THE POTENTIAL FOR ENLARGING THE CONSERVATION ESTATE IN THE ARID RANGELANDS

A discussion document prepared

for the

Department of Conservation and Land Management

by

D.G. Wilcox AM

February 1996

FOREWORD

This report by Mr David Wilcox AM, was commissioned by the Environmental Protection Branch of the Department of Conservation and Land Management (CALM).

The conservation values of the rangelands and the need for positive action by Government has been foreshadowed in a number of recent studies, among them:

- the Government's Policy Statement - 'Managing the Rangelands', 1995
- Nature Conservation Strategy for Western Australia (draft) CALM, 1992
- the Environmental Protection Authority Position Statement - 'Sustainable Development in the Rangelands of Western Australia', 1996

Discussions within CALM have identified the need to extend management for conservation off the vested estate now managed by CALM. In addition, key areas for conservation should be added to the current estate.

To this end, CALM has recently purchased the leases over several stations; CALM has negotiated memoranda of understanding for cooperative management with three mining companies (covering five leases); CALM is also negotiating several agreements with pastoral lessees over selected areas with high conservation value. In addition where opportunities arise, CALM will seek the inclusion of appropriate vacant Crown Land into the conservation estates.

The rangelands offer great opportunities for cooperative management between the pastoral industry and CALM, to the mutual benefit of both parties.

David Wilcox is eminently suited to write this report. He has had extensive experience in the rangelands with the Department of Agriculture, as a consultant and as a member of the Pastoral Board in the Northern Territory. The opinions and the cost estimates expressed are his own and are not necessarily endorsed by the Department. Each case will need to be individually negotiated between CALM and the lessees.

The Environmental Protection Branch will now use the report to prepare a Departmental position, with costings and recommendations for action for the Corporate Executive, CALM.

Frank Batini
MANAGER
ENVIRONMENTAL PROTECTION BRANCH

May 1996

fnw159

TABLE OF CONTENTS

1. INTRODUCTION

The Department of Conservation and Land Management, being the agency responsible for the conservation of biological resources, is principally concerned with the preservation of habitat and of ecological processes. Its principal focus has been the acquisition of land for National Parks, Nature Reserves and other forms of holding where the interests of conservation are paramount. It is also charged with the development of responsible management plans for the management of public and private land and with other measures concerned with the conservation of the natural resources of the state or its biological diversity.

These objectives have been summarised in the EPA report on the sustainable development of the rangelands (EPA 1996) inter alia such that the preliminary environmental objectives are to

- protect rangeland biodiversity, high conservation value habitats and ecosystems by establishing and maintaining a comprehensive, adequate and representative system of conservation reserves
- protect important habitats and ecological systems as far as practical in areas outside of the reserve systems
- encourage, promote (and where necessary require adoption) of best environmental practice for rangeland management.

The purpose of this document is to develop a policy which will facilitate the acquisition of additional areas for conservation purposes from the Arid Pastoral Zone comprising the Austin, Ashburton, Carnarvon and Fortescue botanical provinces, State of the Environment Report, 1992 (SOER), p15. The opportunity to acquire land within this region, which is almost all under pastoral lease, if sparsely settled with 320 leases, has arisen because of the downturn in the fortunes of the pastoral industry impelled first by the sharp decline in wool prices, but exacerbated by an incapacity of the industry to maintain the improvements necessary to practise pastoralism successfully.

An additional and less overt reason for the decline in the industry is the deterioration in the condition of the pastoral resources used by grazing stock. The decline in productivity has increased running costs per head, reduced the drought durability of properties and, therefore, increased the variability in annual income. The deterioration in the quality of the resource caused by pastoralism has grave implications for conservation.

An attempt is made to identify those tracts and ecologically distinct regions which should be conserved within Parks or Conservation Reserves in order to maintain the biodiversity in the region and the integrity of the essential ecological processes. Recognising that

conservation through a reserve system is unlikely to maintain the biological diversity of the fauna and flora of the region, the document suggests mechanisms whereby the survival of important, but comparatively small, ecosystems may be guaranteed. It describes systems of land management outside the reserve system where conservation objectives may be sustained along with those involving other end uses.

2. STATE GOVERNMENT POLICY ON RANGELAND

Previous reports to government on the use of the rangelands such as the Royal Commission of 1940, Fyfe 1940, and the Jennings Report, (Anon 1979) have focussed almost entirely on the pastoral industry. The default use of the land for pastoralism reflected in these reports emphasises the perception then held that no other viable form of land use could be entertained. There were, admittedly, grave concerns expressed about the degradation of the land and of the management practices which had led to the loss of some of the resources of the land. The recommendations which were made on future use were couched in terms which saw conservation treated summarily. Tacit within the reports was the view that conservative stocking practices alone, with some regeneration programs, could restore the pastoral areas to a condition rather like that existing when pastoral leases were selected from about 1860 onwards.

A recent policy document, Anon 1995, shows that a change in perceptions of rangeland has occurred. The document foreshadows an intention of government to "develop and implement long term arrangements for the future of the rangelands", which include the pastoral leases, national parks and conservation reserves, areas of Crown Land and Aboriginal Reserves. The Government is committed inter alia to ensure economic and social development opportunities while conserving the rangelands, conserving native flora and fauna by establishing and maintaining a comprehensive reserve system and developing environmental objectives for broadscale land use within the principles of Ecologically Sustainable Development.

The policy document, brief as it is, recognises for the first time that there are alternative uses for rangelands other than pastoralism, and that pastoralism itself must be practised within an ESD context. The Pastoral Wool Industry Task Force (1993) reviewing the production parameters of the arid pastoral region found that the gross value of production of both wool and stock for the year 1991/92 was $42.6 million or 1.5% of the total value of state agricultural production and 5.9% of the gross value of wool production. Prices received have increased only marginally since then. The value of production of cattle from the same area is unlikely to be higher than $8 million. The annual cost of government services to the whole of the pastoral industry is $6.8 million, not inclusive of loans advanced, but including agricultural and administrative costs, the then Agricultural Protection Board costs and interest rate subsidies. In the area under discussion the annual costs are about $5 million per year.

At the same time gold production from the area amounted to $2,356 million in 1994/95 and iron ore production about $2,800 million. Other mineral exports are negligible in comparison. The value of other industries, including tourism, is more difficult to determine. There are about 50 properties registered as home-stay operations but it is doubtful whether

income from this source would exceed one million dollars. There is a successful tourism venture at Mt Augustus. Other sites of scenic or environmental interest such as the Kennedy Ranges are visited by a few special purpose tour operators. For the most part the potential of the area for tourism remains unexploited. The towns in the area benefit from through-traffic and from small parties bent on outback holidays.

Specifically, for conservation, the policy requires that a comprehensive reserve system will be established representing the full range of land forms and biological communities. Biodiversity will be supported through strategic programs which will conserve native flora and fauna and representative habitats. Finally, government wishes to establish environmental objectives for broadscale land use and to develop land use models which will promote the multiple use of rangelands by conservation and other interests.

Two distinct forms of land use are therefore proposed in respect of conservation in the rangelands. Tracts of land will be reserved within a comprehensive reserve system and, secondly, broadscale land use, presumably pastoralism, must have environmental objectives set within an ESD format. The second form of land use has affinities with the Regional Reserve System established in South Australia, (Cohen, 1992), and denigrated for its lack of definable and attainable objectives by Reid and Puckridge, 1992. Both authors draw attention to very great problems associated with the management of all of the competing land users and of defining the acceptable limits of human-induced change in these reserves. It is pointed out that management must be of a much higher standard, being much more sophisticated of necessity than where nature conservation is the sole management objective. Then again, the uneasy division of managerial power between government and lessee needs to be resolved. Cohen points out, however, that the concentration of all potentially representative biogeographical entities within the arid zone is not possible through a reserve system. The regional reserve system provides an opportunity for conservation at a level which eventually the community itself will dictate. Broadscale use within ESD guidelies have been defined by Burnside et al, (1995) for the arid shrublands. The institutional arrangements for insuring adherence to these principles have not been clearly elaborated.

In 1992, amendments to the CALM Act in Western Australia were approved to provide for a category of land to be known as a regional park to be managed by CALM. The Regional Park concept arose from the System 6 report and included proposals for the parks to include land of mixed ownership, government as well and land held by private owners.

3. PUBLIC PERCEPTIONS OF CONSERVATION IN THE RANGELANDS

Four studies have been made of public attitudes to the use of rangelands in Australia within the past two years. These have made it possible to determine the overt and even latent interests of a wide section of the Australian and Western Australia communities in topics such as conservation, biodiversity and other alternatives to conventional pastoralism in the rangelands.

In the first of these, Mandis Roberts' (1994) overview of the workshops held as part of the process of developing a National Rangeland Management and Action Plan shows that the dominant issue raised by the 1395 participants was ecological sustainability. Almost 50% of those attending were pastoralists in the traditional sense. A closer examination of the data from the workshops held in Western Australia, Wilcox (1995), showed that 34% of those attending saw conservation, ecologically sustainable land use and multiple use of the resources as the most important issues which needed attention in the definition of the National Strategy.

More recently, Nicholls (unpub.), has investigated the attitudes to use of the rangelands held by 435 residents of the Perth metropolitan area. Nature conservation was seen to be the most desirable form of land use in the rangelands. Feral animal and weed control and land rehabilitation were considered to be very important issues whose ill effects should be remedied.. Only 10% of those in the survey considered that grazing was a very desirable form of land use.

In May 1995 a rangeland awareness survey was carried out for the Australian Rangeland Society, (Roy Morgan Research Centre, 1995). Of 1109 interviewees interviewed nationally over 60% had visited the rangelands; 70% in Western Australia as would be expected. Conservation was considered to be the most important product of the rangelands, though it was recognised that grazing was almost as important. Given a choice of urgent issues the interviewees felt that conservation and rangeland rehabilitation were the most important. Between 25 and 38 percent or respondents perceived grazing as being managed poorly or not very, well.

The data from these studies show that the community rates the conservation of rangelands as an important objective, one above that of maintaining the pastoral industry. Some considered, however, that there was no visible ability nor inclination by government to solve current dilemmas in multiple use in the rangelands.

There appears to be no basis for the contention that it is only administrators, conservationists and pastoralist who are interested in the rangeland. Concerns are spread, for instance, across the spectrum of age, education and occupation within the population of 1109 interviewed by Roy Morgan.

It may be concluded that efforts to add to the conservation estate in the rangelands will have general community support. The rangelands are clearly perceived as being community property and not in the de facto ownership of about 320 lessees.

4. THE CURRENT EFFECTIVENESS OF NATURE CONSERVATION IN THE REGION.

Several appraisals of the quality of nature conservation in the region have been made.

4.1 The State of the Environment Report

The State of the Environment Report makes an overall assessment of the coverage of reserves. Earlier studies, notably the Conservation Through Reserves Committee (CTRC) identified the gaps in the reservations and made recommendation concerning future reservations.

The dearth of biological information, an apparent belief that the environment was repetitive on a large scale and an assumption of the primacy of pastoralism allowed these reports to give an account of conservation needs which is inadequate given the now known variability in the environment. Although the SOER observes that there are major gaps in the nature conservation reserve system and that there is an urgent need to protect nature conservation values on vacant Crown land, its superficial examination of the North West and the Goldfields (the region discussed in this document) concludes that the current reserve system broadly represents the major vegetation and land forms. Exceptions are made for the rivers systems, the north and east Pilbara and the mulga communities of the Goldfields.

It is difficult to reconcile this view with the conclusions of Hopkins et al, (priv. comm) and discussed later, who, for the Gascoyne region, showed that of 71 vegetation types contained there, nearly half, (34), were not represented in the conservation estate.

Pringle (1995), has shown that in the north-eastern Goldfields less than one percent of the 100,510km area he surveyed, (Pringle et al, 1994), was in a conservation reserve. Further, there were only two of 11 poorly known or threatened species represented in reserves. He concludes that existing nature conservation reserves are not representative of the biological diversity in the region. Of seven land types, out of 17 in total in the region, those most subject to preferential grazing were either poorly represented in nature reserves or were not included at all. These seven types are the most fertile and best watered in the region and represent foci for biological activity in a background of less productive, less fertile and more arid environments.

4.2 The Red Book Status Report 1993

The progress with the CRTC objectives for conservation are summarised in Table 1. The Red Book areas included the Pilbara, Central West, Murchison and the Goldfields which cover the area under discussion in the paper. The implementation status is shown in Table 2

Table 1. List of land areas set aside for conservation purposes in the Red Book areas 8, 9 and 10. (Red Book Status Report 1993)

Area 8 The Pilbara
- Chichester Range National Park
- Millstream National Park
- Hamersley Range National Park
- Barlee Range Nature Reserve
- Mt Augustus National Park
- Collier Range National Park

Area 9 Central West Coast
- Cape Range National Park
- Peron National Park
- Kennedy Ranges National Park
- Tooloonga Nature Reserve

Area 10 Murchison
- None *one site, a Conservation Reserve, yet to be gazetted*

Area 11 Goldfields
- Wanjarri Nature Reserve
- Mt Manning Nature Reserve*
- Die Hardie Range*
- Goongarrie National Park

*south and west of existing pastoral leases

Table 2. Implementation status of Red Book recommendations - percentages 1992

System	No. recommended	% implemented	Part implemented	Issues resolved	Unresolved issues
8. Pilbara	31	80.7		6.5	9.7
9. Central West	34	68	6	12	14
10. Murchison	3	66.7			33.3
11. Goldfields	16	87.5	6.25		6.25

The Resolution of Conflict Policy of November 1990 provides for all outstanding Red Book recommendations to be implemented and to be immediately classified as Class C Nature Reserves. Although Table 2 would suggest that conservation needs are being met in these areas, since most recommendations have been implemented, an examination of the coverage of the proposals shows that important environments have been omitted from the Red Book list. In the detailed analysis it is suggested that the Red Book treatment of the area is hardly exhaustive and is, in fact, superficial. That the list of omissions is so large, even at this level, shows that conservation objectives in the region require urgent review.

4.2.1 Pilbara

There were 31 recommendations made on 18 areas. Seven of these areas had a principally marine component. Eleven areas only had a land component.

Five National Parks were declared or are in the process of declaration. Four of these are in the ranges. A further hilly area, the Barlee Range, was declared a Wildlife Sanctuary.

Areas in the Marble Bar and Nullagine district were not proceeded with, proposals for Mungaroona were deferred for lack of funds, as was the Teano Range and Jeeaila River Downs recommendation.

Even a cursory review of the recommendations for the Pilbara shows that highly important potential conservation areas have been omitted. These include the Ashburton and Fortescue Rivers, the Fortescue Marsh and the Black Soil Plain/Hilly terrain assemblages which are centres for biological activity.

It is difficult to avoid the conclusion that the Red Book recommendations included only those areas of very low pastoral value such as the Collier Range, the Chichester Range, the Mt Fraser pastoral lease and some possibly abandoned or near derelict pastoral properties in the Marble Bar and Nullagine district. While important for some biological reasons and for scenic attractiveness the proposals and recommendations ignore critical areas of conservation need in the region.

4.2.2 Central West

There were 34 recommendations on 15 areas. Ten of these areas were essentially marine or linked very closely with the Shark Bay Heritage precinct. Five areas only had a land component.

Of these five, one was Lake MacLeod, where difficulties associated with the mining operation there are preventing implementation. Extensions to Kennedy Range and Cape Range National parks are being negotiated and the Callitris-Acacia scrublands of Tooloonga

are now a Class C Nature Reserve. It would appear that the demands for conservation on land had been almost met if the criteria in the Red Book are considered to be exhausted.

In reality, urgent conservation needs on the Central Coast have been ignored. The Gascoyne River and its tributaries with their singular drainage plains are not included. Nor are the fossiliferous beds of the Permian deposits and the characteristic landscapes of these sedimentary rocks with their glacial erratic tracts. The extensive granite tor fields have been ignored, neither are the unusual coastal plains surrounding the lower Gascoyne, Minilya and Wooramel Rivers nor are the undulating snakewood-bowgada plains which dominate the coastal region represented in conservation proposals. A recent proposal to protect some parts of the Wooramel River through Innouendy Station may go part way to counterbalance the deficiencies.

4.2.3 Murchison

There were four recommendations made in respect of three areas. It was decided that there was no case for a conservation reservation around Lake Austin, a relic of the inland drainage. No action was taken on the purchase of a station lease for conservation purposes. There is additionally a proposal to protect a small area of unused country from the Boolardy pastoral area, possibly through 16A of the CALM Act.

Conservation needs in the Murchison have not been well served. Many important tracts of ecological significance have been omitted. They include the granite fields of the central section west of Cue and Mt Magnet, the Murchison River and its tributaries, several important hill belts including the Weld Range and the areas of old land surface which are prominent east of Meekatharra, particularly near the No 1 Rabbit Proof Fence.

4.2.4 Goldfields

There were 16 recommendations made in respect of 11 areas. Six of the areas were in the non-pastoral zone. Of the remainder Goongarrie National Park has been proclaimed and Wanjarri Nature Reserve is preserved. The area around Windich Spring is still the subject of discussion, while the remaining two areas around Mt Manning and the Die Hardie Range are themselves outside the pastoral zones..

Obvious omissions are the tracts of spinifex, the banded ironstone formations, the Princess and Carnarvon Ranges and the immensely variable eucalypt forests.

4.3 ANCA National Reserves Cooperative Program

Hopkins et al, (1995) have made a comprehensive review of the adequacy of the reserve system in Western Australia using Beard's maps of the vegetation drawn at 1:250,000 scale. This major undertaking, made possible with computer based mapping and information interrogation packages, has permitted to production of a new 1:3M scale map of the

vegetation of the State which incorporates 50 supergroups of vegetation types. The supergroups themselves resolve into 199 groups and finally into 823 vegetation types.

Using cadastral overlays of the CALM estate, and adopting the Caracas standard that there should be a minimum of 10 per cent of vegetation types in reserves if conservation needs are met, Hopkins et al. were able to show that of the 562 vegetation types in the region only 59 were adequately represented. The data are shown in Table 3 for the IBRA regions (q.v.) shown.

Table 3 Conservation status of vegetation types in the regions shown.

IBRA region	No. of types in region	Types <10% reserved	Types unreserved	No & % of types underrepresented	
Murchison	119	71	39	110	92%
Carnarvon	118	56	47	103	87%
Coolgardie	98	33	53	86	88%
Pilbara	89	52	27	79	89%
Gascoyne	72	37	28	65	90%
Yalgoo	66	31	29	60	91%
Total	562	280	223	503	

The data show that about 90% of the vegetation types in the arid pastoral zone are underrepresented. The selection is no better in the arid interior.

5. CALM'S ROLE IN CONSERVATION

CALM is responsible for managing the National Parks, Nature Reserves, Marine Parks and Conservation Parks which are vested in the National Parks and Nature Conservation Authority established under the CALM Act (section 24) of 1984. CALM has additional responsibilities for land vested in the National Parks and Native Conservation Authority and for land both freehold and leased which is held in the name of the Executive Director and managed for conservation purposes. Other areas such as Timber Reserves and Sandalwood areas totalling 80,000ha in the Goldfields are managed by CALM and are a part of the conservation network. CALM is the statutory manager of State Forests. Karramindie State Forest No. 8 , south east of Coolgardie, an area of 800ha, is the only State Forest in the region.

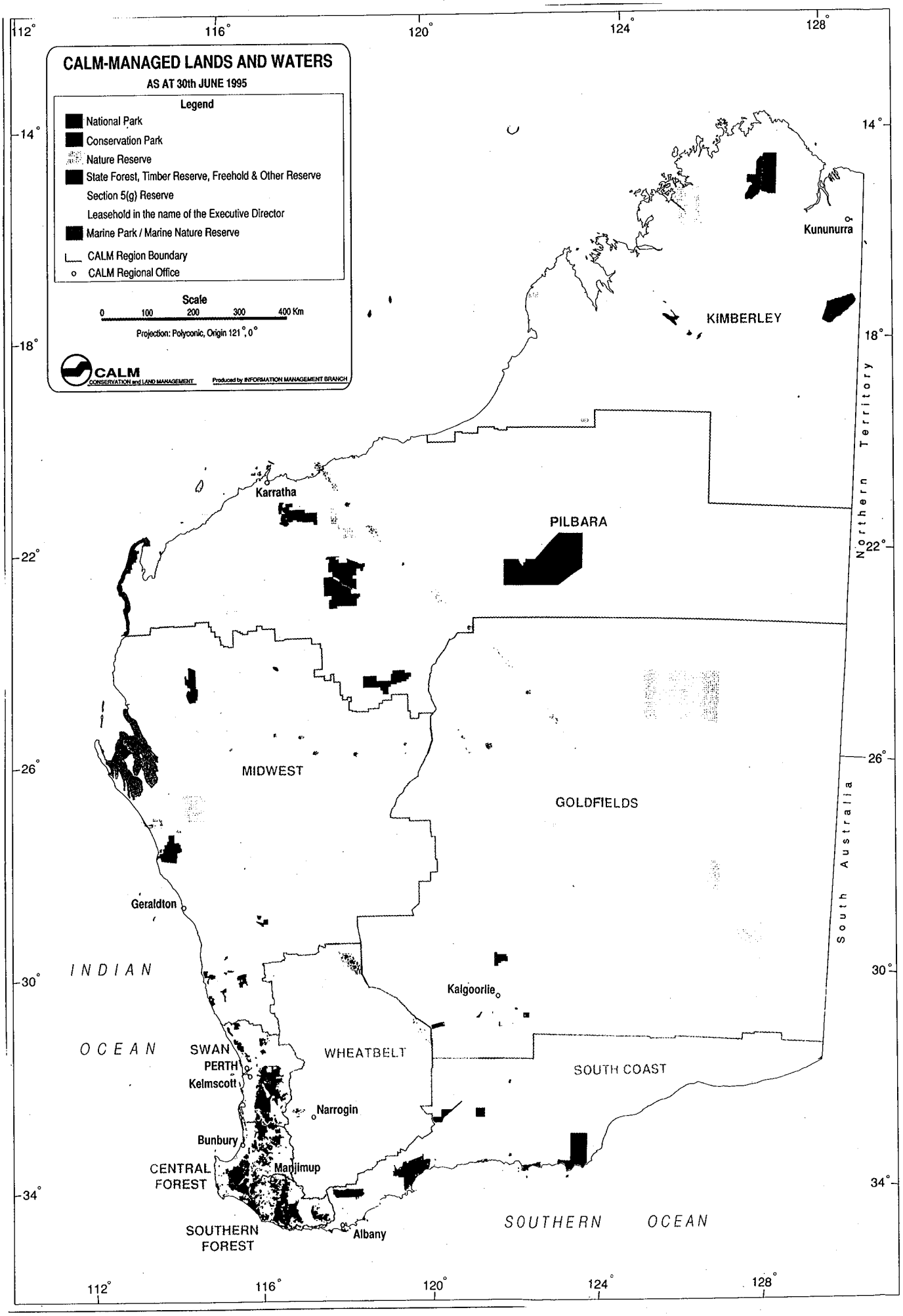
It is the responsibility of CALM to develop the management plans for the reserved lands, section 56. CALM is also responsible (section 33(d)) for the conservation and protection of flora and fauna and is the instrument by which the administration of the Wildlife Conservation Act 1950 is carried out.

It is incumbent upon CALM to ensure that sufficient land for conservation is set aside in reserves such that the natural biodiversity of the state may be conserved and that the ecological processes upon which the conservation of biodiversity depends are not impaired in their function. Figure 1 shows the number of reserves which are currently under the control of CALM for the purposes of conservation within the area of this study.

5.1 Management plans

Management plans have not yet been developed for all areas set aside for nature conservation purposes as required under the Act. The considerable task of gathering biological and other data from these very large areas is a daunting prospect made more so by the lack of staff and of funds to enable the work to be carried out. Extensions to the network of conservation areas will impose additional burdens on an already beleaguered staff.

The problem of the backlog of management plans is exacerbated by the statutory requirement that all new national parks and additions to national parks must be subjected to a review of the biological, mineral and petroleum resource values before they are declared. As a consequence most areas of conservation value are now being set aside as Class C Nature reserves or conservation parks in order that they might be secured within the conservation estate.


CALM-MANAGED LANDS AND WATERS
AS AT 30th JUNE 1995
Legend
National Park
Conservation Park
Nature Reserve
State Forest, Timber Reserve, Freehold & Other Reserve
Section 5(g) Reserve
Leasehold in the name of the Executive Director
Marine Park / Marine Nature Reserve
CALM Region Boundary
CALM Regional Office
Scale
0 100 200 300 400 Km
Projection: Polyconic, Origin 121°, 0°
CALM
CONSERVATION and LAND MANAGEMENT
Produced by INFORMATION MANAGEMENT BRANCH
112°
116°
120°
124°
128°
14°
18°
22°
26°
30°
34°
Kununurra
KIMBERLEY
Karratha
PILBARA
Northern Territory
South Australia
MIDWEST
GOLDFIELDS
Geraldton
INDIAN
OCEAN
Kalgoorlie
SWAN
PERTH
Kelmscott
WHEATBELT
SOUTH COAST
Narrogin
Bunbury
CENTRAL FOREST
Manjimup
SOUTHERN FOREST
Albany
SOUTHERN OCEAN

5.2 Alternatives for the acquisition of land with conservation values

There are four additional ways in which CALM may acquire land for inclusion into its managed estate or may influence management of the land for conservation purposes. These are:

- outright purchase of a pastoral lease, or a part if permitted by the Pastoral Board; section 15 of the CALM Act
- management agreements with the holders of existing pastoral leases; MOUs and section 16A
- through business undertakings with pastoralists for the management and production of sandalwood, and
- through an association with the Commissioner for Soil Conservation in the declaration of a soil conservation reserve under the Soil and Land Conservation Act

The adoption of any of these courses would depend upon the nature of the reservation in question; its size, its shape, its location and the objectives of the reservation. These matters are discussed more fully in section 8.

6. LAND USE IN THE RANGELANDS USED FOR PASTORALISM AND CONDITION OF THE LAND.

The principal holders of land in the study area are pastoralists, most of whom graze sheep or cattle for profit. Some pastoral lessees are mining companies, some of whom graze domestic stock in the traditional manner, while others take the opportunity to destock the leases after obtaining approval from the Pastoral Board.

Miners operating under the Mining Act have title rights over almost all of the pastoral areas, but use only a very small proportion, less than one percent, intensively. Other occupants include Aboriginal communities who have title to land. In a few instances tourist and other commercial ventures have been excised from a lease.

Pastoralism began in the 1860's, in the south near Mullewa, and in the north near Dampier. By the 1900's most of the best quality land was occupied, but new leases continued to be alienated up into the 1960's. Leases taken up in the years following 1900, particularly from the 1930's onward tended to be less productive and less durable, but still offered the potential lessees the opportunity to hold land and to develop it for grazing.

6.1 The Pastoral Industry

Table 4 shows most of the vital statistics for the pastoral industry in Western Australia. The data were provided by the Department of Agriculture.

Table 4 Pastoral activity indicators in Western Australia

	South of Kimberley	Kimberley	Total
Areas of leases (sq km x 1000)	689	251	940
Number of leases	434	93	527
Number of separate businesses	367	60	427
Area of the state (%)	27	9	36
Sheep numbers (x 1000)	2464		2464
Sheep as % of state total	8.3		8.3
Gross value of production ($M)	75.9		75.9
Cattle number (x 1000)	253.2	487.6	740.8
Cattle as % of state total	15	29	44
Gross value of production ($M)	22.8	29.1	51.9
Gross value sheep & cattle prod. ($M)	98.2	29.1	127.3
% Gross value of State agric. prod.	2.9	0.9	3.8

It is useful to compare some of these data with those of Shires in the South West Land Division as shown in Table 5.

Table 5. Sheep and cattle numbers for shires shown (1993/1994)

	Esperance	Gnowangerup	Broomehill
Sheep	2.23 million	709,070	382,543
Cattle	89,818	6,427	1,486
Area of shire (sq km)	42,450	5,000	1,376

Given the higher turn-off rates for sale sheep and assuming that wool returns are about the same, returns in Esperance alone are probably equivalent to the returns from sheep in the pastoral area.

In the pastoral sheep industry operating in the south of Kimberley area Wilcox and Cunningham (1994) stated that there were 322 leases operating as 280 separate businesses. One-third of these leases supported less than 4,000 sheep while half had between 4,000 and 12,000.

Anon, 1979, showed that there are about 4,000 people living and employed on stations.

6.2 Financial situation of lessees

The history of the exploitation of the natural grazing lands of WA has been described by Burnside (1979) who identifies five periods in its development and maturation. These were exploration and early settlement 1850 - 1880; expansion 1880 - 1930;decline 1930 - 1950; recovery 1950 - 1970; and the last period, 1970 - 1979, as troubled. In the period 1979 - 1995 the industry has continued to be troubled and is quite evidently now in decline.

Several factors can be held responsible for the decline in the fortunes of the industry.

The principal factors are:

- a decline in terms of trade - a catastrophic collapse on wool prices and an increase in the costs of production of both meat and wool.
- a loss of drought durability and pastoral productivity as a consequence of decades of inappropriate land management.

Other factors contributing to the decline have been

- an increase of indebtedness per head of stock carried
- an inability to increase size of flock or herd
- an inability to maintain costly infrastructure

- an inability to enhance productivity per unit of stock
- the absence of economically viable alternatives to pastoralism as the prime use of the land.

The Pastoral Wool Industry Task Force (PWITF, 1993), identified wool price and business size as critical to survival in the pastoral industry. In 1979, the Jennings report, Anon 1979, suggested that there were about 150 non-viable pastoral leases and that only 10,000+ sheep flocks were then showing a small surplus. The PWIFT concluded that the situation had deteriorated since that time. In fact, only five Land Conservation Districts, Gascoyne-Wooramel, Lyndon, Murchison, Nullarbor and Kalgoorlie, were operating, on average, in positive dollar balance. The PWIFT concluded that "the evidence is overwhelming that while individual pastoral enterprises will continue to operate profitably, the pastoral wool industry in its current form will not survive in the future under the current wool price outlook". It was expected that 30 - 60 per cent of wool pastoral business would leave the industry. Apart from a minor upturn in the first half of 1995 wool prices have not risen and have fallen further since 1993. The financial position of lessees has worsened, and ABARE does not expect a significant price rise for at least three years.

On a broader canvas Wilcox and Cunningham (l.c.) showed that the Western Australian sheep industry was in dire straits financially and that the wool price had to increase by at least 50 per cent over then existing levels for there to be a surplus to meet owner needs, debt servicing and improvement replacements. Should a drought intervene the financial situation of most wool growers would be extremely difficult.

Cattle stations south of the Kimberley in Western Australia were possibly profitable in good seasons, but would suffer financially if returns were down during the drought. The recent ability acquired by stations in the Pilbara to ship live cattle overseas has boosted the prospects of these properties.

Government has responded to the parlous state of the pastoral industry by proposing a number of economic and structured change initiatives which are underpinned by the assumption that ecologically sustainable development principles will apply. It is considered that these measures will be palliative, at best, for many properties; especially those with high debt loads, low inherent carrying capacity and run-down improvements. While amalgamation of some leases will doubtlessly ensue, enabling economies of scale to be taken advantage of, many properties will be available for purchase or will, instead, be taken up by those whose expectations are not as high as those now occupying them, or by those who want to use the land in a fashion other than that of the current lessees.

6.3 Regional profitability in the pastoral sheep industry

Holm et al., (1995), have made a comprehensive study of costs of production and of income from sheep in the pastoral wool section of the rangelands which extends from Exmouth to Kalgoorlie and includes an outlier near Roebourne. Using regional differences created by land capability which includes water supplies, seasonal variability, wool quality and quantity and other productive parameters including sheep sales, they have been able to discriminate between the Land Conservation Districts which comprise this area, figure 2. They have been able to place these districts into groups on the basis of their potential for sustainability at conservative stocking levels.

Two approaches were used to determine the regional relativities. These were, firstly, a weighted index approach in which production indices and cost indices derived from an evaluation of the production, cost and return variables in each LCD were used to derive a single index of profitability. In the second the economic sustainability of production was assessed for average business in each LCD.

The weighted index approach permitted the separation of the LCD's into four groups as shown in Table 6.

Table 6. LCD's arranged according to profitability index and sustainability.

Group Number	Sustainability	LCD's	Profitability index range
1	Most sustainable	Gascoyne - Wooramel Lyndon	0.9 - 1.0
2		Nullabor - Eyre Highway Roebourne - Port Hedland Murchison, Mt Magnet	0.6 - 0.77
3		Kalgoorlie, NE Goldfields, Cue	0.43 - 0.49
4	Least sustainable	Meekatharra, Wiluna, Sandstone, Yalgoo Upper Gascoyne	0.0 - 0.29

The economic analysis using a standard 10,000 sheep unit showed that there were profitable or sustainable properties in all LCD's. However, six LCD's

- Roebourne - Port Hedland, Sandstone, Shark Bay, Upper Gascoyne, Wiluna and Yalgoo were the least sustainable in both actual property size and standard sheep unit assessments.

Figure 2 BREAKEVEN WOOL PRICE -
(cents per kilogram of clean wool) for a
10,000 Sheep Unit Pastoral Wool Business

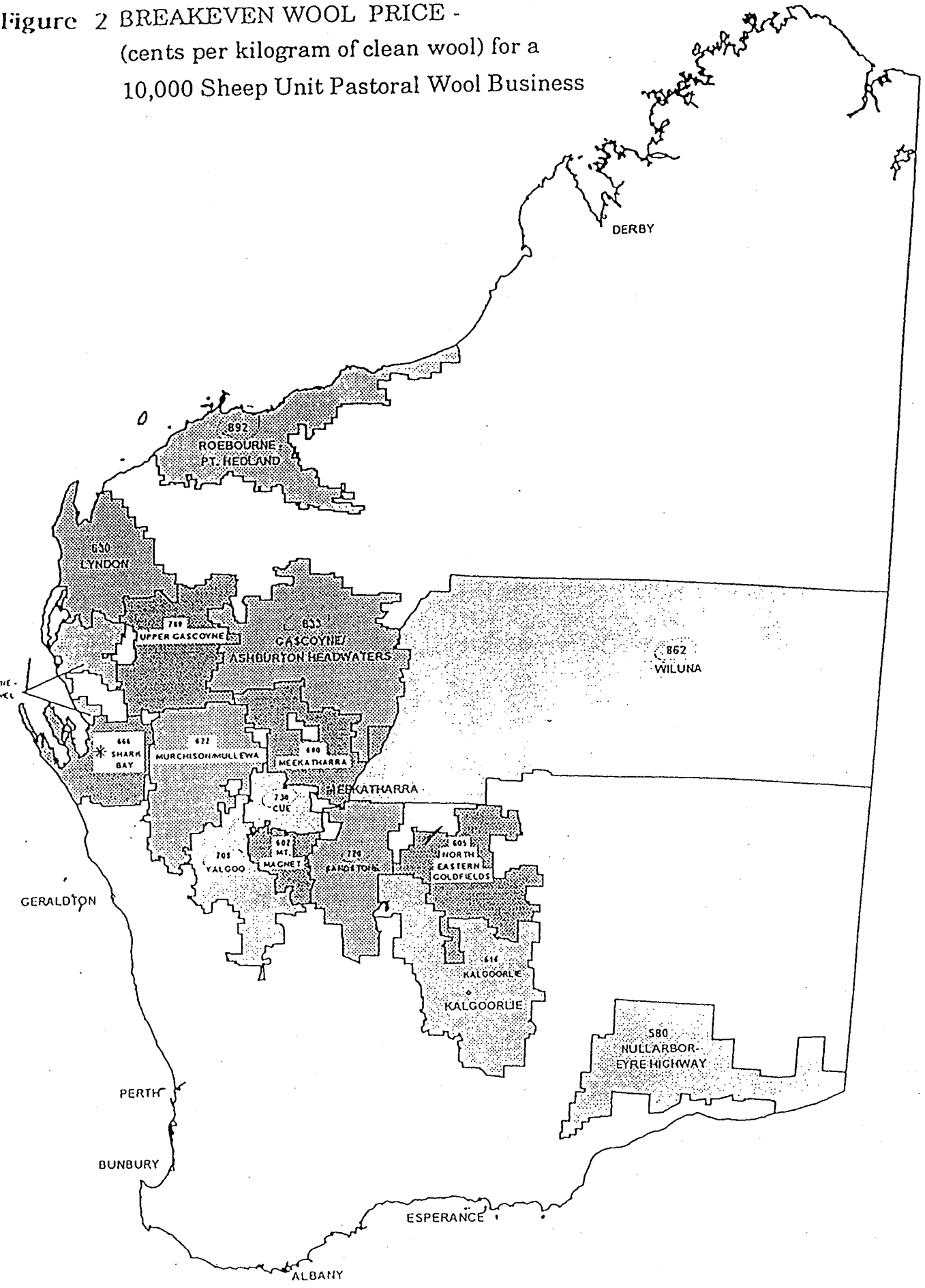


Figure 3 from Holm et al. (1995), shows the profitability and breakeven wool price of the LCD's shown in Figure 2 when actual business size in each district is taken into consideration. The breakeven wool price for each district is also shown. The relatively superior position of Meekatharra LCD in this economic analysis compared with the weighted average is a function of lower micron wool clips produced in that district.

The rankings given admittedly mask the good performances of individual properties within each LCD. These are individual properties in the least sustainable group which are operating profitably. Rankings are, however, a good guide to those areas which are likely to remain in pastoral production and to those where the financial position of lessees is increasing untenable.

The analysis has also provided an opportunity to arrange the LCD's in terms of their average gross margins i.e. gross returns per sheep for wool and meat less the costs of production which might be ascribed specifically to these animals. Table 7 shows the average gross margins for six of the districts.

Table 7. Gross margins for the LCD's shown assuming 10,000 DSE flock (from Holm et al.,1995)

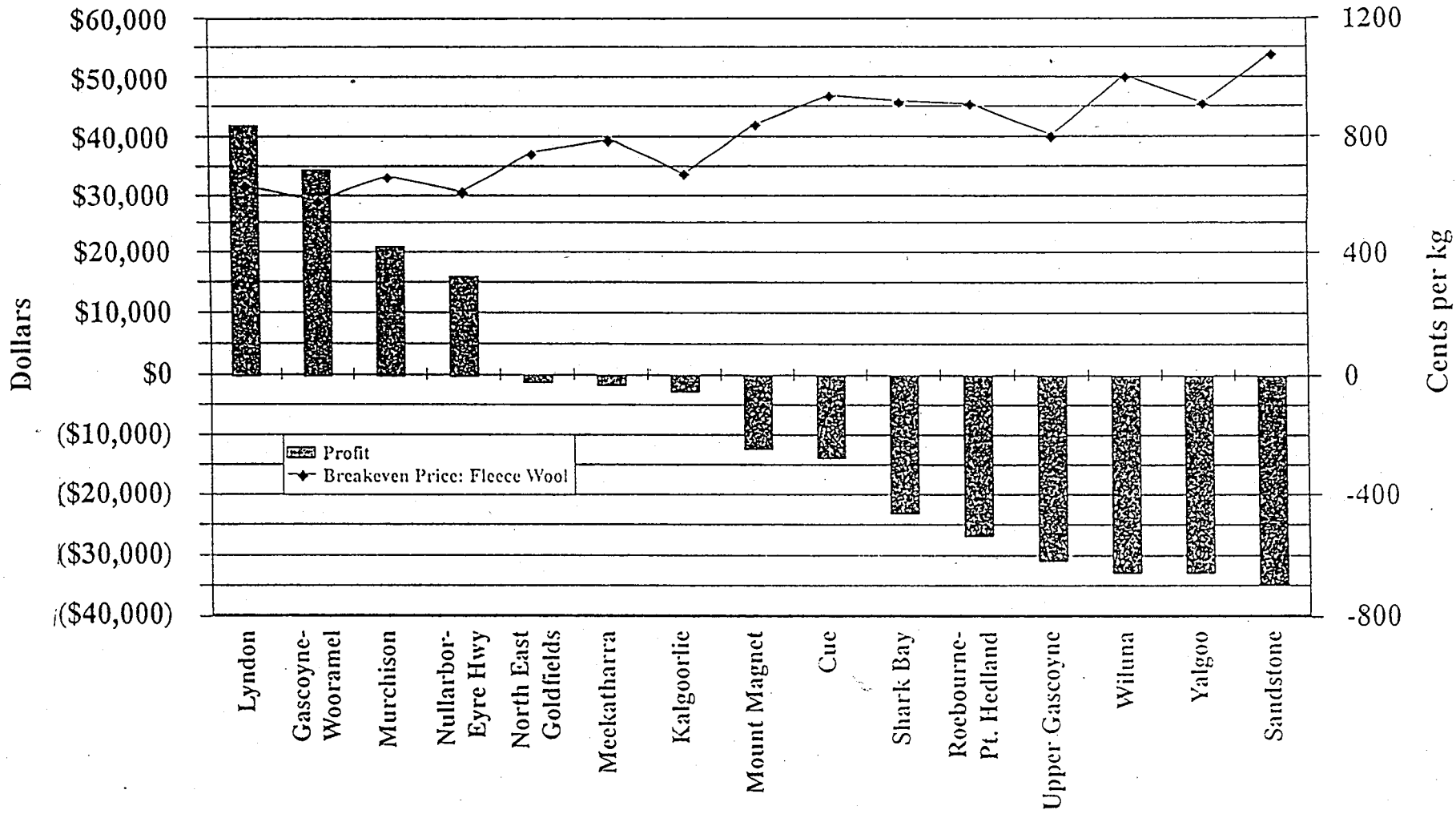
District	Gross per sheep $	Variable costs $	Gross margin $
Gascoyne-Wooramel	16.15	4.06	12.09
Murchison	17.86	3.78	13.08
Cue	19.94	3.90	16.04
Meekatharra	20.66	4.13	16.53
Upper Gascoyne	17.32	4.10	13.22
N.E. Goldfields	20.51	4.12	16.39

It should be noted that gross margins will vary between properties within the same district. Gross margins per ewe will be higher since the margins in Table 7 are based on all animals. Correspondingly, gross margins per ewe will be lower per hectare since one ewe is equivalent to 1.3 DSE.

These figures may be rendered in gross margin per hectare according to the stocking rate assigned to the land using data from Holm et al. Thus, a gross margin of $10 per sheep for example is equivalent to:

- $1.00/ha for 10 sheep/100ha soft spinifex
- $0.70/ha for 7 sheep/100ha mulga hardpan/short grass
- $2.50/ha for 25 sheep/100ha frontage grass/bunch grass

Figure 3. Profitability and Breakeven Wool Price of LCDs.
Actual Average Business Size.



The gross margins per hectare would be used in the determination of the opportunity costs of entering into management agreements of the type to be discussed later.

6.4 Effect of pastoralism on the pastoral resource

Pastoralism in Australia has been held to be the default use for land for which there have been no alternative forms of use, (Wilcox and Burnside, 1995). It is that land where rainfall is so low or erratic that it is not possible to undertake arable agriculture with confidence. Land was consequently leased at very low rates to those who wished to graze stock on natural pastures.

In Western Australia, and in other states, administrators of public land leased for pastoralism were more concerned with ensuring that land was stocked with a minimum number of animals and that improvements such as fencing and water supplies were erected and installed. Prior to 1963 the Land Act did not stipulate the maximum number of stock which might be carried. As Wilcox, 1964, pointed out, land administrators gave no guidance to lessees on proper land management practices. It was no wonder that the pastoral resource deteriorated in this state as it did in all others. Administrators must, with pastoralists, share the blame for this decline.

The SOER states that 7.5 per cent of the area leased for pastoral purposes suffers from soil erosion and that 2.5M ha out of 95.8M ha are severely degraded and eroded, though not all parts of the pastoral zone were reported on. Assessments of range condition undertaken by the Departments of Agriculture and Land Administration were collated by the Environmental Protection Authority in November 1995. The type and extent of the degradation is shown in Table 8.

Table 8. Estimated areas of types of resource degradation for areas shown

Zone	Area	Wind erosion		Sheeting/rilling		Gullying		Poor vegetation condition	
	sq km	sq km	%	sq km	%	sq km	%	sq km	%
Pilbara Gascoyne Murchison	520,636	41,130	7.9%	33,321	6.4%	833	1.6%	111,416	21.4%
Goldfields	180,770	5,423	3.0%	5,423	3.0%	904	0.5%	21,692	12.0%
Nullabor	61,717	1,234	2.0%					*15,429	25.0%
Totals	763,123	47,787	6.0%	38,744	5.0%	9,234	1.0%	148,537	19.0%

* Principal agents - rabbits and fire.

More detailed analyses of parts of the arid rangelands have been undertaken during resource inventory and condition surveys. The results are shown in Table 9 for the area discussed in this paper.

Table 9. Resource condition summaries for the areas shown.

Region	Area sq km	No. of traverse observations	Resource condition assessments % if traverse assessments		
			Good	Fair	Poor
Gascoyne	63,400	2,426	32	53	15
Ashburton	93,600	8,608	64	27	9
Carnarvon Basin	74,000	10,952	45	32	23
Murchison	88,360	13,441	21	37	42
N.E. Goldfields	100,570	10,470	39	32	29
Total	418,930		40	36	24

About one quarter of the rangelands in the arid shrubland zone are in poor range condition.

Curry et al. (1994), for the Murchison, and Pringle et al. (1994), for the North-eastern Goldfields make detailed observations on the impact of grazing upon the separate pasture classes which are grouped according to their potential for grazing.

Curry et al, were able to show that the lands of high pastoral potential i.e. accessible, mostly depositional land systems receiving run-on water and supporting palatable species.

- had high rates of erosion incidence
- exhibited widespread accelerated erosion
- had mainly poor or fair vegetation condition

The areas of severe degradation and erosion in the Murchison area were located mostly in the valley trains of the major and minor trunk drainages.

The lands of low or very low pastoral potential, the hill lands, the drainage plains with shallow soil and the non-saline undulating, stony uplands were little affected by erosion and degradation with the exception of these alluvial plains which lacked a protective stone mantle. The vegetation condition of these lands was usually good to fair.

Field data obtained by Pringle et al. showed that 29 per cent of 10470 observation sites were in poor condition. However, on average, the lands with a high potential were in better condition than the others. Lands with moderate potential were in fair to poor condition. It was believed that the good condition of the high potential land in the North eastern Goldfields was related to the difficulties experienced in obtaining stock water there and to the moderate stocking policies of more recent years, both factors favouring the conservation of the land.

While the methodology adopted by both groups of authors included assessments of perennial shrubs and herbaceous shrubs and soil conditions, it was contended (by Pringle et al.) that the composition and density measurements were a surrogate for measures of the efficiency of ecosystem functioning. The reduced perennial cover and the diminished diversity of 'poor' condition sites provided the evidence for change in the ecosystems.

An examination of the field data for all survey areas, except perhaps for the North-eastern Goldfields shows, as Curry found, that the better watered lands, those on depositional surfaces with alluvial soils and receiving run-on water, and those which were most accessible to stock were the pasture lands which were most degraded. The hill lands, arid and stony uplands and the spinifex sandplains were in general in good range condition.

Morton and Stafford Smith (1994), would place these degraded areas of high potential into two classes termed either fertile landscapes (chenopod shrublands) or fertile pockets in a background of infertile soils (run-on areas in Acacia woodlands for example).

The deterioration of the habitats within the fertile landscapes and fertile pockets has great significance for conservation. Equally, the complex mosaic or distribution of islands of fertility has important connotations for the development of a comprehensive, adequate and representative reserve system. This will be discussed later in this document.

6.5 Impact of feral animals

While camels and donkeys have made an impact on the rangelands in restricted areas south of the Kimberley, feral goats have had an enormous impact on the vegetation in their zone. Southwell and Pickles, 1993, made aerial surveys of 1.2 million sq km of the state including all of the pastoral lands south of the Kimberleys in the period 1987 to 1990 in order to estimate the numbers of both kangaroos and goats and their distribution in this region. Their surveys indicated that goat populations ranged from 363,000 to 596,000 and that the contribution of feral goats to the grazing biomass was increasing. In the period of the survey the zones of highest density they recorded moved from the North-eastern Goldfields in 1987 to the Murchison and the coastal Gascoyne in 1990 suggesting a capacity for migration across the pastoral zone.

Pastoral lessees have recently begun coordinated programs aimed at goat eradication. Since the fecundity of the population is high it is necessary that the removal rate is maintained at a high level. It is doubtful whether the annual 'take' of 187,000 between the years 1987 - 1990 will have a significant impact on grazing biomass.

Goat populations will have a major impact on the attainment of conservation objectives in the pastoral zone. Fletcher, 1991, has shown that they have considerable overlaps with sheep in terms of dietary preference and should be regarded with as much apprehension as

the sheep flocks for their impact on fragile ecosystems. Their ability to move across country unimpeded by standard fencing will make conservation reserves open to their depredations. Neighbouring pastoral lease holders of land would expect conservation interests and others to be as vigorous in their pursuit of goat eradication campaigns as they are.

In parts of the rangelands, particularly the Nullabor and in pockets associated with calcareous valley trains, rabbits are a significant additional grazing pressure.

6.6 Kangaroos

There is general agreement that red kangaroo numbers have increased substantially since the development of the arid pastoral zone following European settlement. Red kangaroo numbers are estimated to be about two million in this area though the numbers vary considerably as a result of seasonal influences.

Although it has been shown that there is considerable dietary overlap between kangaroos and sheep (and goats) and that they adversely affect wool production, there is little information on the effect of these animals on rangeland rehabilitation. Gardiner (1986 a and b) showed that they adversely affected the recovery of Eragrostis eriopoda and Maireana glomerifolia at Yeelirrie in the North eastern Goldfields. Norbury et al. (1993), in a study north of Carnarvon, concluded that the recovery of degraded rangeland pasture is likely to be severely limited unless kangaroo numbers are controlled. These investigations confirm the subjective judgement that red kangaroos are a major grazing biomass. In the event that degraded land is reserved for conservation, and some surely will be in the interest of obtaining access to large fertile patches, control of kangaroos will be a major and costly component of reservation management. Since the home ranges of adult kangaroos are about 26.5 sq km, (Norbury and Norbury, 1993), populations of kangaroos outside reserves will have a major impact on the reserves as will kangaroos within the reserve system.

Wilson (1996) has discussed the existing kangaroo management programs conducted in Australia. The State based, but Commonwealth approved, programs have three basic aims

- to maintain viable population of each species of their entire ranges
- to manage the harvested species as a sustainable resource
- to mitigate the damage to vegetation and the pastoral industry caused by high populations of kangaroo.

Wilson contends that for red kangaroos the annual permitted cull is set only with reference to the first aim, while ignoring the others. He further points out that populations are under estimated though the use of outdated correction factors and consequent sustained yield predictions.

Given the proved adverse impact of high kangaroo numbers on rangeland condition, particularly in periods of low rainfall, there is a need to establish commercial cull quotas which consider regional difficulties in habitat maintenance requirements, in rainfall received and in numbers of animals.

6.7 Cats and Foxes

In addition to the control of herbivores the control of feral cats and foxes will be required in those areas where wildlife values are to be enhanced.

6.8 Weeds and non-endemic pasture species

Weeds are now recognised nationally as a major problem in the pastoral zone. Large areas have been invaded by tenacious weeds which have occupied niches left when the original community elements have disappeared. Important weeds include Onion Weed (Asphodelus fistulosus), Saffron Thistle (Carthamnus lanatus), Wards Weed (Carrichterea annua) and Doublegees (Emex australis).. It is incumbent upon landholders to control declared weeds such as Saffron Thistle. Ideally other weeds such as Onion Weed and Doublegee should also be controlled. Neighbouring landholders would expect CALM to contain weed infestations.

Sown species including buffel and birdwood grasses are considered to be environmental weeds in some situations. Field observations suggest that these grasses will eliminate some bluebush and saltbush species in habitats favoured by them because of their better water relations and higher fertility.

So called woody weed invasions resulting from changes in the plant communities induced by grazing or fire are a different matter. Increaser species such as Turpentine Bush (Eremophila fraseri), Desert Cassia (Senna nemophila) and Needle Bush (Hakea preissei) now occupy tracts of land populated earlier by other species. In some instances, Needle Bush for example, a change back to the original plant community following destocking is unlikely to occur for decades.

6.9 Cattle stations south of the Kimberley

No detailed analysis has been made of the financial situation of cattle producers south of the Kimberley. Wilcox and Cunningham (l.c.) concluded that this industry is viable economically, though the assumptions made were not conservative on a year-in-year-out basis. They point out that returns may not include sufficient for the maintenance of improvements nor were allowances made for debt amortization or taxation.

For those lessees, in the Pilbara especially, able to participate in the live export trade to South-east Asia economic viability is probably not a problem. For those unable to do so and

who are confined to the Western Australian market the financial outlook is not good and for those with debt it is bleak.

Land condition in the cattle grazing country varies from poor in the productive alluvial tracts, marginal to and tributary to the rivers, to good in the largely unused hilly terrain. In this way it resembles conditions in the sheep zone. The attractiveness of the alluvial plains to pastoral lessees resides in the capacity of this land to produce large quantities of short lived pasture following rain. Such land is likely to be held tightly by the current lessees. It therefore presents a significant challenge to conservation interests for the river valleys are important tracts of fertility within a generally rocky and arid infertile landscape.

7. ATTITUDES OF STAKEHOLDERS TO CONSERVATION.

The attitude of the community generally has been discussed in section 3.

7.1 Pastoral lessees

The impact of pastoralism on the rangelands and the present economic instability of the industry is discussed in section 6. It has been shown that grazing by domestic stock has had an adverse impact on the environment, an effect exacerbated by large increases in managed species such as red kangaroos since European settlement and by the large herds of feral goats which are common in the Gascoyne and Goldfields and that recovery of degraded environments in the absence of stock is limited unless such species are controlled.

Conversely, it may be asked what would be the effect of increases in the area of conservation reserves upon the pastoral industry, collectively and individually. The answers can be conjectural only since there is little large scale experience which would assist in the resolution of the issues. A number of points have been made by pastoralists at various forums some of which have been discussed by Wilcox (1995). They are as follows:

- An increase in the conservation estate at the expense of pastoral lessees means a reduction in the number of constituents in the industry and a loss of position for the industry. Its ability, collectively, to bargain on other matters affecting the industry could be seen to be weakened.
- A reduction of leases in favour of conservation will result in a reduced production of commercial products and an associated diminution in the public infrastructure which now services the industry. While this apprehension has currency in the Northern Territory and the Kimberley, it may be less significant in the sheep grazing pastoral industry since this infrastructure there is largely supported by a vigorous mining industry.
- There may be some opposition to the inclusion of new players, i.e. conservation interests such as CALM into the management decision arena now occupied almost exclusively by the pastoral industry. There could be a perception that decisions made in the Regional Development Commissions and affecting pastoralism may favour conservation interests.
- Equally, a strengthening of the stability of the resident population through its involvement in conservation, as discussed elsewhere, would be seen by many lessees as a positive contribution from conservation to social amenity. Many pastoralists value their ability to live in their chosen environment free of the pressures which exist in areas where social interaction and responsibility is ever present.

The Pastoralists and Graziers Association policy in respect of conservation in the rangelands mirrors that outlined above. Fundamentally, the Association has no objection to the acquisition by CALM of pastoral leases for the purpose of conservation.
The Association has enumerated its concerns about the subsequent management of land so acquired. They are listed below:

- properties acquired for conservation should be treated in the same way as pastoral leases in respect of responsibilities for land management. Feral and declared managed animals or pest species including weeds, should be controlled, boundary fences should be maintained and there should be adequate bushfire control.
- the PGA is concerned about the trend to purchase leases and the subsequent transfer of these to the CALM managed estate which in the eyes of the Association seems to absolve CALM from assuming its social responsibilities for pest management, fire control and pest maintenance.
- there are concerns that CALM may not have sufficient funds for the management of leases it acquires once purchase has been effected.
- the PGA would welcome an opportunity to participate in the formulation of policy in respect of conservation
- the perception that CALM, or other agencies, will not pursue the control of feral animals and other managed species with the same vigour as pastoral lessees could lead to disaffection with the conservation interests and even to outright dispute. This issue needs to be addressed since the alleged difficulties in achieving adequate feral and managed species control in conservation reservations in other states figure largely in the minds of the pastoral community. This view may not be shared by all pastoralists, for example by those who surround the Kennedy Range.

7.2 Conservation Council of WA

The Conservation Council of WA has an arid lands policy which is printed below. The objectives of the policy are to establish representative reserve systems throughout the arid zone particularly in those areas where there are currently severe deficiencies. The Council recognises the need to establish the pastoral industry on an ecologically sound basis. It also introduces the concept of employing former lessees as land managers for conservation and other purposes.

Conservation Council of WA Arid Lands Policy

"The arid lands of Western Australia are suffering from long-term land degradation, loss of biodiversity, inadequate representation in the conservation estate and serious economic problems.

Currently in WA those arid lands used for pastoral activities are leased to pastoralists on long-term leases. 38% of WA is leased for pastoral activities.

The Australian arid zone has lost more mammal species than any comparable area in the world. Most inland areas have lost about half the original numbers of ground dwelling mammal species. The status of other species such as birds, invertebrates, reptiles etc is poorly known. Biodiversity is being lost at a rapid rate.

There are many plant and animal species and communities in the pastoral areas that are not adequately represented in the present reserve system. There are many unimplemented proposals for new reserves made in the EPA Red Books or resulting from biological surveys. There are deficiencies in the reserve system in areas such as Ashburton, the Gascoyne, Carnarvon, Kimberley, the Goldfields and the Nullarbor.

Land degradation is extensive in the rangelands with all rangelands affected by some form of land degradation. The Department of Agriculture has estimated that land degradation is costing the state $74,000 per lease per year.

At present the pastoral industry is suffering chronic economic hardship and many pastoral properties are uneconomic. Prices for produce are down, costs of inputs continue to climb, productivity is not reliable and debt levels are increasing.

The pastoral industry needs restructuring to ensure:

- ecologically sustainable land use
- the viability of leases or parts of leases that are potentially viable
- phase-out from pastoral use of leases or parts of leases that are not viable for pastoral activities for conversion to other uses, e.g. conservation, tourism.

Arid lands have uses other than grazing domestic animals. These include conservation, tourism, recreation, mining and Aboriginal rights and requirements.

There are many other issues which need to be addressed such as ownership, diversification, conflicting landuse, environmental assessment, control and monitoring. These issues need to be resolved before any changes are made to the land tenure system.

Policy

1. An adequate conservation reserve system in arid lands must be established prior to any change of tenure for landusers in the arid lands.
2. All native title, as recognised by the High Court and enshrined in Commonwealth legislation must be fully recognised.
3. Where after full land capability studies are carried out it is established that pastoral activities can be viable, ecologically sustainable management must be the objective.
4. Where land capability studies establish that areas are not viable for pastoral activities, those properties should be phased out of pastoral use, that is, the hard-hooved domestic animals removed. These could be converted to other uses such as conservation and tourism.
5. Where pastoral leases are phased out, the pastoralists should be given the option of staying on as land managers for conservation and related purposes, funded by the State and Federal Governments.
6. No-one should be given perpetual tenure. Where pastoral activities are to continue, leases should be 50-year rolling leases with 7-year reviews.
7. Full environmental assessment should be carried out before alternative land-use options proceed. For example, tourism developments must be fully and publicly assessed for environmental impact.
8. Management plans must be drawn up for all viable pastoral leases that are to continue, with lease renewal to be conditional upon the satisfactory implementation of the plan.

7.3 Aborigines

As far as can be ascertained there are no specific conservation perspectives developed by the Aboriginal Land trusts in the area. Head (1994), also points out that there are little quantative data available which would define Aboriginal approaches to conservation or multiple land use. She states that conservation within a multiple land use system is a cross-cultural issue. Rather than argue that Aboriginal concepts of land use are universally appropriate or even applicable in a changed world, she is of the view that their store of accumulated wisdom should be used in defining management policies for conservation within reserve systems.

But what is this store of accumulated wisdom there being no written text? Rose (1995) tries to identify it for the area within the purview of the Central Land Council in the Northern Territory. There, it was concluded that European notions of conservation are not well understood by Aboriginal people since they are not acquainted with intervention in the

control of processes and events, regarding themselves instead as being integrated with the environment. Rose feels that, for Aborigines, the motives for conservation management are obscure and not relevant to the hunt for sustenance. Aborigines consider that without Aboriginal law in operation conservation practices may be irrelevant. This view stems from their stance regarding the ownership, control and management of land outside a conservation reserve system. It might appear therefore that Aboriginal concepts for land use and those of the European conservation movement are not congruent.

Williams and Johnston (1995) restate Head's conclusions and argue that land ownership is a prerequisite for the application of Aboriginal ecological knowledge. They refer to extensive consultation in western NSW and elsewhere as support for this view.

It is difficult, in the view of the above authors, to see Aboriginal involvement in the fullest sense of cooperation with conservation reservations without attention being given to the question of land ownership. If it is accepted that land use is inextricably mixed with land ownership in Aboriginal eyes, some Aboriginal oriented policy of conservation may then arise. Until the ownership issue is accepted the contribution is unlikely to be significant.

7.4 Environmental Protection Authority

The Environmental Protection Agency charter requires it to protect the environment and to prevent, control and abate pollution. The Authority proposes to interpret this mission in the broadest sense and wishes to work with the teams established by Government to implement the 'Managing the Rangelands' initiatives. To this end it has developed a preliminary position which goes beyond the present understanding of its role in the management of biological resources.

In a draft paper the EPA has prepared a response to the varied calls for action to conserve the resources in the rangelands. It has enunciated some preliminary principles for sustainable development and environmental protection. It is argued that the bland objective contained within the 'Managing the Rangeland' statement that environmental objectives for broadscale land use will be established begs the question of what information is required, who will collect it and who will administer the land use systems which will be derived.

In a development of this theme the draft document discusses the need for integrated assessments of the biological information so that the desirable outcomes of harmonious land use will be achieved. It is considered that resource allocation should be made on the basis of the greatest long term community benefits. The implied list of tasks for research and administration alike is enormous and the completion would require a Herculean effort by all parties though the document states that the absence of scientific certainty should be no reason for postponing measures which favour conservation.

The new proposals call for it to investigate the development of environmental legislation which will underpin and guide resource management in the rangelands. Further, it will undertake the process of reserve selection through an enhancement of the CTRC approach and will protect high conservation value habitats and land systems. It is also concerned at the lack of response by existing administrations to conservation needs in the rangelands.

While these objectives are laudable it is difficult to see how the EPA will achieve its objectives other than by its membership of the various steering committees.

8. OPPORTUNITIES FOR CONSERVATION IN THE ARID PASTORAL ZONE

The above discussion has revealed a number of features characterising the arid pasture zone. These are:

- insufficient land has been allocated for conservation purposes throughout; the present and proposed reservations for conservation are inadequate
- important ecological environments have been omitted from the Red Book proposals for the area - systems 8, 9, 10 and 11.
- the community at large considers that the rangelands offer opportunities to put conservation into practice and that pastoralism is not always a desirable use of the land
- conservation groups favour the creation of more reservations to extend the coverage to neglected environments; pastoralism should only be practised in the area if it is ecologically sustainable
- the pastoral industry has no opposition to the formation of reserves for conservation or to the purchase of pastoral leases for conservation provided that land husbandry appropriate and that conservation is socially responsible,
- Aboriginal groups have no conservation policy per se, saying there can be no land stewardship without land ownership,
- the pastoral wool industry is in a calamitous financial situation with no immediate prospects for a turn-round in its fortunes; stations or part stations could be available for purchase; similar observations can be made about the cattle pastoral industry south of the Pilbara,
- land degradation is widespread throughout the arid pastoral zone; the more accessible, better watered and more fertile larger tracts and smaller fertile inclusions have been reduced significantly in condition; fertile lands, being well watered are important to the functioning of conservation in arid lands and should be included, even if degraded, into a reserve system.
- the 'Managing the Rangelands' policy calls for the identification and establishment of the comprehensive reserve system representing the full range of habitats and communities and for the conservation of biological diversity through strategic action.

CALM has the charter for the conservation of the biological diversity of the arid pastoral zone. This review shows that it has the mandate from government and the community to extend its network of reservations to achieve this aim. It is unlikely to find opposition to an increase in the conservation estate from individual pastoralists or from the pastoral industry as a whole. In some instances acquisition of leases will be welcomed, the pastoral industry

recognising that it has run its course as the sole occupier of these lands and is now looking for alternative means to support itself.

8.1 What Should Be Reserved

8.1.1 Description and Location

Hopkins et al. (1985) have shown the lamentable lack of adequacy of coverage by the current reserve system in the arid rangelands, section 4. Their review goes well beyond the judgments of the Red Book Status Report. In addition Morton et al. (1995) have identified specific targets for conservation in five refugia important for biological diversity in the region. They are Lake Annean, Wooleen Lake, Lake Barlee, Lake MacLeod and the lower Murchison River.

Hopkins et al. using a coarse grid of 1:1M map sheets were able to demonstrate the general distribution of the inadequately reserved vegetation types. One hundred and eighty vegetation types were inadequately represented in the Pilbara and Murchison which is broadly the area covered by this review. Additional unreserved types would almost certainly be found on the west of the Great Victoria Sheet east of Wiluna, in the north-east corner of Swan sheet and in the north-west of the Nullabor sheet which are included in the arid shrub zone. Since their project also provided a new map of the vegetation of Western Australia based on Beards 1:250,000 series it is possible to locate the unreserved types within the biogeographical stratification proposed by Thackway and Cresswell (1995) and shown in Figure 4.

This seminal work allows for the first time a quantitative assessment of the needs of conservation on a regional basis and an evaluation of the potential for reservation or other conservation orientated form of land use against a background of existing land use.

For example, it is possible to identify that Acacia quadrimarginaea communities, jam on greenstones and mulga with snakewood are poorly represented in the Pilbara. Acacia sclerosperma, minnieritchie, bowgada scrub and jam scrub are in turn poorly represented, with many others in the Murchison. A complete assessment of the gaps in the conservation network can be made after a detailed and comprehensive review of Hopkins et al.

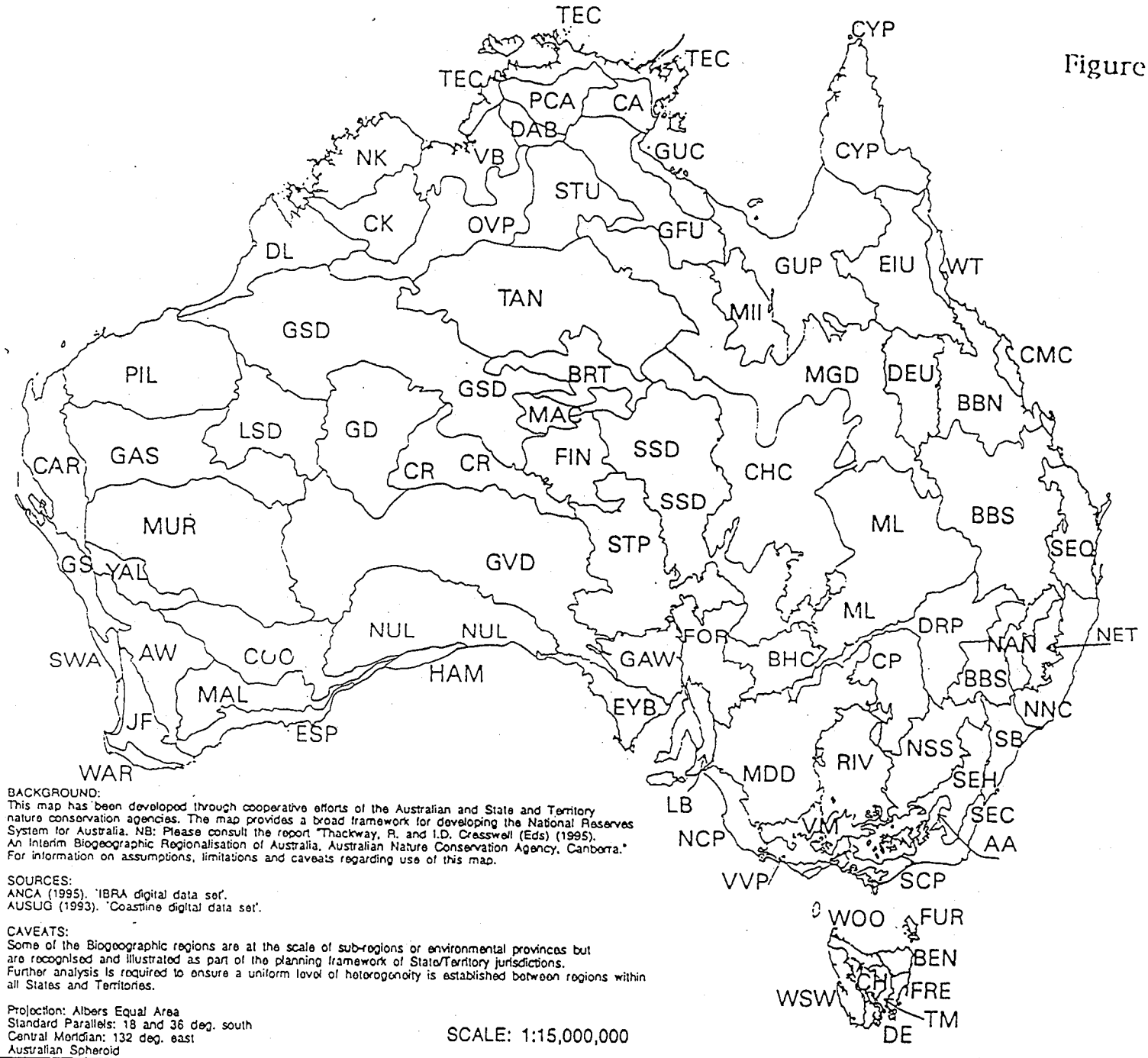
8.1.2 Suitability for conservation - the CAR criteria for admission into the reserve system.

McKenzie (priv.comm.) recommends that three criteria be considered in the definition of a reserve system:

- It must be comprehensive (C), including at least one example of each ecosystem type. This criterion begs the questions of scale and of ecosystem function. To a large extent

Boundaries of IBRA Regions

Figure 4



BACKGROUND:
This map has been developed through cooperative efforts of the Australian and State and Territory nature conservation agencies. The map provides a broad framework for developing the National Reserves System for Australia. NB: Please consult the report 'Thackway, R. and I.D. Cresswell (Eds) (1995). An Interim Biogeographic Regionalisation of Australia, Australian Nature Conservation Agency, Canberra.' For information on assumptions, limitations and caveats regarding use of this map.

SOURCES:
ANCA (1995). 'IBRA digital data set'.
AUSLIG (1993). 'Coastline digital data set'.

CAVEATS:
Some of the Biogeographic regions are at the scale of sub-regions or environmental provinces but are recognised and illustrated as part of the planning framework of State/Territory jurisdictions. Further analysis is required to ensure a uniform level of heterogeneity is established between regions within all States and Territories.

Projection: Albers Equal Area
Standard Parallels: 18 and 36 deg. south
Central Meridian: 132 deg. east
Australian Spheroid

SCALE: 1:15,000,000

queries on comprehensiveness will be answered by a critical examination of the data from the first stage in which gaps in the reserve network and the descriptions of these gaps are identified.

- It must be adequate (A). Will the reservation adequately provide for the persistence of all of the element of biodiversity and evolutionary processes? From size and shape to location and spacing factors. The context of contribution made by the surrounding lands.

  Morton et al. (1995) show that it is difficult to guarantee the permanent security of plants and animals on any individual reservation in arid Australia because of the impact of capricious rainfall. Therefore consideration needs to be given to the size and shape of reservations or managed areas so that as much as possible of the variability inherent in the system can be accounted for.

  Thus, reservations aimed at the floodplains will necessarily be long and sinuate to encompass the variability and to provide for security. Such refugia have special problems of boundary effects which must be considered in planning. Reservations in hilly terrain may, more reasonably, be in solid blocks. Reservations in the former type may comprise a greater proportion of the available land than that of the latter since the former is restricted in extent. In some instances important refugia may require total reservation of a piece of land.

- The reserve system must be designed to optimise representativeness (R) in a cost effective way. It should contain the full range of species expected in the environments being conserved. This is not to say that every element of biodiversity needs to be made secure in reserves. Indeed the work of Morton et al. (l.c.) would suggest that this would be inappropriate since all land would need to be reserved, natural variability being so great even in the arid environment.

Achieving a fully representative reserve system also implies a knowledge of species occurrence and distribution and of ecosystem function which may not be complete. It is contended that this deficiency should not invalidate the selection of reservations nor impede progress towards the sequestration of the land for conservation purposes. Indeed to delay until all information is available would defeat the objectives of a conservation program.

Pressey (1992) has reviewed the limitations of different forms of data bases which are relevant to the problem of reserve selection. He points out that land systems or their equivalents are geographical subdivisions and, at an acceptable scale, are inherently heterogeneous thereby casting doubt on their applicability for the reservation of all species. Nevertheless, they are a first approximation even though some species may fall through the

net. He suggests that lost species might be targeted through specific, local conservation objectives.

Broad land systems, he states, often do not sufficiently delineate important niches within communities. In hill upland communities, for example, important, saline drainage foci may be obscured in the generalized descriptions given of the land form.. He suggests three further principles to guide reserve selection, those of

- complementarity; once a representative target has been identified, sites should be as complementary as possible to each other.
- flexibility in approach so that there are a number of potential solutions to the conservation proposed; and
- irreplaceability so that the importance of an environment may be properly ranked.

Finally, he makes the point that reservation on its own may not be the only answer to the conservation of biological diversity in the arid zone for the reasons of intense heterogeneity arising out of landform and of capricious and low rainfall. Alternative and complementary procedures will also be required to achieve the aims of conservation. It would appear, however, notwithstanding Pressey's concerns, that there is no valid reason why the currently massive gaps that are apparent in the reserve system even at continental scales of resolution cannot be defined from present information, and potentially suitable sites for reservation distinguished.

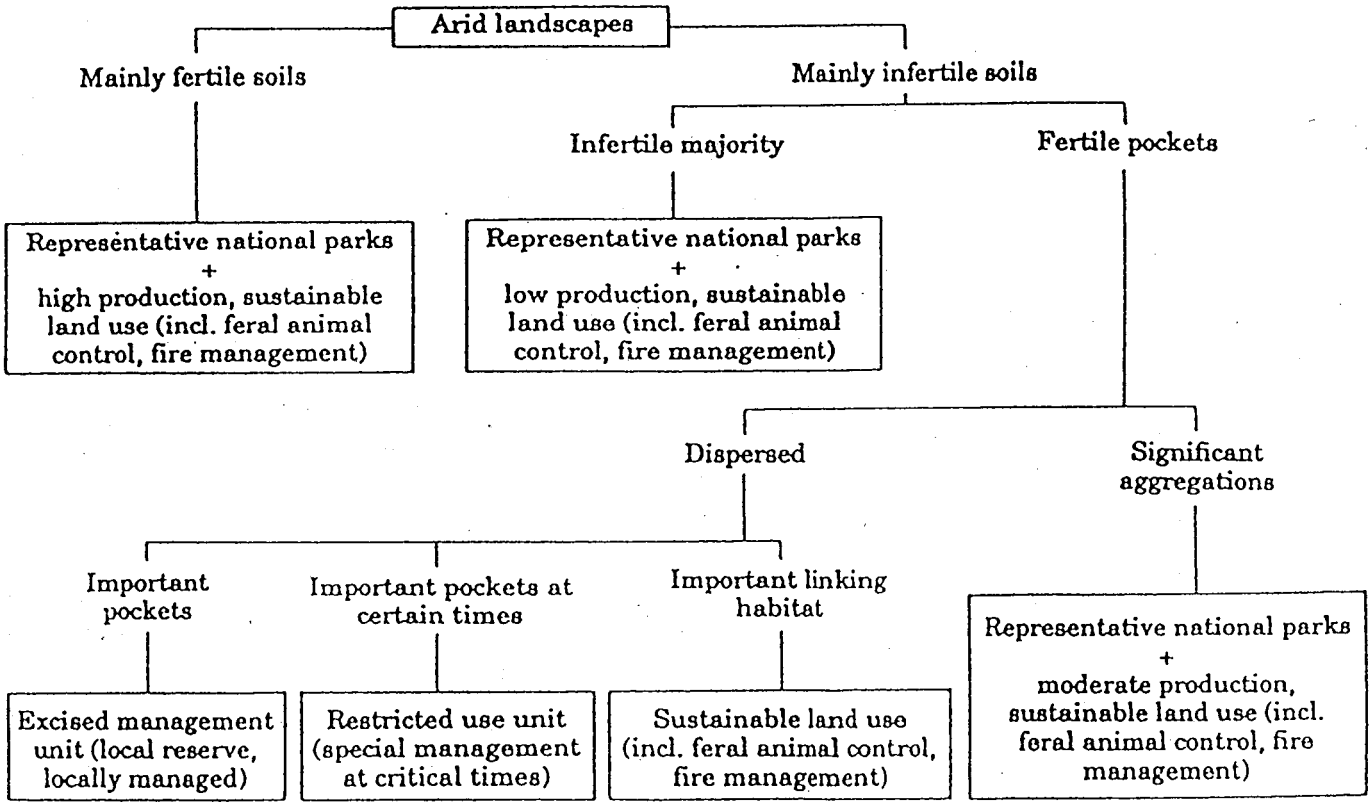
8.2 How can conservation objectives be implemented

The foregoing discussion shows that gaps in the conservation estate have been identified and that it is possible to isolate these tracts of land which, added to the CALM estate, will fill the gaps. Given that funds are finite, and never sufficient, an hierarchy of areas identified for inclusion in the CALM estate needs to be established. Some suggestions which are based on land availability and cost of operations are included here.

Morton et al. (1995) provide a breakdown of appropriate land allocation and land use in the arid zone on the basis of fertility and water relations, Figure 5. They suggest that land can be allocated to National Parks, locally important reserves (EMUs), areas which can be used in certain restricted circumstances (RUUs) and land which may be grazed or used or other purposes, consistent with sustainable land use principles, (SLUs).

Conservation objectives in the arid zone may be pursued within this land use framework. In some instances pastoralism or forms of use other than conservation may be practised in restricted use units on the understanding that they will be prohibited in certain critical time.

Figure 5


Arid landscapes
Mainly fertile soils
Mainly infertile soils
Infertile majority
Fertile pockets
Representative national parks + high production, sustainable land use (incl. feral animal control, fire management)
Representative national parks + low production, sustainable land use (incl. feral animal control, fire management)
Dispersed
Significant aggregations
Important pockets
Important pockets at certain times
Important linking habitat
Representative national parks + moderate production, sustainable land use (incl. feral animal control, fire management)
Excised management unit (local reserve, locally managed)
Restricted use unit (special management at critical times)
Sustainable land use (incl. feral animal control, fire management)

This idealised breakdown of land use implies an overall land management authority with responsibilities for conservation, and sustainable forms of land use including pastoralism. Bureaucratic structures and current and proposed leasing provisions do not permit one authority to control all activity. Nor is it wholly desirable to do so given the difficulties of supervision and control in this very large area. Instead the framework provides an opportunity to explore the potential for achieving conservation objectives outside National Parks and Nature Reserves. More than that they have the capacity to involve biological scientists in the holistic management of the arid zone.

Sources of land

Land in the arid pastoral zone other than CALM managed land is held as:

- Vacant Crown Land
- Pastoral Leases
- Aboriginal land in reservations

The tracts of CALM managed estate include, for example the Goongarrie National Park and Wanjarri Nature Reserve.

The nature of the tenure dictates the way in which CALM could proceed in the extension of the conservation estate. It should be noted that all additions to the estate from whatever source will have to pass through a standard process if the tenure is to change to CALM managed conversation reserve. Such tenure changes are subject to review by the Departments of Land Administration and Minerals and Energy and by the Department of Aboriginal Affairs. All changes in tenure have to proceed through the Native Titles procedures.

It may not be necessary to proceed down this path which is often tortuous and slow if memoranda of understanding or section 16A agreements containing conservation objectives can be negotiated with existing landholders.

8.2.1 Vacant Crown Land

Advantages

There are large tracts of Vacant Crown Land east and north of existing arid pastoral zone.

There may be significant areas for conservation contained within this zone.

Acquisition should be a fairly simple process though it will be necessary to review this land in terms of its mineral and petroleum potential and native title implications. Virtually

none have been declared in the last decade despite recommendations. Acquisition would be largely cost free.

Disadvantages

The Vacant Crown Land is remote, very arid and does not contain those elements of the environment which are attractive to pastoralism and hence essential to fundamental ecological processes. To concentrate on this land would still leave gaps in the conservation estate as important environmental niches and significant habitats are not present in the area.

Action required

Identify those areas which are important to the conservation estate.

Vacant Crown Land may not be regarded as a high priority for investigation. It is comparatively little used and lacks the network of permanent and artificial waters which characterize the settled zone. There are few areas of immediate conservation concern within it. There are few, if any, areas of degradation where urgent action is required to rehabilitate the land in the interests of conservation.

Process

1. Identification of land
2. Review committees - DOLA, DOME, AAPA (Native Title processes)
3. Change tenure to CALM managed land

Resulting land

Land acquired in this region of the state will probably be National Park or Nature Reserve.

8.2.2 Pastoral land

Land held under pastoral lease has to be considered from three points of view. Recent, present and future economic circumstances and the switch in some areas to ownership by non-pastoral interests, e.g. mining companies and CALM, has changed the leasing environment. The categories will influence the actions which CALM would take to acquire the land or an interest in the land.

1. Purchase of leases by CALM

Advantages

This is a relatively simple matter. Land transfers can be made easily and the land may be entered into a CALM managed estate by the process already described or may be held as 'pastoral lease' as natural recovery of biota occurs.

There is a certainty that the purchased land would contain ecosystem types that are major gaps in the existing system and not significantly represented in other land tenures and would thereby enhance the conservation estate.

Acquisition of individual leases would add very significantly to the area of the conservation estate and would, in consequence, look impressive.

Land not required by CALM may be able to be sold to adjoining leases as part of the restructuring process (discussed in 2 below).

Disadvantages

CALM has to recognise the fact that funding would be required for the management of these areas with their demands for fire control, weed control and feral animal and managed species control while they are held within a background of pastoral leases.

Some individual leases going on to the market could be expensive as they may attract other purchasers who have little interest in pastoralism, but more in an altered life style. Some leases again may have inflated values because of their innate tourist potential.

Leases with rated carrying capacities of 2000 - 3000 sheep may have a price which far outstrips their economic pastoral potential..

Individual leases may contain tracts of land represented adequately elsewhere. CALM would have to enter into competition in the market place; a position in which it may not be entirely comfortable.

Action required

Identify as soon as possible those environments which must be added to the conservation estate.

Locate those environments within currently leased pastoral land.

Arrange to be notified of impending sales, either commercially or through the Pastoral Board.

Reserve funds for the acquisition of lease. A minimum of $200,000 per lease may have to be set aside..

Prepare model management plans in order to estimate the annual recurring costs of acquisition.

Process

As for Vacant Crown Land except in the option for retaining the land as 'pastoral lease' when no action would be required.

2. Acquisition of land through restructuring

The Government Policy Statement 'Managing the Rangelands' states that Government is committed to 'conserving native flora and fauna, establishing and maintaining a comprehensive conservation reserve system'. Structural change along with economic development will be encouraged by the elaboration of mechanisms to remove land not suitable for pastoral production from the industry.

CALM therefore should be a partner in the restructuring process in order to acquire additional land for the conservation estate.

Restructuring implies in part the amalgamation of leases to increase the viability of the resultant larger lease, to reduce the number of lessees mendicant upon the government, and to secure the withdrawal of unproductive land from the commercial arena. Land made available under these arrangements would be mostly of low inherent fertility. However it may be distant from the operational headquarters of the new lease and be of higher fertility. CALM may be able to negotiate with new owners to purchase areas additional to those discarded in amalgamations.

Advantages

CALM may be able to acquire parcels of land sufficient for its purpose without the need to hold land of low values in terms of the proposed conservation estate. These tracts could be of manageable size. There would be no need to pay for the land surrendered in the amalgamation process. Funds for conservation could be directed elsewhere.

CALM would be able to select land of its choosing.

Disadvantages

Not all land rendered available by restructuring would be suitable for conservation purposes and pastorally desirable ecosystems that are the greatest gaps in the system are least likely to be surrendered in the case of land surrendered by a pastoralist following reconstruction. The conservation process would be open to outside influences.

CALM may have to finance the cost of transfer of stock to the remainder of the lease and to compensate in some measure for the transfer of improvements. The process would be open to outside influences. It is not anticipated that the demands for such funds would be great.

Action required

Identification of needs as in 'purchase of leases' above.

CALM participation in the restructuring process by direct liaison with the Pastoral Board and other bodies concerned with the reorganisation of leases. CALM is not currently represented.

CALM resolved to put forward its claims for land.

Provision of funds for the payment of displacement costs to lessees.

Process

Process for the Acquisition of land as for Vacant Crown Land since the land would have been surrendered from existing pastoral lease and would have reverted to VCL status.

3. Land held by existing lessees

To complete the cover of conservation reserves over all environmental situations it may be necessary for CALM to explore opportunities outside the avenues described above. Some vegetation types may not be available in surrendered, purchased or restructured leases since they are very productive. Alternatively, some landholders may be unwilling to surrender land to CALM because of the restrictions this could place on them in respect of future development. The vegetation types concerned are unlikely to be extensive. Although small they are important components of the conservation network.

The attitudes of the different lessee groups to CALM needs is discussed below.

(a) Mining Companies

Mining companies may hold mining tenements under the Mining Act which itself overrides other Acts. Mining houses are the lessees of many pastoral leases particularly in the eastern and north eastern goldfields. Some companies have the permission of the Pastoral Land Board to destock. Others attempt to run the leases as pastoral enterprises, almost all of which would be loss producing. Still others use them as training facilities for Aborigines or allocate them to Aboriginal groups for use as pastoral enterprises. The companies favour multiple land use provided that it allows them ongoing access to the land for mineral exploration and mining.

It is most unlikely that mining companies would enter into any agreement with CALM to use land for conservation if in so doing others were to be banned from undertaking exploration or mining on the land. It could be construed as an anti-mining policy. In consequence it will be necessary, should CALM need such land to enhance the conservation estate, to arrive at agreements on land use which permit access for mining or

exploration while still observing the need to respect conservation values. CALM may not see a problem with this approach.

Mining companies have been prepared to enter into memoranda of understanding with CALM which respect the conservation values of certain tracts of land provided no caveats were placed which prevented mining and exploration. Limited control of the conservation area, however lightly it is restricted may not appeal to the conservation establishment. The reality is, however, that this option provides CALM with an opportunity to secure land for a future which must come when mining ceases. Mining companies would, almost certainly, welcome the favourable publicity which would surround an agreement of this type.

Advantages

CALM would be able to secure some areas for the conservation estate through a Memorandum of Understanding for cooperative management of the land. The MOU would be developed in concert with the Mining Company and could apply to the whole of the lease or merely to those parts which are of conservation interest.

The cost of entry into this form of conservation is likely to be low since in some cases stations are destocked and sheep would not be displaced nor pastoral operations adversely affected. Mining companies may even be prepared to participate financially.

This approach to conservation, if successful, could promote similar projects with other groups e.g. regional LCD's.

Disadvantages

It may be costly to guarantee the non-prospectivity of the proposed conservation area.

Action required

Identification of gaps and the location of sites to fill the gaps.

Approaches by CALM to mining companies in possession of leases with the objective of developing MOU's.

Preparation of model MOU's between mining companies and CALM for discussion between the parties.

Development of management plans for each parcel of land in cooperation with the company.

Process

Use of Section 16A management agreements if appropriate.

(b) Other pastoral leaseholders.

The financial circumstances surrounding pastoral lessees in the arid rangelands have already been discussed, section 6. There is, for most, insufficient surplus to provide adequately for superannuation (retirement), education of children or the redirection of hard core debt. Opportunities to augment income are therefore attractive to those who wish to continue living in the social and physical environment and in an industry to which they have become accustomed. There are opportunities for CALM to supplement the cash flow of these individuals while achieving gains from the conservation estate.

Knowing the sorts of ecosystems which need to be conserved and the locations of suitable examples CALM could pin-point those stations where it should be possible to pay a compensation in exchange for land which could be added to its estate. CALM could then enter into negotiations with specific lessees to identify the land from the lease for conservation purposes. In this case, however, management could be under the provisions of section 16A whereby CALM has control over the land through a negotiated management agreement. A component in the agreement could be a payment for the loss of production from the land for the term of the lease. Alternatively, it may be possible to arrange for the payment of the value of the land if the Pastoral Board and lessee agrees to the excision from the lease.

The Land Administration Act currently before Parliament provides for the excision of land from leases for conservation purposes. Removal of parcels of land, however, to this end should not affect the overall viability of the lease or the integrity of the industry and should meet the approval of the Pastoral Board.

The amount which would be paid to lessees would depend upon the rated carrying capacity of the land and the annual value in terms of production per ha. or the market value for the land. Section 8.3 discusses payments.

Having established within a lease the conservation area required the question on ongoing management must be faced. The principal issues for the management of the reserve are boundary fence integrity, perhaps fire control and the control of feral animals and declared managed species. These would be most efficiently and more cheaply carried out for a fee by the resident pastoral lessee. It should not be difficult for CALM to negotiate the amount of a fee which takes into account the matters raised above.

The amounts which would be paid would vary according to the size of the area and to the shape of the tract of land. Using the assumptions made in Section 8.3 some approximations may be made for an area of 100 sq.km. shown in Table 10. Such an area may even be distributed between two leases.

Table 10 Suggested costs of the excision of 100 sq km for conservation purposes.
Payment of an annual fee

	Loss of production	Managment fee	Cost to CALM
Land of low fertility	$5,400	$5,000	$10,400
Land of high fertility	$12,100	$5,000	$17,100

Purchase

	Capital cost; non- recurring
Land of low fertility	$7,000
Land of high fertility	$44,000

The amounts in Table 9 are only estimates which will vary between sites for the reasons listed in Section 8.3. It is assumed that all fences and gates are in good order prior to the management agreement being initiated.

Advantages

CALM is able to secure small parcels of land it requires for non-targeted conservation purposes unencumbered with land it does not want.

The estimates show that conservation objectives can be achieved at comparatively low cost, especially those of annual running costs.

Local reserve management employed would be familiar with district characteristics..

Disadvantages

If the reserves are large or the excisions large i.e. up to 100,000ha the cost may be too high.

Action

Identification and location of areas of conservation.

CALM to initiate negotiations with lessees.

Setting aside of funds by CALM for the purposes of the MOU and management agreements.

Process

Action through Section 16A of the CALM Act.

(c) Other administrative procedures

It has been suggested that management agreements commonly used, for example in sandalwood leases, could be used to further the needs of conservation. As well, the use of the Soil and Conservation Act with the concurrence of the Commissioner of Soil Conservation has also been proposed as an avenue to achieve the objectives of conservation.

The potential for using the provisions of the CALM Act and the Soil and Conservation Act need to be explored.

8.2.3 Aboriginal land

Large tracts of land in the arid shrubland zone and in the arid interior have been vested for the benefit of the Aboriginal community, section 7.3. Although it has been concluded that conservation for its own sake is alien to Aboriginal land management objectives CALM has a responsibility to ensure that biodiversity is maintained and conservation values respected on that land. A dialogue with the peak bodies concerned with Aboriginal land should be initiated in the first instance prior to taking the issue to local Aboriginal Councils.

The process is likely to include:

Aboriginal Affairs Planning Authority and the Western Desert Council and other Councils, e.g. the Kalgoorlie Council, to develop common grounds for discussion.

It is not possible to predict the outcomes of these discussions. The following alternatives might be expected:

(a) The development of MOU's for the management of land with local Aboriginal groups. Bearing in mind the inclination of Aborigines for multiple-use, in their terms, agreement on MOU's may be difficult to obtain.

(b) CALM taking a role in the education of Aboriginal groups in the advantages to be obtained from conservation, for example in eco-tourism.

(c) CALM taking the initiative to provide technical advice and assistance to Aboriginal groups in areas such as fire management and especially feral and declared managed species control.

8.3 The cost of new conservation initiatives involving the excision of land

The cost of acquiring land for conservation purposes will depend upon the size of the land parcel being acquired in relation to lease size, the inherent productivity of the land and the location of the land parcel in relation to the operations on a pastoral lease. Several scenarios may be viewed.

8.3.1 Excision of land for a National Park or Conservation Reserve

Land of inherently low productivity

Land of this class has a year in year out (YIYO) capacity of 7DSE per 100 ha (or less) though it must vary regionally being lower in the east and higher in the south and west. Holm et al. (1995) make estimates of the long term sheep carrying capacities for the arid pastoral zone. They range from 10DSE/100ha to 4.5DSE/100ha depending on LCD. Where the reservation is large it may be necessary to excise the whole of the required land from the lease after a valuation is agreed upon.

If it is assumed that today's property prices are $30/head, the land component, not including fences and water supplies, is probably about $10 assuming a sheep value of $20. If the average stocking rate for the land is used, 7DSE/100ha, land of this type probably has a value of about $0.7/ha or less, though as discussed later values can be distorted by many factors.

Should small areas be required in order to protect special niches or to attach to land of the same type on a neighbouring lease the cost of removal of the land from production should be calculated. The gross margin has been shown to be $11 per head. If the land carries 7DSE/100ha the value of these small areas could be $0.77 per ha per annum. However, this value should be reduced by 30% to allow for bad seasons. Consequently a figure of $0.54 was used.

Land of inherently high productivity

Land of this class has a YIYO capacity ranging from 8 to 14DSE/100ha. Following Holm et al. again and assuming a mean value of about 11DSE/100ha and a land component of $40 in a total price of $60 per head, the land has a value of about $4.40 per ha.

Small areas would have an annual gross marginal value of about $1.21 per ha.

Variability in value

The above estimates are simply based upon average production of sheep and meat products. The actual prices paid for land will vary enormously depending on a number of other factors which will include:

- the size of the property; small properties may attract buyers who wish to have a change in life style and are willing to pay a premium for this perceived advantage
- there is also a market factor due to purchases by Aboriginal interests with Federal funding
- tourism values on the property will significantly enhance its value
- proximity to centres of employment; some properties have a higher value because they are close to mining ventures
- some properties may be attractive to mining companies who may compete with conservation interests in their purchase
- it should also be noted that the estimates given for the high productive potential properties could be ±50%.

9. CONCLUSIONS

This discussion has shown that there is an inadequate conservation reserve system within the arid rangeland region south of the Kimberley. Government is committed to enlarging the conservation estate.

The public generally and pastoral lessees individually recognise that conservation is a legitimate form of land use in the arid shrublands and can contribute to the local economy and social fabric.. The pastoral region is no longer the preserve of the grazing industry.

The criteria which would guide the selection of areas for conservation are known. Importantly, CALM is in a position to define, with some precision, the gaps in the conservation estate and to delineate those areas which, if included in the estate, will plug the gaps to complete the network of reservations.

The initiative for obtaining land for the conservation network lies firmly with CALM. A number of methods for acquiring land have been proposed, including purchasing entire leases on the open market, acquisition of selected areas from the restructuring program and from individual lessees where management plans can be developed or where memoranda of understanding can be agreed upon. Areas for conservation can also be acquired from the stock of Vacant Crown Land.

There are advantages and disadvantages to these methods. In some instances the acquisition of large areas for conservation may replicate the holdings of certain vegetation types or habitats already adequately covered elsewhere. The cost, if the area is an existing pastoral lease, may be high.

The reservation of large areas, especially if contained within a background of other existing land uses, would place financial obligations on CALM. On the other hand large holdings have advantages. They are more resistant to the adverse effects of a maldistribution of rainfall and provide opportunities for the study of local variabilities.

Opportunities to acquire smaller, fertile patches of high biological significance or of rare and endangered communities within existing pastoral leases either through purchase, lease under MOU or through the pastoral restructuring process have to be seized by CALM. The advantages include a lower initial cost, targeted conservation of smaller, but significant, habitats such as snakewood over saltbush and bluebush or mulga over succulents and the potential to secure local management. Non-targeted conservation strategies may also arise out of these arrangements.

CALM should also explore the potential of entering into MOU with those mining companies which have pastoral holdings. The caveats which these companies are likely to

propose have been identified. While constraining CALM to some extent the relationship with the company would be of mutual benefit.

It will be necessary for CALM to open dialogues with Aboriginal Land Councils in the pursuit of conservation on Aboriginal lands. In the first instance, the role of CALM is likely to be technical and advisory. Later it may attempt to resolve the apparent basic differences between European and Aboriginal concepts of land use which have been identified in WA and the Northern Territory. The employment of Aborigines in conservation parks and the like is no way hindered, of course, by the cultural differences.

Figure 6 shows a summary of the options available to CALM once the gaps in the conservation network or the targets for conservation have been identified and located. At present the purchase by CALM of pastoral leases, path C, has a high priority because the actions to be followed are known. The cost may be high.

The opportunities under restructuring, path B, have promise but need to be explored actively by CALM as a participant in the process and in terms of the potential cost.

Paths E and F, involving the use of MOUs are worthy of examination. The former would give access to large tracts of land with some constraints, but with the promise of financial support. The latter has the potential to yield to conservation lands now held under pastoral lease since the financial circumstances of pastoralists have altered. The Murchison area where these opportunities largely reside is not under as active a mineral exploration program as the Goldfields but is almost completely held under pastoral lease offering no opportunity to CALM to secure specific tracts for conservation in association with mining companies.

REFERENCES

Anon 1979 — The present and future pastoral industry in Western Australia, Dept.of Lands, Perth

Anon 1992 — State of the Environment Report, December 1992, State Print, Western Australia

Anon 1993 — Red Book Status Report (1993) on the Implementation of Conservation Reserves for Western Australia, EPA

Anon 1995 — Government Policy Statement, ' Managing the Rangelands'.

Burnside D.G. 1979 — The pastoral industry of the North West, Kimberley and Goldfields, Agriculture in Western Australia 1829 - 1929, G.H. Burnside ed., Govt. Printer, Perth

Burnside D.G., Holm A., Payne A. and Wilson G. 1995 — Reading the Rangelands 140pp, Dept. Agric. W. Aust.

Cohen B. 1992 — Multiple land use and nature conservation in South Australia's Arid Zone. Rangel. J. 14(2) 205-14.

Curry P.J., Payne A.L., Leighton K.A.,Hennig Pard Blood D.A. 1994 — An inventory and condition survey of the Murchison River Catchment and surrounds, Western Australia, Tech. Bulletin 84, Dept. Agric. W. Australia.

EPA — Sustainable development in the rangelands of Western Australia. 1996

Fyfe W.V. 1940 — Report of the Royal Commission appointed to inquire into and report upon the financial and economic position of the pastoral industry in the leasehold areas of Western Australia, Govt. Printer, Perth, 1940

Gardiner H.G. (1986a) — Dynamics of perennial plants in the mulga (Acacia aneura F. Muell) zone in Western Australia I Rates of population change. Australian Rangeland J. 8 : 18-27.

(1986b) — II Survival of perennial shrubs and grass. 8. 28-36

Head L. 1994 — Aborigines and pastoralism in North-Western Australia: Historical and Contemporary perspectives on multiple use of the rangelands. Rangel. J. 16(2) 167-183

Holm A.McR, O'Connor R., Foster I., Stevens M. and Beeston G. 1995 — Regional relativities of sustainable pastoral sheep production in Western Australia, Misc. Pub. 23/95, Dept. Agric. W.Aust.

Hopkins A.J.M., Coker J., Beeston G.R., Bowen P. and Harvey J.M. (1995) Conservation Status of vegetation types throughout Western Australia. ANCA National Reserves Systems Cooperative Program Project No. N703 Final Report.

Mandis Roberts Consultants 1994 Development of a National Strategy for Rangeland Management, overview of thirty workshops held Australia wide - Report to Dept. Environment, Sport & Territories.

Morton S.R., Short J. and Barker R.D. 1995 Refugia for biological diversity in Arid and Semi-arid Australia. Biodiversity Paper No 4, DEST, Canberra

Morton S.R. and Stafford Smith D.M. 1994 Integration of production and conservation in Australia's rangelands in R&D for sustainable use and managements of Australia's rangelands, occasional paper 06/93, LWRRDC, Canberra

Morton S.R., Stafford Smith D.M., Friedel M.H., Griffin G.F. and Pickup G. 1995 The stewardship of arid Australia : Ecology and landscape management. J. Env. Management 43 : 195-217

Norbury G.L. and Norbury D.C. 1993 The distribution of red kangaroos in relation to range regeneration. Rangel. J. 15(1) 3-11

Norbury G.L., Norbury D.C. and Hacker R.B. 1993 Impact of red kangaroos on the pasture layer in the Western Australian Arid Zone. Rangel. J. 15(1) 12-23

Pastoral Wool Industry Task Force 1993 Report to Hon. Monty House, Dept. Agric.

Pressey R.L. 1992 Nature conservation in rangelands : Lessons from research in reserve selection in New South Wales. Rangeland J. 14(2) 214-26

Pringle H.J.R. 1995 Pastoralism, nature conservation and ecological sustainability in Western Australia's southern shrubland ranges. Int. J. Sustain World Ecol. 2 - 26 - 44.

Pringle H.J.R., van Vreeswyk A.M.E. and Gilligan S.A. 1994 An inventory and condition survey of the north-eastern Goldfields, Western Australia, Tech. Bull. 87, Dept. Agric., W. Aust.

Reid Julian and Puckridge J. 1992 Innamincka Regional Reserve - A mismanaged multiple use reserve, In Conference Papers: 7th Biennial Conference, Australian Rangeland Society, Cobar.

Rose B. 1995 Land management issues : Attitudes and perceptions amongst Aboriginal people of central Australia. Central Land Council, Alice Springs.

Roy Morgan 1995 Rangeland Awareness Survey 27/28 May 1995 for the Australian Rangeland Society, The Roy Morgan Research Centre Pty Ltd, Perth.

Southwell C.J. and Pickles G.S. 1993 Abundance, distribution and rate of increase of feral goats in Western Australia. Rangel. J. 15(2) 334-8

Thackway R. and Cresswell I.D. 1995 An interim biogeographic Regionalisation of Australia. ANCA, Canberra.

Wilcox D.G. 1964 Prospects for the low rainfall Pastoral industry, Farm Policy 4 : 55 - 59

Wilcox D.G. 1995 A collation and analysis of information collected at the workshops held in Western Australia for the National Rangeland Management Strategy. Report to Dept. of Agriculture and Dept. of Environmental Protection, 58pp.

Wilcox D.G. and Burnside D.G. 1994 Land administration in the rangelands : What for, who for and how? Rangel J. 16 (2) 298 - 310

Wilcox D.G. and Cunningham G.M. 1994 Economic and ecological sustainability of current land use in Australia's rangelands pp87 - 172 in R&D for Sustainable Use and Management of Australia's Rangelands, S.R. Morton and P.C. Price Eds., LWRRDC Canberra.

Williams N. and Johnston R. 1995. 'Not passing through' Aboriginal stakeholders in the rangelands. Rangel. J. 16(2) 198-205

Wilson A.D. 1996 Kangaroos, sheep and rangelands. Range management newsletter 96/1. Australian Rangeland Society.

Figure 6 Options for the acquisition of land for conservation in the arid rangelands