Lesueur National Park

Notes for the post-conference tour, Landscape Fires 1993

Thursday 30 September 1993

Compiled by Angas Hopkins and Ted Griffin from Burbidge et al. 1990 and papers therein, the papers cited and from unpublished data.

BACKGROUND INFORMATION

Introduction

The Lesueur National Park was created by proclamation in the Government Gazette on 24 January 1992. This represented the culmination of a major land-use debate between conservation interests and mining interests: although the area had long been recognised as of outstanding value biologically and in terms of its landforms, a proposal for the development of a coal mine and power station complex was put to Government.

The Park (Reserve A42032) comprises an area of 26 986 ha is near Jurien Bay, some 220 km to the north of Perth (Figure 1.1). It is vested in the National Parks and Wildlife Authority and managed by the Department of Conservation and Land Management.

The Lesueur National Park is the most important nature conservation area in the northern kwongan, the area commonly known as the northern sandplains where the vegetation is composed predominantly of sclerophyllous shrubs. There are currently seven other national parks and Class A nature reserves in the northern kwongan, totalling only 107 460 ha (The newly created Coomallo Nature Reserve of 8 815 ha at tha junction of the Brand Highway and the Jurien Road is a C Class reserve).

The Lesueur National Park is an area of world, national, State and regional nature conservation significance. Its major characteristics are uniqueness of many geological, landform and biological attributes, biodiversity, very high nature conservation values, representativeness for more common components of the northern kwongan flora and fauna, and scenic grandeur.

Because of the conservation significance of the Park and the high level of public interest generated by the land-use debate, the Department of

Conservation and Land Management has given priority to preparing a management plan for the area. The issue of fire management is a major one to be resolved through the planning process.

European Exploration

Mt Lesueur was first observed and named from the sea by French explorers on the corvette *Naturaliste* in June 1801. Charles-Alexandre Lesueur was a topographical and natural history artist on the expedition. Europeans first traversed the proposed national park in 1839, and a party led by A.C. Gregory ascended Mt Lesueur in 1849. From 1850 onwards, Lesueur was avoided by travellers and pastoralists because of its rugged terrain and the abundance of poisonous plants (*Gastrolobium* spp.). 1850 was also the year that the proposed national park was first explored by a botanist, James Drummond, who delighted in finding a rich flora with many plants new to science. Neglected by all but a few bushmen and botanists for 100 years, the Lesueur area was prominently featured in a Ph.D. study by N.H. Speck written in 1958. Since the early 1970s, the area has been visited by an increasing number of botanists, naturalists and bushwalkers, as well as employees of mining and petroleum exploration companies.

Physiography and Soils

Permian to Mesozoic sedimentary rocks are overlain by thin layers of Triassic and Jurassic sandstones in the Lesueur uplands and by Quaternary and Recent sediments on the coastal plain. The ancient sediments have been distorted by a series of roughly north-south trending fault lines, exposing examples of Triassic and Jurassic rocks. Thus the rugged uplands have a variety of interbedded rock types, including sandstones, siltstones, shales and coal. Laterite formed as a fossil soil horizon over undulating land surfaces during the Tertiary and Quaternary. These land surfaces have been eroded leaving lateritic upland residuals, some in the form of flat-topped mesas (e.g. Mt Lesueur, Mt Michaud). The Coastal Belt has a series of dunes of varying ages, some underlain by limestone, and with a chain of salt lakes and freshwater springs parallel to the coast.

A sequence of landforms in the National Park may be recognised from the coast inland: Quindalup Dunes bounded by a Salt Lake Complex, Spearwood Dunes, Bassendean Dunes bounded by the Gingin Scarp, Peron Slopes, Lesueur Dissected Uplands, Gairdner Dissected Uplands, Banovich Uplands, and Bitter Pool Rises (Figure 3.3).

Soils on the uplands are an extremely complex mixture of siliceous sands, lateritic gravels, yellow duplexes, yellow massive earths and brown mottled cracking clays. The Coastal Belt has yellow and brown siliceous sand, sometimes over aeolinite, with shallow calcareous and gypsiferous soils on the salt lakes.

Three major youthful drainage systems have their headwaters in the Lesueur area - the Hill River (with Munbinea Creek as the major tributary), Cockleshell Gully and Stockyard Gully. In addition, one arm of Coomallo Creek (also a tributary of the Hill River) has mature tributaries arising in the eastern end of the Lesueur. The National Park protects the upper sections of these catchments in a natural state, allowing them to be used for bench mark studies applicable to catchment management issues. Flow in the drainage lines is seasonally intermittent, but permanent water occurs in some pools.

The Lesueur National Park encompasses some of the most attractive countryside to be found in the northern kwongan. The Gairdner Range, with its distinctive mesa landforms, is an area of high scenic appeal. Within the Range, one is confronted by ever-changing vistas of steep breakaways, low hills and gullies with eucalypt woodlands set amongst heath-covered slopes. The heathlands themselves, when viewed more closely, reveal a rich tapestry of plant forms, colours and textures.

Climate

Lesueur has a typically Mediterranean climate of hot, dry summers and cool wet winters, with a moderately reliable rainfall (550 mm at Jurien, 620 mm at Mt Lesueur). The distribution of plant species on and around Mt Lesueur has been suggested to indicate important variations in micro-climate which have evolutionary significance (Griffin and Hopkins 1985, Hopkins et al. 1983).

Vegetation

The vegetation of the Lesueur National Park is shown to be structurally diverse, consisting mainly of shrublands and woodlands interspersed in a complex mosaic. Even greater complexity is evident when communities are identified on a floristic basis. Major vegetation units are numerous, they form an intricate mosaic, and they show a close relationship to landforms. Moreover, within the one vegetation type studied in greatest detail (heath on lateritic uplands), there are 11 distinct floristic sub-types within the park which are geographically identifiable and can be related to specific geological substrates and soil erosional processes.

The great diversity of communities reflects the complexity of underlying strata and unusually large array of habitats found in the National Park, particularly in the eastern area. Detailed mapping has identified a very fine-scale mosaic in the eastern landforms. Some communities in the eastern uplands are not found elsewhere.

Flora

James Drummond in 1850 noted the exceptional richness of the flora, particularly of proteaceous genera and of locally endemic species. Subsequent work this century commencing with C.A. Gardner and N.H. Speck ~~reaffirmed~~ confirmed Drummond's observations. The authors of

this paper started a comprehensive study of the flora and vegetation in the late 1970s: this work provided much of the data on which the report by Burbidge et al. (1990) was based.

The present study supports earlier views on plant diversity in the Lesueur National Park. It has 821 taxa of vascular plants, representing approximately 10% of the State's known flora and a third of the taxa found in the Irwin Botanical District. Moreover, Lesueur has seven species of Declared Rare Flora, nine taxa endemic to the proposed park itself, 111 regionally endemic taxa, and 81 taxa reach their northern or southern limits in the proposed park. The numbers of Declared Rare Flora, endemics and taxa at the end of their geographical ranges are the highest of any area in the Irwin Botanical District. The Lesueur area has been and will continue to be an important refugium for species from wetter climates.

A rapid geographical replacement of species is notable. Even within the same vegetation type, moving as little as 0.5 km may reduce the number of species in common to less than 40%. When species richness is measured at the scales of landscape unit or within stands, diversity in the proposed national park is comparable with that in the Fitzgerald River and Stirling Range National Parks. Lesueur ranks as one of the three most important areas for flora conservation in southern Western Australia.

Fauna

Although not studied in detail, the fauna of the Lesueur National Park is known to be rich in species of vertebrates, with 15 indigenous mammal species, 124 bird species, 48 reptile species and 9 frog species. In comparison with other existing conservation reserves in south western Australia, it is richer in species than all except a few, much larger areas.

Among birds, Lesueur is rich in species of the kwongan and species that depend on nest hollows in the wandoo woodlands, e.g. Carnaby's Black Cockatoo and the Regent Parrot. The reptile fauna is particularly rich in geckoes and legless lizards.

Terrestrial and aquatic invertebrates have not been studied in detail. However, the little that is known suggests that it is rich in species, e.g. 104 species of macro-invertebrates were sampled in a brief survey of aquatic sites. The Park includes some invertebrate species not known from elsewhere.

Inter-relationships Between Plants and Animals

Banksia tricuspis is a Declared Rare species endemic to the Lesueur area. It shows a strong preference for microclimatically favourable sites, and may be a relict species from wetter times. Pollinators, including birds, mammals and insects, are essential for seed set in this outbreeding species. Moth larvae and cockatoos reduce the reproductive success of *Banksia tricuspis* through predation.

However, because cockatoos destroy more moth larvae than flower heads, the latter which they damage `in error', the cockatoos have a positive effect. The ability of *B. tricuspis* to cope with fire is influenced by fire frequency, which influences plant survivorship, and seasonality, which influences seedling recruitment. Management of *B. tricuspis* should ensure that all organisms involved in its inter-relationships are catered for. In the cockatoos' case this is extremely important and will require protection of wandoo woodlands, kwongan and freshwater sources throughout the Lesueur - Coomallo region.

Black Kangaroo Paws (*Macropidia fuliginosa*) are dependent on honeyeaters for pollination and sustain some nectar loss from the introduced honey bee.

The ecological links that exist between these plants and animals in the National Park highlight the need to not only manage and conserve rare and restricted species but also to conserve the organisms that interact with them. To achieve this, a larger area of native vegetation than that occupied by a rare plant is often required.

Plant diseases

Phytophthora cinnamomi and other *Phytophthora* species are having a major detrimental effect on the vegetation and associated fauna of many national parks and other conservation reserves in southern Australia. In the northern kwongan, studies on the extent of these plant diseases commenced only recently, but it is known that five types of *Phytophthora* occur there, with *P. cinnamomi* having been found recently near Eneabba. Three sites of infection with *Phytophthora citricola* have been found within the Lesueur National Park.

Preventing the spread and intensification of dieback is the greatest management concern within the Park. In the longer term, the disease has the potential to degrade the ecosystems of these areas more than would fire. Construction and maintenance of mineral earth breaks is being kept to a minimum to reduce the risks associated with soil movement.

FIRE

Fire History.

The earliest fire which was reliably mapped occurred in 1967. Although previous fires were identifiable, their extent could not be determined. Most of the area between Lesueur and Coomallo is now between 8 and 15 years old. The oldest patches are about 30 years but these are relatively small. Much of both areas has been burnt more than once in the last 30 years. Elsewhere it has been speculated that the pre-European fire regime involved fires with a return time of

between 25 to 50 years (Bell et al. 1984). These estimates were based on observations of the biology of particular plant species.

Lightning is a significant cause of fires in the Central Coast region and recently several large fires started in this way. The fires started this way in Lesueur and Coomallo have mostly been small and either naturally extinguishing or quickly contained. The majority of the area burnt in the last 30 years has been by fires started by humans, mainly accidental. Part of the Coomallo Nature Reserve was burnt by aerial ignition in about 1989.

Fire Behaviour

Fire behaviour is affected by the amount and type of fuel, air temperature, fuel dryness, wind speed and topography. Different vegetation types accumulate fuel at different rates and have different fire spread characteristics. The major fuel types in the Lesueur National Park and Coomallo Nature Reserve are scrub heath and mallee heath vegetation types.

Little information is available on the fuel accumulation rates of the many different vegetation types in the area. A study by Delfs et al.(1987) at Coomallo showed rapid accumulation of total above-ground biomass to a plateau level of about 16 tonnes ha^{-1} in the first 7 years following fire. Not all of this is available fuel. For example, after fire some ~~1-2~~ 2-3 tonnes ha^{-1} of large, living (moist) woody material may remain: this rapidly dries out and becomes available to burn before gradually rotting. The experience of a 3 year old fuel in this region burning readily in a wildfire in 1984 highlights the importance of this fuel component whilst, at the same time, suggesting that factors other than fuel build up are significant contributing factors to fire behaviour in this area.

Wind speed and direction is probably the major factor influencing the spread of wildfires in the Central Coast. A typical summer pattern starts with light to moderate off-shore winds in the early morning. Moderate to strong south to south-westerly sea breezes take over in the late morning or early afternoon. The sea breeze is commonly over 30 km per hour. These usually abate in the evening returning to the east or south-easterlies.

The predictability of these changes in wind speed and direction may assist in planning buffer burns. Open edge burns of east-west buffers can be conducted relatively safely. North -south buffers are more difficult to cope with.

The head-waters of the Cockleshell Gully include steep slopes and gullies which can promote erratic and severe fire behaviour. This makes wildfires difficult and dangerous to contain by direct attack.

Ecological factors.

Plant species can be classified according to whether or not they are killed by a fire, their mode of regeneration, the location of the perenating organ, and their rate of regeneration. This is a useful way of highlighting those species which are most vulnerable to inappropriate fire regimes, such as frequent fires or fires out of season.

As has been reported in studies of other areas the most vulnerable species are killed by fire and regenerate only from seed (obligate seeders). Those relying on seed retained on the plant appear to be particularly so. This generalisation has not proven entirely reliable as a number of soil stored obligate seeders are also vulnerable. The most important issue is how quickly these species regenerate and produce adequate seed to replace themselves.

Monitoring (authors' unpublished data) has shown that the plants of the Lesueur and Coomallo areas have a variety of ways to regenerate after fire. A provisional classification of species in the region is being used as an aid to the development of the fire management plan.

The single-stemmed woody shrub life-form type includes most of those which appear to be especially vulnerable. In the Lesueur area this life-form accounts for about 20% of the total flora. Multi-stemmed woody shrubs (30%), perennial sedges and grasses (14%), annuals (12%), geophytes (11%) and sub-shrubs (9%) are the main life-form types of less vulnerable species.

The provisional assessment of the flora of the Lesueur National Park has identified around 40 that might be vulnerable to too-frequent fires; these are mainly species in the Proteaceae, the Mytraceae and the Epacridaceae. A number of priority or geographically restricted flora are included (e.g. *Andersonia longiflora* and *Hakea neurophylla*). However, none of the Declared Rare species are considered particularly vulnerable. That is not to say that some may be adversely affected in some way. *Banksia tricuspis* which survives by epicormic sprouting still requires in the order of 25 years before reliable seed set. On the other hand some such as *Asterolasia drummondii* appear to be more abundant in the years (perhaps up to 10) following fire.

Many of the vulnerable plant species are dominant or structurally important species in a high proportion of the vegetation types in the Lesueur National Park in particular. Not only would frequent fires result in the depletion of these species but also a number of the vegetation types would be grossly modified.

Appropriate fire free intervals are yet to be determined. This is a complex issue as the rate of regeneration of the most vulnerable species varies greatly. Limited research has suggested that a fire-free interval of greater than 15 years was desirable for an area of Coomallo.

An assessment of the potential impact of fuel reduction burning on the those declared rare and priority 1 species which occur in buffers has also been made. Several species might be adversely affected. The rate of regeneration of *Andersonia longifolia*, an endemic to Lesueur, in not known. The total or major proportion of populations of four species in the Park or Reserve are within these buffers and must be carefully considered. *Dryandra* sp. aff. *hewardiana* and *Verticordia fragrans* are also present in other conservation areas so any potential impact on these species by buffer burning will be less than is implied. However, *Goodenia xanthotricha*, and *Grevillea batrachioides* are only known from Lesueur. Both have small, poorly mapped populations and nothing is known of their response to fire.

Some patches of old or long-unburnt vegetation (about 30 years since the last fire) in the Lesueur area have been examined. There is no evidence of the vegetation in these areas being too old or senescent, e.g. showing a decline in vigour or collapse of the tall obligate seeders. It is unlikely that any of these areas would require regeneration within the next 10 years.

The monitoring studies have also revealed a number of species, mainly annuals, which become very important in the first years after fire. This only occurs in some vegetation types, mainly those on the heavier soil types in the Lesueur area. These species are responsible for the increase in species richness often observed after fire. The species richness declines to prefire levels within a few years.

Perimeters areas adjacent to cleared land are vulnerable to weed invasion and is exacerbated by frequent burning. Vegetation types on loamy or duplex soils are particularly vulnerable because of the natural ability of these areas to support a flush of annual species following fire.

There is no direct information about the influence of fire on the fauna in the Lesueur or Coomallo areas. However the predominant view is that the recognised, varied requirements of the different groups of fauna would be best served by much of vegetation being long unburnt supplemented by areas of a range of fire ages.

The implications of management techniques used in buffer areas has received some attention recently. Scrub-rolling and chaining both knock down the tall plants and facilitate effective burning under relatively safe conditions. Both techniques adversely affect the tall, woody, obligate seeders with canopy storage of seed as the mechanical disturbance promotes release of seed which is damaged or destroyed by the subsequent fire.

TOUR STOPS

1. Vista point south of Mt Lesueur.
This stopping point has been positioned to minimise the liklihood of vehicles transporting *Phytophthora* into any of the major catchments of the National Park. Looking north from the rise, visitors can see the near circular mesa of Mt Lesueur with a second mesa, Mt Michaud, off to the north west. The Lesueur Fault runs along the eastern side of Mt Lesueur; the valley to the east is a result of down-faulting and erosion.

Further to the east and to the west of Mt Lesueur are uplands where the lateric gravels of the Tertiary/Pleistocene remain.

An account of the flora and vegetation of Mt Lesueur is given in Griffin and Hopkins (1985).

2. Closed edge burning along Cockleshell Gully Road.
Closed edge burning is the term used for prescribed burning between two mineral-earth firebreaks. The practise is used extensively to provide protection in coastal heath fuels.

3. Open edge burning at the northern Park boundary.
Open edge burning is prescribed burning where there is only one mineral-earth break or where a strip is to be burnt without any breaks. The area of the stop has been burnt recenly.

At this stop it will be possible to see Mt Lesueur away to the south.

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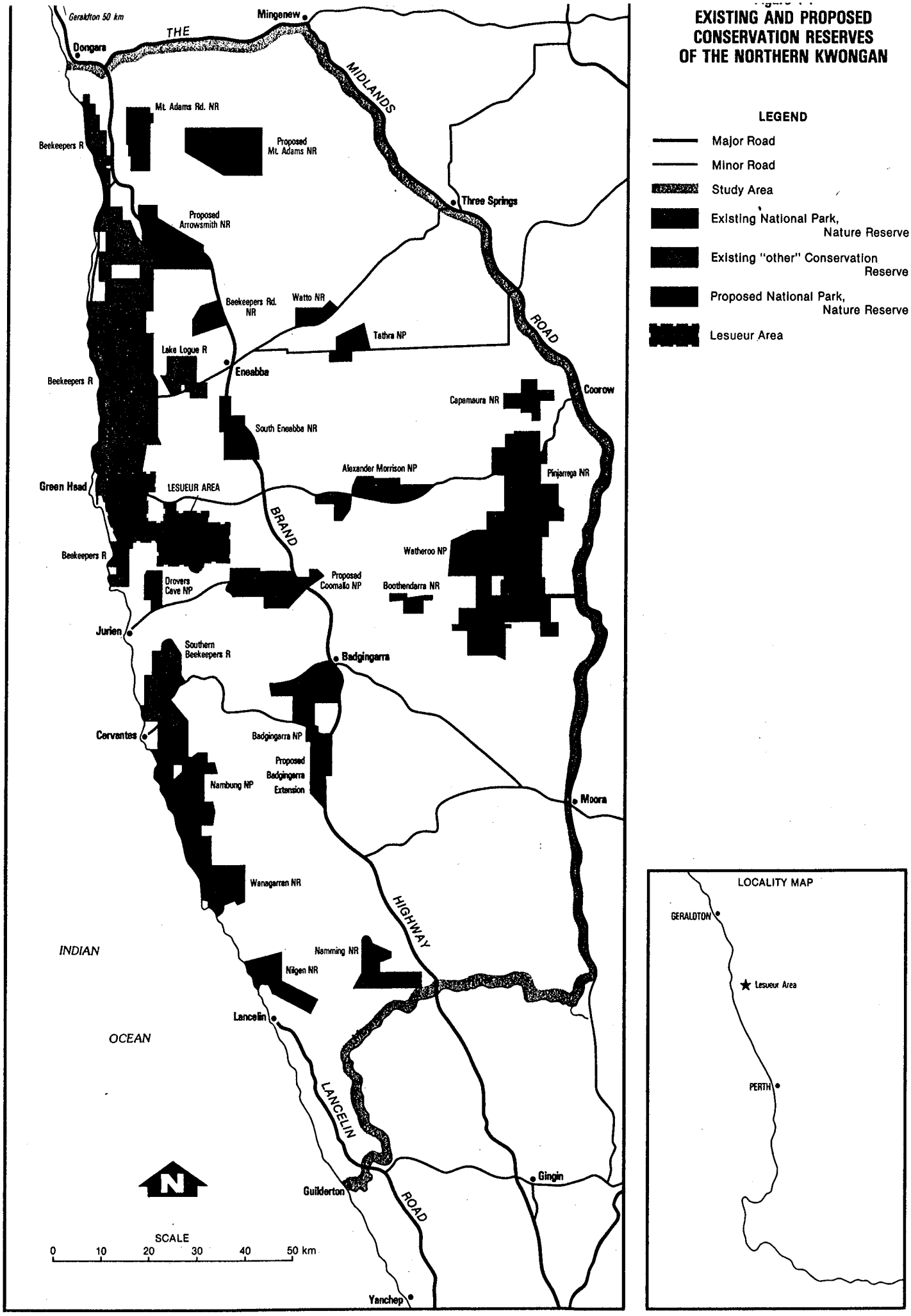

EXISTING AND PROPOSED CONSERVATION RESERVES OF THE NORTHERN KWONGAN

LEGEND

- Major Road
- Minor Road
- Study Area
- Existing National Park, Nature Reserve
- Existing "other" Conservation Reserve
- Proposed National Park, Nature Reserve
- Lesueur Area

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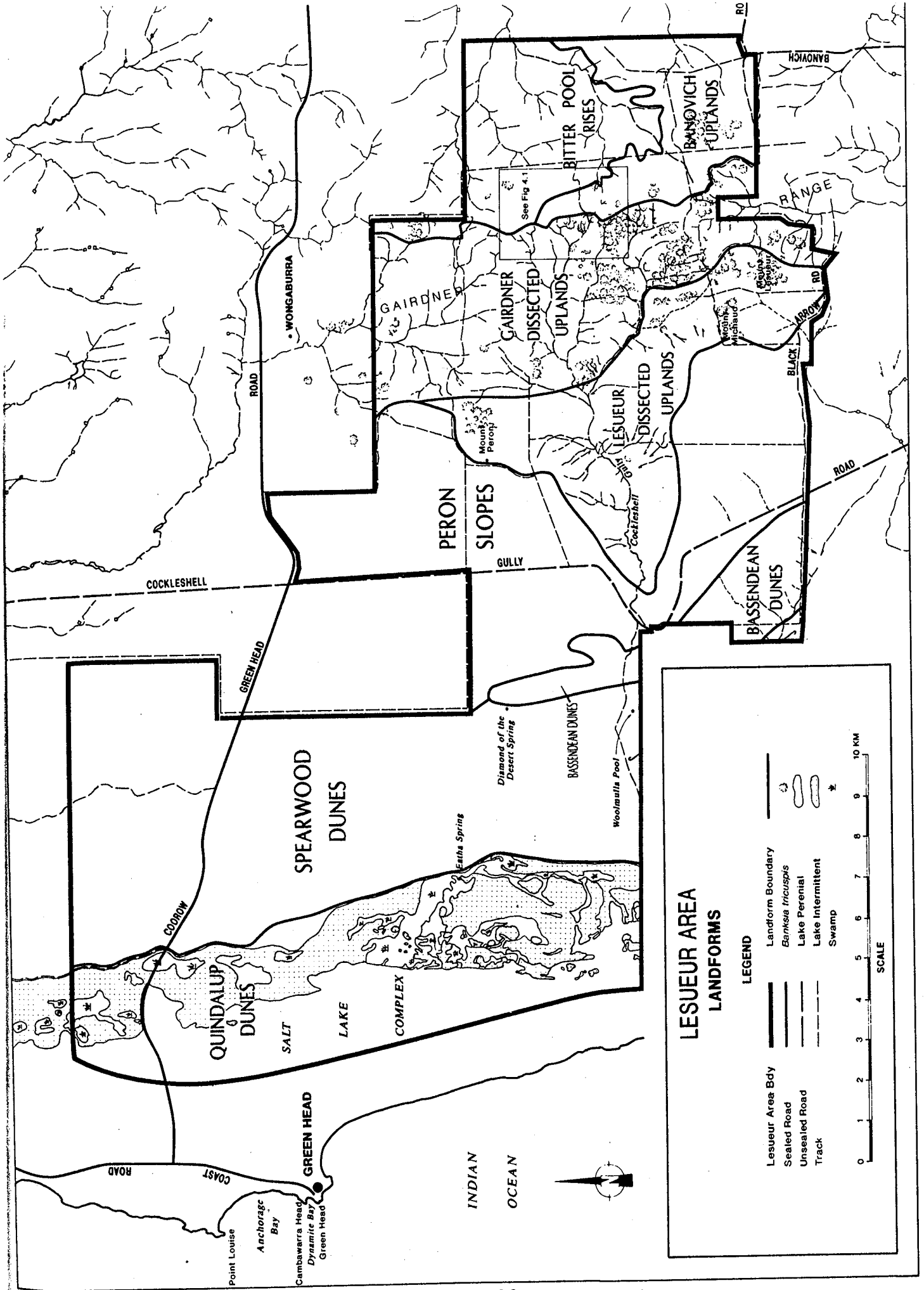
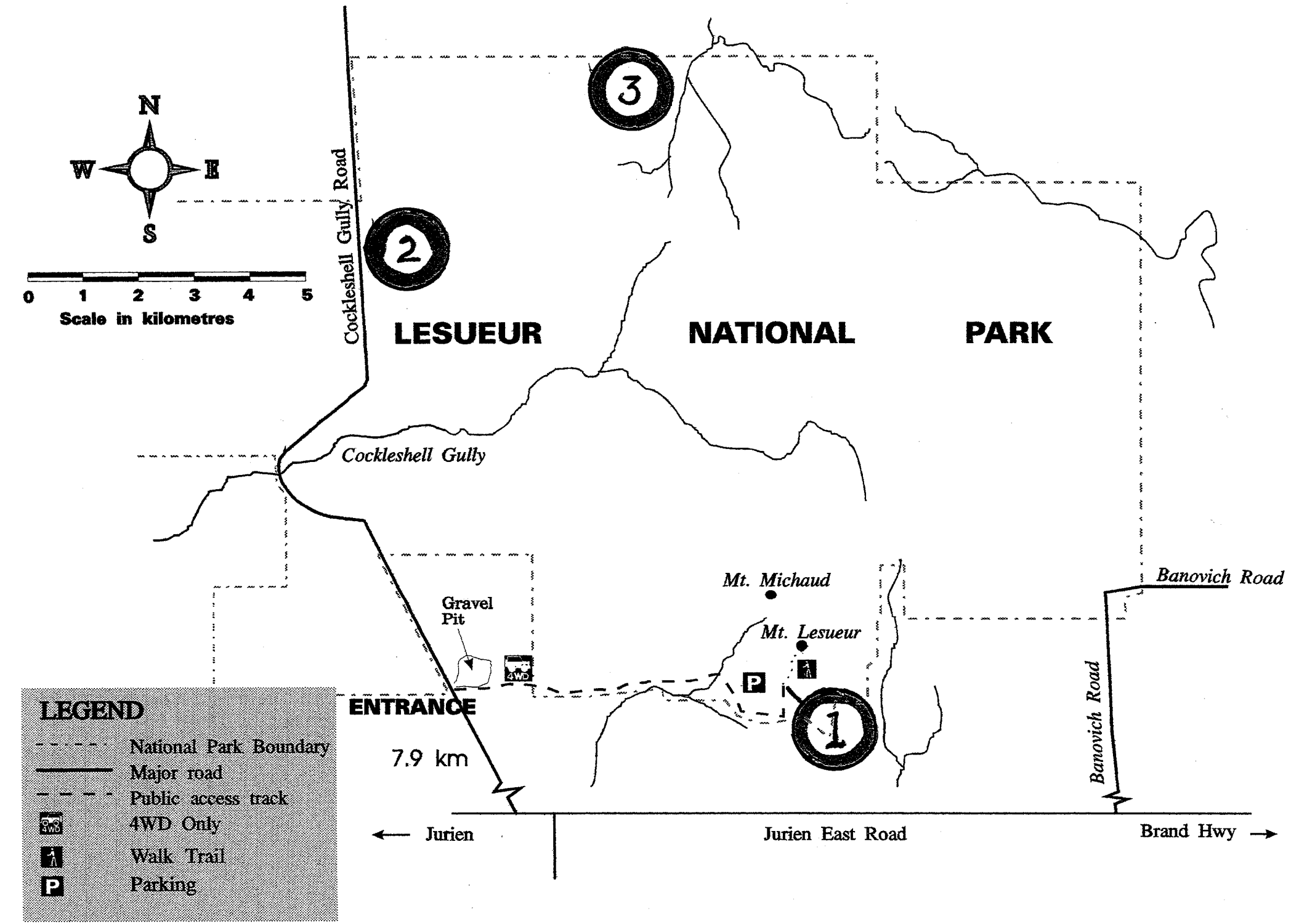


Figure 3.3
Landform map of Lesueur Area


N
W
E
S
0 1 2 3 4 5
Scale in kilometres
Cockleshell Gully Road
3
2
LESUEUR NATIONAL PARK
Cockleshell Gully
Gravel Pit
4WD
Mt. Michaud
Mt. Lesueur
P
1
Banovich Road
Banovich Road
ENTRANCE
7.9 km
LEGEND
National Park Boundary
Major road
Public access track
4WD Only
Walk Trail
Parking
← Jurien
Jurien East Road
Brand Hwy →