sized mammals.

This hypothesis was tested on Barrow Island where four medium-sized mammals persist. These species have either greatly declined or are extinct on the mainland. Abundance, condition indices, and reproductive status of burrowing bettongs, golden bandicoots, and northern brush-tailed possums were assessed at 24 locations across the island that differed with respect to habitat diversity, mosaic scale, and disturbance due to oil-field operations. Habitat diversity (measured as the Shannon - Wiener index of vegetation associations within a radius of 1 km^2 of the trapping grids) and mosaic scale (measured as total boundary length of vegetation associations) are created by edaphic factors rather than by fire on Barrow, with areas of highest diversity and finest mosaic scale typically being close to the coast.

No significant trends were found other than that due to seasonality. Scale of mosaic and habitat diversity had no detectable impact on population parameters.

THE RE-INTRODUCTION OF THE BOODIE (*BETTONGIA LESUEUR*) AND THE GOLDEN BANDICOOT (*ISOODON AURATUS*) TO THE GIBSON DESERT

Per Christensen, Department of Conservation and Land Management, Brain St Manjimup W.A. 6258

Australia's arid zone has suffered an alarming loss of native mammal fauna over the last 30-50 years, probably due to the combined effects of predation by foxes, cats, changes to traditional Aboriginal burning patterns and competition with introduced herbivores such as the rabbit.

The Department of Conservation and Land Management has a major project under way to investigate the relationship between burning, as carried out by the Aborigines, exotic predators and desert mammals. The re-introduction of species formerly abundant in this area is an integral part of these studies.

The re-introductions are being attempted partly in an attempt to gain further insight into the reason for the disappearance of the species from the deserts in the first place and partly also to develop and test possible management techniques for re-introductions of species to remote arid zone areas.

The objectives of the project are:

Scientific Objectives

To test the three hypotheses put forward to explain the decline and extinction of desert mammals:
- the changed burning pattern resulting from migration of the Aboriginals;
- the introduction of predators such as the fox and cat;
- and the introduction of herbivores such as the rabbit.

To test whether animals can be successfully translocated from an island habitat to an inland desert habitat.
To further test the "pilot" animal method of reintroduction.
To develop predator/prey population model suitable for economic pest control.

Management objectives

To re-establish viable colonies of both target species in the Gibson Desert Nature Reserve.
To develop practical methods of pest control suitable for remote areas.
To develop and test methods of reintroducing mammals to remote areas.
To develop practical monitoring techniques for predator/prey population control.

Workshop Summaries

GUIDELINES FOR THE WORKSHOP SESSIONS

The Workshop sessions have been planned to discuss specific issues that participants have identified as major areas of concern or interest. Since limited time is available, questions to address on each of the topics have been listed below. They are not intended to restrict the scope of discussions, but rather to ensure the two workshop groups discuss similar material.

Lists of Workshop participants will be posted in the Training Centre at the commencement of each day. Each group is required to produce a one-page legible (!) summary of discussions for use in the final session, "Setting Research and Management Priorities".

A short (500-600 words max.) typed report of each group's discussion will be required within two weeks of the completion of the Workshop. We are all busy people and this short report is not designed to be a burden, but to be a record of the discussions which following collation, will be distributed to participants.

JULY 11 1530-1700hrs *DYNAMICS OF SPINIFEX COMMUNITIES*

What are the critical gaps in our knowledge in relation to spinifex communities?
Define the minimum data set required to be able to manage spinifex areas, emphasising achievable management.

JULY 12 1300-1500hrs *INTERACTION OF LAND MANAGEMENT AGENCIES AND ABORIGINES.*

How can we achieve positive interaction to benefit both nature conservation and Aboriginal interests? Avoid legislative restrictions and politics; identify what positive things can be achieved at the on-ground level.

1530-1700hrs *FIRE REGIMES AND MANAGEMENT OF SPINIFEX*

What should the objectives be? What do we know? (examine on a biome basis) What are the research priorities?

JULY 13 0830-1030hrs *REINTRODUCTION OF LOCALLY-EXTINCT SPECIES AND FERAL ANIMAL CONTROL*

Is reintroduction worth it? If so, which species are the priorities?
Compile a checklist of the practical considerations necessary to undertake a reintroduction program.
Should we be attempting more broadscale feral animal control in areas not targeted for reintroductions?

1100-1300hrs *TRANSFORMING RESEARCH RESULTS TO ON-GROUND MANAGEMENT ACTION*

Discuss the concept of "experimental management". Does it have a role?
How do we motivate managers and the bureaucracy to commit more resources to the management of spinifex deserts?
How do we better communicate the concept of needing to manage deserts to the public, bureaucrats and politicians?

DYNAMICS OF SPINIFEX COMMUNITIES (Group 1)

Leader - Julian Reid; Reporter - Peter Latz.

Q1 - What are the major determinants of change in spinifex communities?

1a. Climate (Rain mainly).
- extremely variable and often patchy;
- unpredictable and can't be controlled;
- where rain finishes up is important i.e. rainfall, transport (above or below ground), to site of collection (often will be a "hot spot");
- absence of rain (drought) also important.

1b. Fire. Manageable.
- can be used to direct change;
- scale of fire is all important (landscape phenomenom, therefore landscape scale);
- timing (intensity), frequency (history) and area burnt also important.

1c. Human Impact. Manageable.
- traditional Aboriginal practices (past and present and how have they changed with European contact?);
- modern practices e.g. exotic biota (pastoralism and ferals), tourism, mining.

Q2 - Do we know enough about the dynamics of the entire range of spinifex formations?

NO! - We do not know enough.

We need to base future research on the needs of spinifex management. Because spinifex communities are so (beguilingly) diverse (in terms of structure and processes), we need to look for unifying principles, especially at the larger scales. We want to know what will be the community response to a management practice within different regions (is the functional group concept useful?).

There is a critical need to identify and locate the most important areas ("key sites", "hot spots") for biological conservation and management, with respect to rare or threatened species and otherwise significant (e.g. rich, localized, threatened) communities. We recognize a need, therefore, to compile and adopt uniform listings of rare and threatened taxa occurring in spinifex - with priorities indicated, and compiled on a national, state and regional basis.

Heterogeneity across spinifex communities, independent of recent fire and rain history, arises from:
- geographical position (lat/long) and landform type (sandridge, sandplain, laterite surface, rocky) i.e. broad-scale attributes;
- local community composition, local topography/ hydrology, and proximity to adjacent or inlying non-spinifex environments (finer scale).

We need to get a handle on this heterogeneity.

Q3 - On what gaps in knowledge of dynamics should management-oriented research now focus?

1. Prior to investigating dynamics, we need to identify and document "hot spots", by a combination of remote sensing techniques and then focused ecological survey. Also, but with lesser priority, there is a need for more broad-scale biological survey across spinifex landscapes in representative areas (inventories).

Critical areas will mostly be associated with moisture- and nutrient-rich conditions, and so research should focus on:

- active drainage channels and floodouts;
- paleodrainage systems;
- uplands within spinifex landscapes.

2. Focus ecological research on these critical (hot spot) communities, in relation to, or impacts of:

- fire ecology;
- mammalian extinctions;
- feral biota;
- pastoralism;
- mining and tourism;
- Aboriginal land-use;
- climatic, landform and edaphic controls.

3. There is an urgent need to gather ethno-ecological knowledge, particularly from older Aborigines. We also recognize the need to involve land managers and (traditional) owners in the design and implementation of research and management.

Q4 - What is the minimum data set required for achievable management of spinifex areas?

The group did not address this topic specifically, but the information presented above contains relevant indications. To summarise the above, important factors to be considered are:

- patchiness and variability of rainfall, and drought (more extreme than in temperate and island situations);
- fire, with effort to be focused on protecting sensitive communities and manipulating habitats for rare species;
- redistribution of water and nutrients, with areas of higher water and nutrient availability likely to be critical habitats;
- the role of landscape heterogeneity in promoting biological diversity;
- assessment of human impacts;
- establishment of effective monitoring programs.

DYNAMICS OF SPINIFEX COMMUNITIES - GROUP 2

S.R. Morton and P. Masters

What are the serious gaps in our knowledge of the dynamics of spinifex communities from the point of view of management for nature conservation?

1. What are the major determinants of temporal change in spinifex communities?

We set aside the uncontrollable causes of temporal change - rainfall and drought - because there is nothing that managers can do about them directly. We then agreed that the potentially manageable determinants were as follows: fire; grazing by domestic herbivores; grazing by feral herbivores; predation by introduced mammmals; weeds; and human impacts (Aboriginal land use, tourism, and mining and exploration).

2. What is the relative impact of these determinants on different regions of the spinifex grasslands?

Here we had to set aside the problem of islands, as we found it impossible to generalise; islands would have to be assessed individually. Other regions were categorised according to substrate and rainfall, as follows, and then the significance of each impact was rated on a scale of 1 (least important) to 8 (most important). Examples of the regions included in the four categories are the Pilbara (rocky, high productivity), the Tanami (sandy, high productivity), the Great Sandy (sandy, low productivity), and the Gibson (rocky, low productivity). Finally, the sum for each impact across the entire range of spinifex gave us an idea of their relative importances.

	Substrate				
	Rock		Sand		
Rate of production of plant biomass	Low	High	Low	High	Total
Fire	7	8	7	8	30
Domestic grazers	3	1	2	3.5	9.5
Feral grazers	6	7	6	7	26
Introduced predators	8	5	8	6	27
Weeds	3	6	3	2	14
Aboriginal land use	3	4	5	5	17
Tourism	3	3	1	1	8
Mining	3	2	4	3.5	12.5

Clearly, the three big issues are fire, introduced predators, and introduced grazers, across all spinifex types.

3. What should be the major research tasks to address these management problems at the regional scale?

1. Fire: impact of fire beginning in spinifex and spreading into adjacent habitats;
impact of fire regimes on special habitats within spinifex grasslands;
identification of important habitats for particular plants and animals within the spinifex.

2. Introduced predators: can acceptable limits to the abundance of these animals be achieved?

3. Feral grazers: relative impact on widespread spinifex formations as distinct from the important habitats mentioned above;
interaction with introduced predators;
can acceptable limits to the abundance of these animals be achieved?

WORKSHOP 2 : INTERACTION OF LAND MANAGEMENT AGENCIES AND ABORIGINES

Leader: Charles Carter

Reporter: Julian Reid

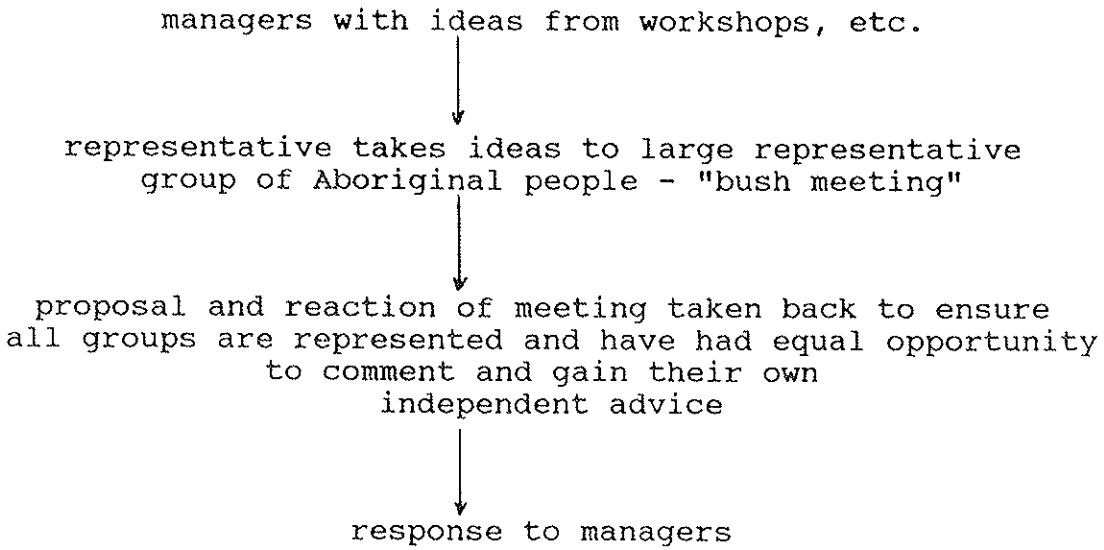
Northern Territory situation.

Interaction breakdown areas - N.T. Government ideologically opposed to Federal Land Rights Act. C.C.N.T. required to implement Government policy so this often causes conflict with Aboriginal organisations.

Aboriginal organisations often do not or cannot distinguish between Government departments; complicated by numerous departments, changing names and sources of funding.

Political difficulties overshadow or have implications on all other aspects.

OPERATIONAL INTERACTION



- misbalance of power between dominant powerful agencies and disadvantaged Aboriginal people.

- appropriation of control of land.

- conservation and exploitation of resources not necessarily the point of conflict - but need sustainable resource use.

- not enough resources on the ground to undertake appropriate liaison with Aboriginal communities.

- conflicting land "rights" arrangements and reserves on the border of States makes it difficult to negotiate satisfactory joint management arrangements.

- suggest positioning of liaison staff in regional offices to improve communications.

- "liaison post" with communities or councils funded by independent funding ? A.A.P.A.? A.T.S.I.C.?

- difficulties with organisation imposing ideas on communities - need to have the person chosen by communities.

- difficulty with setting up programs because previous failures mean people do not wish to run over the same issues again.

- training needs to be undertaken and carried through to some finite endpoint.

- suggest employing Aboriginal people as experts to provide information to the management process as well as typical ranger training in the European ranger role. Pay experts as such i.e. professional rates not ranger rates,; make a distinction between expert work and training.

- encourage Aboriginal people to contribute to interpretation and the training of European rangers.

WILDLIFE HARVESTING

- sustainability - what impact are Toyotas and guns having? concentration of people, greater access and greater killing ability.

- education role for park managers to alert Aboriginal people to the dangers of over-exploitation of rare and limited distribution species.

- include people in active ecological management programs, this helps educate people about the problems and encourages their involvement.

- differences in perceptions as to why animals disappear and reappear - need to blend both cultural perceptions to a joint aim.

- communications - cultural and linguistic differences need to be addressed.

ABORIGINAL OWNERS OPENING UP LAND TO EXPLOITATION

- over-exploitation of firewood resources

- mining interests - concerns about species of limited distribution or habitats. E.I.A. still needs to be prepared. Aboriginal owners do have more say over mining (in N.T.) than European land owners.

POLITICS OF ACCESS ROADS

- concerns about the decision making process - Aboriginal organisations building roads without consultation. For instance, C.A.L.M. would like to be in a position to advise or suggest good locations to protect flora and fauna.

FLEXIBILITY OF EMPLOYMENT

- limitations caused by A.E.D.P. etc. funding which does not include funds for a European co-worker or researcher.

- arbitrary restrictions on how funds can be expended.

- time frame - conflict of time constraints versus time needed to incorporate Aboriginal people into research programs.

- funding by financial years - difficult to have funds released quickly at the start of the year and disposal of funds at the year's completion often problematic.

Workshop 2

Interaction of land management agencies and Aborigines

Leader: Tony Start Reporter: Don Langford

Issues discussed:

- What are "nature conservation" and "aboriginal" interests?
- What are the areas of common interest?
- What are the areas of potential conflict?
- What can be done to avoid conflict?
- What can we do to initiate "on ground" action

Conservation Interests	Aboriginal Interests
Maintain biodiversity	Maintain biodiversity
Rehabilitate (restore) biodiversity	Rehabilitate (restore) biodiversity
Consultation	Consultation
Access to land with special conservation values	Access to land
Site protection	Site protection
Employment	Employment
Education	Education
Use of resources (recreation, science, etc.)	Use of resources (bush food, medicine, spiritual/cultural)
Exotic animals and plants	Economics (aboriginal enterprise)
	Recognition of aboriginal land ownership (trad/modern)

Summary: Many common interests, but the recognition of aboriginal ownership and their decision making perogative is fundamental.

Areas of Common Interest or Conflict

Biodiversity	Aboriginals and conservation agencies both want biodiversity. Potential conflict: feral animals - utilise or aradicate?
Access	Common interest in access, but for different purposes. Potential conflict: control of access?
Employment	Both groups want meaningful employment for local people. Potential conflict: What is meaningful?
Education/training	Both groups want education and training. Aboriginal to Aboriginal Non Aboriginal to Non Aboriginal Non Aboriginal to Aboriginal Aboriginal to Non Aboriginal Potential conflict: What is meaningful education?
Ownership	Both groups need to learn and understand meaning of modern and traditional ownership. Potential conflict: Misunderstanding of the meaning of ownership/control; non acceptance by some.
Resources	Both groups want sustainable use of resources. Potential conflict: Management of rare species and/or localised populations.
Economics	Both groups want Aboriginal people to have a sound economic base. Potential conflict: Some enterprises antagonistic to environmental conservation or visa versa.
Legislation	Both groups recognise the need to legislate or to change some existing legislation. Potential conflict: inadequate consultation or understanding - bad legislation.
Values	Both groups want special sites protected. Potential conflict: differing cultural values and aspirations.

What can be done to overcome or avoid conflict?

1. Effective communication

Education in communication skills (blacks and whites)
Willingness to communicate
Adequate resources to facilitate meaningful communication
Recognise established liaison groups (Ab Liaison Officers) or create them
Provide training opportunities (languages, cross cultural courses)
Learn how a bureaucracy operates
Understand "gate keeping" principles
Sincerity and honesty in communication
Personal (social) relationships are important
Consistency/continuity of personnel
Recognition of the limitations of participants
Patience
Educate the "bosses" (Executives/politicians)

2. Education and Training

Aboriginal to Aboriginal, Non Aboriginal to Non Aboriginal, Aboriginal to Non Aboriginal, Non Aboriginal to Aboriginal
Operators need to train their bosses
Record the ethnobotanical knowledge of older people for bilateral use
Resources should be made available to facilitate education and training
Provide appropriate educational materials for use in school
Help schools to develop their own resources
Provide education/liaison prior to an operation
Encourage feedback following operation
Provide feedback on successes and failures

3. Other issues

There needs to be a long term commitment to programmes from funding bodies.

What can be done to initiate "on ground" actions?

Recognise traditional, and where appropriate, legal ownership of land.
Listen to Aboriginal aspirations.
Involve Aboriginal people in meaningful conservation activities.
Facilitate interaction between organisations.
Provide training for conservation organisation personnel in Aboriginal culture and values (understand the process of decision making in Aboriginal society).
Learn how Aboriginals use the environment and what impact this may be having on the sustainability of those uses.
Generation of meaningful and desirable employment relevant to both Aborignals and Non Aboriginals.
Education - must cover all ages and both sexes.
Joint application for funding - both groups should argue a common case when possible.
Provide support structures for Aboriginals whilst they are training away from home.

Fire Regime and Management of Spinifex

Workshop Summary : Group 1

Fire Regime : - Season
- Frequency
- Intensity
- Size / Spatial distribution

Leader: Neil Burrows
Reporter: Geoff Lundie-Jenkins

What should the objectives be ?

GOAL : Conservation of Biological Diversity incl. - Loss of species
- Loss of habitat
- Loss of communities

OBJECTIVES :

1. Protection of vulnerable areas and communities including fire sensitive communities, rock art sites, human life and property from the impact of wildfires.

2. Establish research areas to examine the long term effects of various fire regimes. Carry out programs to monitor a diverse range of fire regimes inn various biomes.

What do we know ? (on a biome basis)

- Mulga degenerates under a frequent fire regime
- Post-fire response is essentially rain-driven but is also influenced by other external factors including grazing pressure
- Good knowledge of fire behaviour
- Some knowledge of post-fire response on sandplains --> Strong post-fire succession
- Very preliminary view of impact of fire pattern on animals
- Island situations - No apparent shifts in populations following fire

NB General agreement that we have basic information in relation to many aspects pertaining to fire regimes and management of spinifex, but we still need to know much more in order to be confident in the way that we manage our spinifex ecosystems.

What are the research priorities ?

- Review of Spinifex Fire Research knowledge
- Identify Key areas / Fire vulnerable areas
- Study existing mosaics, examining Wildfires v's Imposed (Aboriginal) regimes
- Establish reference areas
- Integrated Flora / Fauna fire effects research
- Encourage co-operative / inter-agency research
- Research on aboriginal knowledge and its religious / cultural associations
- Specific research on rare wildlife species, especially arid zone specialists eg. Princess Parrot and some fire sensitive plants

WORKSHOP 3

FIRE REGIMES AND MANAGEMENT OF SPINIFEX

FACILITATOR: GRAHAM GRIFFIN

REPORTER: PETER KENDRICK

A. Decided to begin by sorting out what we do and do not know regarding fire and management of spinifex, particularly with respect to patch burning.

1. What do we know?

Patch Burning

- Assumed that application on a broad scale is neither practicable or desirable. The empirical support for patchy mosaics is also not yet unambiguous. However, extensive areas of uniform aged spinifex are likely to be undesirable with respect to community diversity **and wildfire protection.**

- Management must be considered at two different geographic scales; broad -vs- local. The appropriate scale of application depends upon the specific management issue. High value localities may require specific fire management.

- Patch burning has a role in protecting ecosystems from wildfire, at both large scale (buffer zones or strips) and local scale (individual site protection).

2. What don't we know

- We lack detailed information on the responses of communities to small scale fire mosaics. We need case studies to produce generic theories.

- We need to get data on the responses of restricted, rare or endangered species to fire regime.

- How does fire regime affect soils and soil faunas, vegetation. Some people weren't too sure about this - how far does one go, when do you stop?

- We have a dearth of information on effects of fire regime on non-sandplain spinifex communities.

B. What should our management objectives be with fire and spinifex.

General	Specific
1. Maintain biological diversity.	1. Protecting currently endangered species.
2. Publicise knowledge and identify gaps in knowledge.	2. Maintain all successional

3. Maximise fire regime diversity by landform types.
4. Protection of conservation and other assets.
5. Pre-planning in implementation of fire.
6. Make management decisions at appropriate levels - whole landscape -vs- individual species.
7. Keep your options open - diversify management approaches as 'insurance'.
8. Implement concurrent management of feral fauna/flora.
9. Involve local or interested communities in fire management (Aboriginal people, pastoralists).

stages, particularly old and very old patches.
3. Manipulate habitats for requirements of specific species or communities.

- Fire is disturbance. Weeds may benefit and this should be considered in management.

C. What are our Research priorities.

General

1. How to identify 'key sites' as specific management issues.
2. Nutrient distribution and relationship to water and productivity.
3. Documentation of fire regime and monitoring of effects.
4. Effect of exotic species in different fire regime/community types.
5. Which species and at what scale should we be monitoring?
6. What of non-fire perturbations, and how do they interact with fire, e.g. grazing.
7. At what scale is application of patch burning appropriate?
8. Develop simple (or simplify existing) pre/past burn monitoring methods.

Fauna/Flora

1. Fire regime and influence on soil composition/ structure/stability/ productivity.
2. Responses of fire sensitive species to fire regime.
3. Database of species responses to fire regime.
4. Fine tuning for individual species.
5. Experimentation with different fire regimes.
6. Predictive models for fire behaviour and more accurate weather predictions.

WORKSHOP SESSION:
RE-INTRODUCTION OF LOCALLY-EXTINCT SPECIES AND FERAL ANIMAL CONTROL

WORKSHOP LEADER: Per Christensen
SCRIBE: Rick Southgate

The workshop participants addressed the following questions and areas of concern:

1. Is re-introduction worth it?
The immediate response to this question was "How do we decide if it is worth re-introducing particular species?"
The following criteria were listed:

- increase a population size
  - no. of individuals in a population
  - increase genetic variability/diversity and ecological opportunity
- popular opinion
- good way of finding out what limits a population
- salvage a species from extinction

The value of a re-introduction program has to be assessed against these criteria

2. Which species are the priorities?
The discussion suggested there where a number of criteria with which to set priorities:

- genotype threatened species
- critically endangered species
  - very small numbers of individuals
  - very few populations
- species facing specific realised threats
- keystone and/or functionally important species
- species providing a good chance of re-introduction success

3. Compile a check list of practical considerations necessary to undertake a re-introduction program

- experimental approach was considered a primary component
- monitoring the result of re-introduction and setting the objectives before the start
- having an adequate biological knowledge of the species involved and a handle on limiting factors
- having adequate resources for the project before the start
  - biological (suitable animals)
  - structure of project (has to be long term ie production of 2nd/3rd generation individuals from founding stock)
- suitable habitat for re-introduction
  - structure and floristics
  - nutritional status

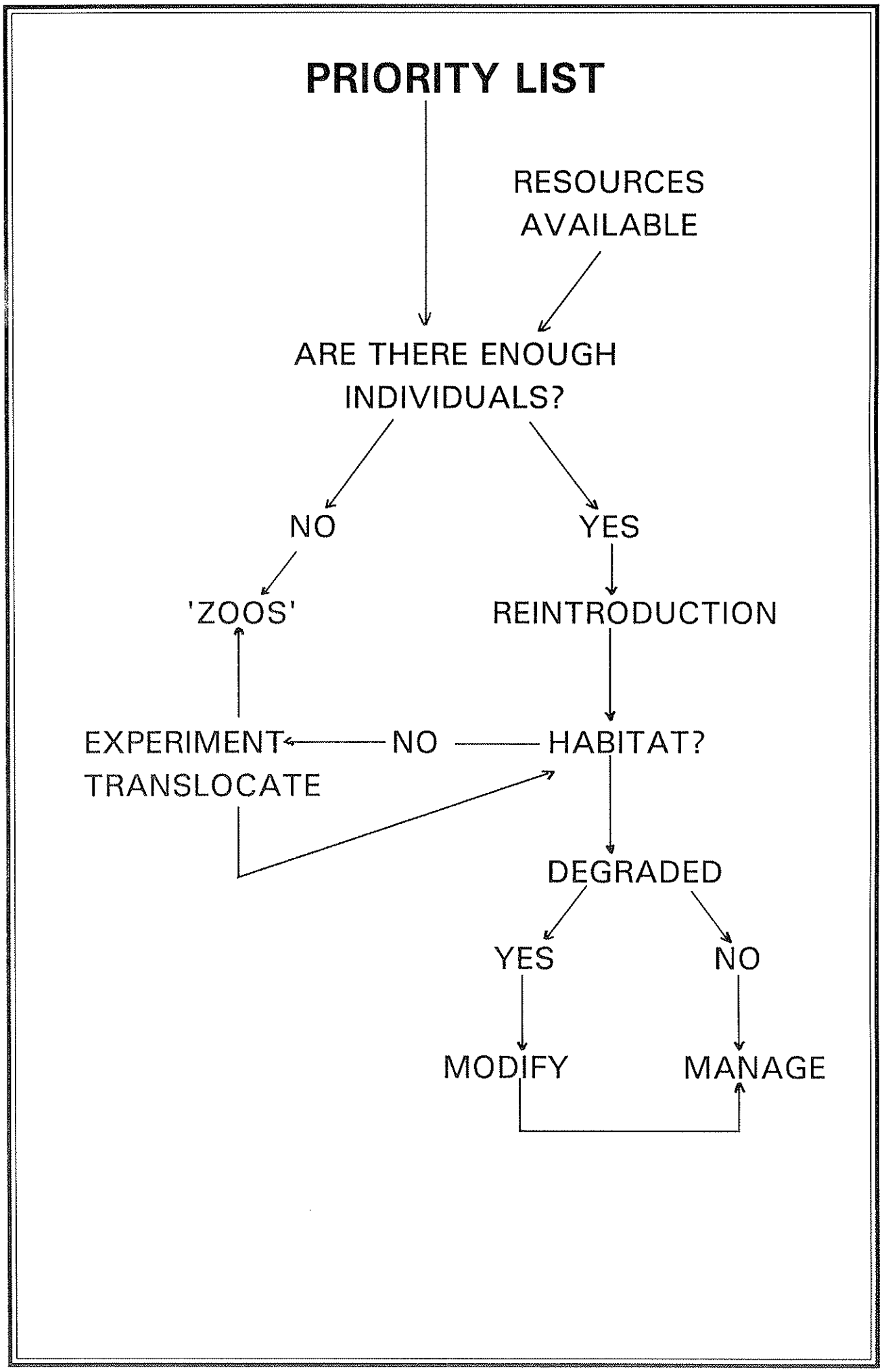
- tenure to ensure adequate management
. coordination and communication between agencies
. national coordination
. monitoring the impact of re-introduction on other species (more important for introductions)

Graeme Griffin provided a flow diagram (see attached photo-copy) to examine the options available in a re-introduction program.

4. Should we be attempting more broad scale feral animal control in areas not targeted for re-introductions?

The consensus of the workshop was "No" to this question. However, it was agreed that there should be some targeted feral animal control with certain conditions attached.

Before implimentation:
. Elimination of the feral animals must be the goal
. The interactions between predators and potential prey species must be understood. Control of predators may enable prey items, such as rabbits, to increase in numbers and degrade habitat making it unsuitable for native species.
. The interaction between predator species must be understood. The control of a species, for example the dingo, may selectively improve the conditions for other less easily controlled species, such as species cats and foxes.
. Critical areas "hot spots" need to be identified.
. Need to locate the critical areas


PRIORITY LIST
RESOURCES AVAILABLE
ARE THERE ENOUGH INDIVIDUALS?
NO
YES
'ZOOS'
REINTRODUCTION
EXPERIMENT TRANSLOCATE
NO
HABITAT?
DEGRADED
YES
NO
MODIFY
MANAGE

Spinifex conference - Como July 1990
Summary of discussions at workshop on reintroduction of locally-extinct species and control of feral animals

Leaders: Peter Copley S.A. N.P.W.S., Adelaide.
Jeff Short CSIRO Wildlife & Ecology, Perth.

Reintroductions

Why bother reintroducing locally extinct species?

Reintroduction can be a useful management tool to increase the security of species by increasing the number of sites at which they persist, to increase understanding of the forces that impinge on a threatened species, and to enhance nature conservation values of a site. It may have additional benefits in increasing the public profile of nature conservation, in education of the general public, and in generating funds for nature conservation. It may also provide opportunities for active participation by Aboriginal people and facilitate and reinforce the cultural involvement of their youth with the traditional values of the land. The negative side of reintroductions is that they are expensive and may have a low probability of success.

The major costs of reintroduction programs in spinifex deserts were seen to relate to the expense associated with remote research and management, the greater logistical problems involved, and the potential competition with other programs for a limited resource pool.

Suggested alternatives to doing reintroductions in the spinifex deserts were reintroduction trials closer to research bases to reduce logistical problems (although densities of exotic predators and competitiors may be much greater) or the concentration of research effort on those species that have persisted in spinifex desert but which are perceived to be under threat (mulgaras, bilbies, rufous and spectacled hare-wallabies). It was generally agreed that each strategy could be profitably pursued if sufficient resources were available.

Which species and which areas should receive priority attention?

Species for reintroduction can be prioritised on a number of bases:

(a) perceived risk;
(b) representativeness (i.e. a spread of species from each taxonomic group that has suffered major decline. This would lead to the inclusion of species with a range of lifestyles: burrowing, surface nesting, arboreal);
(c) likely success (i.e. start with easy species);
(d) importance to Aboriginal residents.

There was no agreement on which was the preferred option for setting priorities.

The spinifex deserts were seen as ideal for reintroductions by some because of tenure (land under CALM control in W.A. cf. aboriginal control in N.T.), and because of perception that this ecosystem is more intact than other land use zones; but regarded unfavourably by others (disadvantages of remoteness creating problems in long-term monitoring and maintenance of feral animal control).

The view was put that reintroductions should have as a primary goal the unravelling of the causes of prior local extinction and hence should be designed in such a way as to separate out the effects of rabbits, foxes and fire regimes.

What needs to be considered before reintroducing a species?

A suggested check-list of practical considerations necessary to undertake a reintroduction program includes:

CONCEPTUAL:

- clear objectives,
- experimental design,
- background information on past successes and failures (what lessons have already been learnt?)

BIOLOGICAL:

- health and numbers of source population,
- captive breeding vs direct translocation,
- knowledge of prior distribution,
- habitat requirements (food and shelter),
- social organisation,
- ability to identify most suitable habitat (appropriate food and shelter, low predator numbers),
- number, sex ratio, age of animals to be reintroduced
- requirements for transport of animals,
- requirements for acclimatisation and settling of animals.

LOGISTIC:

- continuity of funding,
- continuity of human and physical resources,
- ability to implement and maintain management strategies (predator control, fire management) for an indefinite period,
- ability to maintain monitoring effort over establishment period (1-2 years?).

COMMUNICATION:

- with local land managers,
- with local communities (Aborigines),
- with other researchers within project and those working on similar projects.
- with media (inevitably reintroductions will have a

high profile)

BUREAUCRATIC:
- licence for reintroduction,
- licence for application of 1080, cyanide or other poisons,
- restrictions on burning.

Feral animal control

Control of foxes and rabbits and, if possible, dingoes and cats were seen as essential in any attempt to reintroduce species. It was recognised that there was a nexus between fox and rabbit numbers which, in most reintroductions, would require control of both species. Broad-scale control, beyond its use as a tactical tool in reintroductions, was seen as desirable but impractical in the medium-term, because of the size of the areas involved and the cost of control. Developments in biological control may greatly increase practicality and economics of control in 10 - 20 years.

Camels were targeted as a species that may have increased in numbers substantially over the last decade and of which little was known of its effects on the desert ecosystem. It was suggested it should receive some research attention rather than immediate control.

Transforming research results on ground management action

Leader: Ian Kealley Reporter: Keith Morris

Experimental management could be defined as the interaction of research and operations staff to undertake field manipulative trials to determine the effects of certain management practices on conservation problems. These management practices are those perceived to enhance conservation values.

This experimental management is an extremely important process for conservation agencies to participate in and is particularly relevant to the management of spinifex deserts. It is a process which involves both research and operations staff, and should be considered a necessary precursor to any major operation in spinifex deserts.

The process of experimental management was discussed using specific examples from the desert, and a list of steps to be undertaken was developed. These are:

1. Identify the problem jointly between research and operation staff.

2. Prioritize the perceived problems.

3. Seek and obtain funding.

4. Undertake the research.

5. Communicate to others involved.

6. Demonstrate the findings to others in the field.

7. Establish guidelines for ongoing operations.

8. Establish monitoring regions.

9. Modify guidelines if necessary.

Because research in remote areas can be an extremely expensive undertaking it was considered necessary that

a) funding must be sought and obtained prior to commencement

b) motivation of staff at all levels was important.

The motivation of managers can be achieved by

a) asking them what they see as conservation priorities in their region

b) involving them in the process from the beginning.

The motivation of more senior bureaucrats and politicians is more difficult and involves giving them access to field

trips, preparing "good news" articles for press, lobbying, impressing upon them the wider application of results etc.

It was generally felt that there was a public misconception about the deserts being a wasteland, unproductive and not worth preserving. This attitude needs to change, and improved communication is the major way of achieving this. Several means of communicating were discussed.

1. There is a need for a facilitator to push the management issues of spinifex deserts at all levels.

2. Spinifex desert management needs to be included on the agenda of joint land use planning bodies, where all interests are represented.

3. There is a need for better interaction with other user groups, particularly the Aboriginal people and pastoralists e.g. field days, membership of Aust. Rangeland Society.

4. There is great scope to include professional and amateur conservation groups in the management of spinifex deserts.

5. Use of other groups such as Tertiary students and school live play groups should also be encouraged.

6. Corporate sponsorship for desert projects should be sought.

7. There needs to be a coordinated approach to research between state and territory government departments, with joint application for funding.

8. Education within National Parks.

9. Obtaining the services of special media personnel and programs (Quantum etc.), and the opportunistic press exposure is also worthwhile.

TRANSFORMING RESEARCH RESULTS TO ON-GROUND MANAGEMENT ACTION

Leader: Gary Drewein
Reporter: Hugh Chevis

Experimental Management

All management is to some extent experimental given that management is ongoing and that research knowledge can never be complete.

Experimental management can range from trial and error in the absence of any research knowledge through to the more preferable situation of assessing research findings in operational practice.

Experimental management requires close liaison between researchers and managers. This liaison can be formalized through a system of monitoring, ensuring constant feedback between researchers and managers.

Experimental Management in Spinifex Communities

Experimental management should be directed towards specific objectives in the management of these communities, due to limited resources. Specific objectives identified by the group are;

1. Fire - especially the control of large wildfires.

2. Re-introduction of rare or restricted species.

3. Increasing biodiversity.

4. Habitat rehabilitation and manipulation.

Underlying all of these objectives is a need to bring stability, and to reduce the scale of disturbance to the spinifex communities.

Is Experimental Management Being Used by Managers?

Experimental management is being used, but the level of commitment depends on other pressures on managers' time. It can be a low priority for on-ground managers such as Park Rangers, due to the pressure of day to day commitments.

For experimental management to work it requires top management to be committed to the idea. The idea must also be sold throughout the heirarchy of the organization.

Making Experimental Management Happen

(i) Institutional

Within an organization it is important that there is a culture supporting experimental management. The institution must be structured to allow experimentation to occur and support managers, some of whom may see experimentation as risky.

Communication within and by the organisation is vital. Interaction between researchers and managers needs to be ongoing. Lobbying is an effective means of promoting ideas within an organization. Public support can be enhanced by positive media coverage.

Both managers and researchers need to be involved at the grassroots level of development of experimental management. New ideas in management always take time to become established in an organization. Reasonable periods of time are necessary to allow new ideas to be incorporated into planning and budgeting.

A specialised role was recognized for a person to act as a bridge, or facilitator, between research and management. In CALM this person is known as an Ecologist and the Ecologist positions are based both in Head Office and in Regional offices. It is desirable that these people have long-term tenure within a Region in order to understand its ecology and management issues of the area.

(ii) Public

Experimental management must be made to appeal to the general public and to other land users. The involvement of other land users is particularly important as much of the spinifex lands are not within conservation reserves.

Ways of appealing to the public include;

(a) appeal to national pride; images of restoring the outback;

(b) encourage active participation such as Friends of Parks;

(c) provide interpretive material;

(d) ensuring media coverage, making sure that good news is given along with any bad news;

(e) making sure messages from different organizations are consistent;

(f) structuring projects to have political appeal.

Conservation agencies should employ people with professional skills in public relations.

Resources to Carry Out Experimental Management

Managers and bureaucrats are very conscious of cost and so low cost approaches to management will be accepted most readily. Within an organization resources will either have to be redirected or new money found. Corporate sponsorship is a promising prospect, especially as the business community is working to improve its environmental image. In attracting additional resources within government it is important to present projects to appeal politically.

SETTING PRIORITIES FOR RESEARCH AND MANAGEMENT

The final plenary workshop session aimed to identify the key information requirements for effective management of spinifex desert. A further aim was to list the issues relating to conservation and to identify the management programmes that should be initiated in the near future.

Research Priorities

1. Biological Survey

   Participants concluded that the desert biota was poorly known and that resource inventories were an immediate need. Biological surveys should be sensitive to the dynamism of arid environments and should provide data for a range of seasons rather than being once-off field studies.

2. Exotic Predators

   (a) Control Methods

   Biological : new methods employing disease, parasitism and/or genetic manipulation are required for broad scale control.

   Conventional : improved techniques for high intensity management areas.

   (b) Ecology

   Research into interaction between dingoes, foxes and cats and between these species and their prey is required for evaluation of the secondary effects of control programmes.

   The impact of foxes, cats and rabbits on nature conservation values will require rigourous documentation if the public is to be re-assured of the benefit of genetically based control programmes currently under development.

3. Other Exotics

   (a) Control Methods

   Rabbits : New or enhanced parasite and disease controls together with genetically based techniques.

   Weeds : Techniques for controlling *Rumex* spp., *Cenchrus ciliaris* (Buffel) and *Cynodon dactylon* (Couch).

(b) Ecology

Impact of rabbit control on the distribution and abundance of exotic predators (foxes, cats), native predators (dingoes, Wedge-tailed Eagles) and native herbivores.

Ecology and environmental impact of camels, House Mouse and domestic stock.

4. Fire Ecology

"Mosaic theory" : The influence of patch burning on the maintenance of biological diversity and role in the decline of mammals was considered equivocal and in need of further testing.

Fire behaviour : Investigation of parameters in some habitats.

Investigation of fuel load / state assessment and prediction and the role of remote sensing.

Investigation of community response to varying conditions of season, rainfall and fire intensity.

Establishment of long-term experimental areas in which highly patchy and largely homogeneous fire ages are maintained separately in large (e.g. 100 km^2) blocks to enable short and long-term testing of the "mosaic theory".

5. Re-introductions

(a) Experimental design : Various experimental designs are being used to examine techniques for re-introduction. These need rigourous documentation to enable methodologies to be evaluated and compared for their use with other species and under various habitat and regional conditions.

(b) Which areas : The choice of areas for re-introduction varies according to regional priorities and logistic circumstances.

(c) Which species : The choice of species also depended on regional priorities and logistic circumstances but it was recognised that economies of scale could be generated and more comprehensive data collected in multi-species programmes.

6. Ethno-ecology

The extensive ecological knowledge held by Aborigines and its gradual decline as old people died was recognised. The documentation of this information should be fostered whenever possible.

Related Issues

1. Aborigines

Improved liaison with communities and the expansion of co-operative nature conservation programmes will benefit the conservation of spinifex deserts where Aborigines have substantial legal and / or traditional ownership.

2. Communication

Improved communication within and between agencies will assist in consolidating research and management programmes.

Communication of the successes, values and requirements of research and management to the government and agency hierarchy is needed to raise the profile and resourcing of nature conservation in the spinifex desert.

It is also essential to promote the deserts to the general public (Aboriginal and non-Aboriginal).

Management Priorities

1. Issue

There will be continuing changes in the spinifex deserts due to

- loss of species, reduction in species' ranges, and loss of biodiversity,
- exploration for and extraction of, minerals and petroleum,
- development of outstations and alternative land uses by Aborigines,
- increasing tourism, and
- potentially increasing pastoralism.

2. Action

Fire management can now be applied to protecting fire sensitive and restricted communities, and to ameliorate the impact of large scale wild fires.

Feral animals should be controlled in important conservation areas.

The participation of Aborigines in the planning and implementation of conservation programmes needs developing.

Improved communication between research and management groups will assist the setting of priorities and the effective adoption of research results.

Management programmes need promotion with the public and relevant agencies to improve appreciation of, and the resourcing for, conservation in the spinifex deserts.