TOUR 11 "MEDITERRANEAN" SHRUBLANDS

The flora of south western Australia is very different, particularly at the species level, from that of the rest of the continent. The area is now, and has been for a long time, isolated by climate and to some extent by soils from neighbouring areas. There is a high degree of endemism, reminiscent of that found in Cape Province, South Africa. The areas of south western Australia that are the richest in plant species are those dominated by a sclerophyllous shrubbery called kwongan.

Kwongan is to be found throughout much of the south west. It reached its best development, prior to extensive clearing by Europeans, in a broad crescent extending from Shark Bay in the north west to Israelite Bay in the south east, and mostly inland of the forested belt. Kwongan was dominant on a variety of soils such as deep siliceous sands, shallow soil over limestone, and lateritic gravel and clay. All sites were very poor in plant nutrients. Fire probably occurred periodically from both lightning strikes and as a result of man's activities.

The present Tour, in association with the 13th International Botanic Congress, is designed to show a small portion of the species-rich Kwongan of the south west. It will do this by traversing two major transects. Firstly, there is a south to north gradient paralleling a decline in precipitation and increase in temperature. Secondly, there is a west to east gradient also covering declining moisture but with temperatures becoming more extreme in both maxima and minima. The latter gradient also covers a change in soils from largely young, depositional ones to ancient, insitu weathering-products.

The remainder of the booklet will present information on the climate, geology, biogeography, vegetation, botanical history, and human occupation. A description of each place we will stop, together with maps and some partial species lists conclude the booklet.

CLIMATE

Westen Australia divides naturally into three major climatic regions -

North, with wet summer and dry winter
South west, with wet winter and dry summer
Intermediate, with scanty, erratic rains

The present tour is contained within the south west region, the climate of which may be classified as warm to dry-warm Mediterranean. This is an unusual climatic type occurring only in restricted parts of the earth, notably around the Mediterranean Sea, in California, Chile, South Africa, southern South Australia and south west Western Australia.

Within the tour area there are two rainfall-temperature gradients, a north-south gradient reflecting an increase in rainfall and decrease in temperature towards the south, away from the arid zone, and west-east gradient reflecting the decrease in rainfall and increase in temperature from the coast to the interior. These trends are illustrated in the table below for Geraldton (situated on the coast in the north of the region), Perth (situated on the coast in the south of the region) and Carnamah (situated about 100 km from the coast in the central interior of the region).

	Geraldton	Perth	Carnamah
Rainfall			
Mean annual (mm)	477	883	398 mm
Average no. rainy days/year	88	119	78
Wettest month (mm)	June (119)	June (187)	June (83)
Driest month (mm)	Dec. (5)	Jan. (8)	Dec. (9)
Temperature			
Annual mean max (°C)	25.7	23.5	26.7
Annual mean min (°C)	13.5	13.5	12.1
Hottest month (°C)	Feb. (32.2)	Jan-Feb. (30.3)	Feb. (35.3)
Coldest month (°C)	July (19.4)	(Aug. (9.1)	July (7.0)
Relative humidity			
Mean annual (% 3 pm)	49	50	36

GEOLOGY

Western Australian geology is dominated by an Archean Shield which is amongst the oldest and most stable land masses in the world. The shield is bordered by sedimentary basins which also are very old. This tour will be over the northern portion of the Perth sedimentary basis, which is a narrow strip on the western margin of the shield, and on adjacent areas of the shield.

The most prominent geological feature of the south western corner of Western Australia is the Darling fault. This north-south trending fault which is over 1,000 km long separates the Perth basin from the Archean granitic rocks of the shield. Near Perth, the Darling fault is evidenced by the prominent Darling scarp but its presence becomes obscured towards its northern limit.

The rocks of the Perth basin are mainly Mesozoic sandstones with minor amounts of siltstones and shales. Zones of faulting are evident in the Perth basin but relative stability has existed for over 60 million years. Geological modifications in that time have been minor, with subsequent deposits being shallow and poorly consolidated. Quaternary sands are thickest on the coastal zone.

With its great age and geological stability, Western Australia's landscape shows little relief. Very ancient soils including laterites have developed on deeply weathered rocks.

A low plateau reaching heights of 200 to 300 metres above sea level occupies the eastern portion of the Perth basin. A coastal belt of 10 to 20 km wide and reaching 100 metres above sea level flanks the plateau. A marine escarpment which formed during a period when the relative sea level was about 100 metres above that at present, separates the coastal zone from the plateau.

Rivers which drained the Archaean shield during periods when rainfall was much greater than at present have strongly dissected the western portion of the plateau. This erosion provides the most striking landscape features to be seen in this area - small Mesas and steep-sided valleys. Erosion by the present-day streams is minor and flow in most streams is low and occurs only after heavy (usually winter) rainfall.

Few streams flow directly into the Indian Ocean because of the limestone deposits on the coastal belt. Alluvial deposits developed east of the limestone where these streams were blocked. Frequent, shallow, ephemeral lakes occur in these areas.

Drainage from the Archaean shield is low and ineffective at present. This has produced shallow unconsolidated deposits on the eastern portion of the Perth basin. These deposits are mainly quartz sand. Saline lakes are a feature of the shield.

The Perth basin contains deposits of economic importance. Natural gas, coal and water occur in the Mesozoic sediments. Heavy mineral sands and Diatomaceous earth deposits occur in the shallow quaternary sands.

BIOGEOGRAPHY AND VEGETATION

The south west of Western Australia has one of the richest angiosperm floras in the world. About 3,600 named species were known from the region by the mid 1960's, with 68 per cent of these being endemics. Recent taxonomic research indicates that many taxa (from 10 to 30 per cent of the total) remain undescribed, so that the actual numbers of species present in the south west is probably in the region of 4,500. There are at least 2,000 species in the area seen on this tour.

J.D. Hooker, in 1860, was the first biogeographer to note the apparent enigma in the south west of a rich flora in terrain of relatively low relief and subdued topography. The region certainly has no mountains comparable to those which harvour the rich flora of South Africa. However, it is now apparent that areas of the south west that are particularly rich in species occur where tertiary plateau surfaces have been greatly dissected to form complex soil mosaics. Ample evidence of this dissection will be seen on the present tour.

The area to be traversed, known locally as the "northern heathlands" or "west midlands", shows a gradient in mean annual rainfall from 800 mm at Perth to 400 mm at Geraldton. Several lines of evidence suggest that this semi-arid climatic belt experienced climatic fluctuations throughout the quaternary period. The combined effects of an unstable climate and complex soil mosaics on plant populations probably facilitated the prolific speciation now in evidence in the northern heathlands.

Families that are well represented in the area include the Proteaceae, Myrtaceae, Fabaceae, Cyperaceae, Restionaceae, Epacridaceae, Haemodoraceae, Goodeniaceae, Lilliaceae, Stylidiaceae and Dilleniaceae. The Proteaceae and Myrtaceae each constitute from 20 to 30 per cent of the species throughout the area.

The rapid replacement of closely related species within genera from south to north is a notable geographic trend. Resticted endemics with geographic ranges less than 100 km are quite common.

Recent ecological studies have demonstrated remarkably high patchiness in the local distribution of species throughout the heathlands. For example, a survey of the flora of lateritic uplands documented a maximum similarity in species composition of only 50 per cent for sites as close as 0.5 km on seemingly identical soils and landforms. This feature of the flora presents a formidable problem to the effective conservation of taxa in nature reserves and national parks. It also is indicative of the dynamic influence of climatic change, soil mosaics fire on population structure in the flora.

The vegetation of the area is predominantly shrubland, less than two metres tall and usually with no particular species being noticeably dominant. It frequently consists of 3 to 5 discontinuous layers or strata. Other formations that are found in the area include woodlands, low forest, Acacia shrublands, halophyte shrublands, and mallee vegetation (dominated by Eucalyptus and multiple stems arising from undergound lignotubers).

BOTANICAL HISTORY

This area was one of the first parts of Australia to be discovered by Europeans. In 1619, Frederick Houtman of the Dutch East India Company sighted the islands of the Houtman Abrolhos group, 80 km off the mainland west of Geraldton. The Frenchman, Captain Hamelin, in 1801 was the first to carefully examine the coast between latitudes 30° and 31°S. During this expedition a number of coastal features were named - Ronsard Bay, Jurien Bay - as well as Mts. Lesueur and Peron which were sighted from the ship but not visited. These peaks were named after two naturalists in the party.

It was not until 7 years after the foundation of the Swán River Colony (in 1829) that the area was first entered by Europeans. John Septimus Roe, the Surveyor General, led a party from York in 1836 and eventually reached the site of New Norica in the south east of the region. In 1839 the coastal tract was traversed by Captain George Grey's exploring party who had lost their boats at the mouth of the Murchison River (130 km north of Geraldton) and were forced to make a long and arduous overland march to get back to Perth.

Botanical exploration in the area commenced with the work of the great collector, James Drummond. Drummond had been Curator of the Botanical Gardens at Cork in Ireland before emmigrating to Western Australia in 1829 where he was appointed honorary Government Naturalist. Drummond supplemented his meagre farming income by the sale of botanical specimens to patrons in Europe. His specimens are the "types" of numerous Western Australian plant names. In 1841 Drummond examined the country in the vicinity of New Norcia and in 1842 a second expedition took him to the site of the present day town of Moora. In 1850 Drummond drove stock overland from the Swan River (Perth) to Champion Bay (Geraldton). The party travelled via Dandaragan where Drummond's son James had already established the station "Yere Yere" and Drummond senior spent several days collecting in the area. They subsequently travelled east of Mt. Lesueur to the Arrowsmith River and so to the Irwin River.

No further signficant botanical collections were made in the area until the beginning of the pesent century when the two German botanists, Ludwig Diels and Ernst Pritzel, passed through Moora on their way to Geraldton in January 1901. In December of the same year they visited Dandaragan. Not only did these workers make extensive plant collections they also published a detailed account of the vegetation of Western Australia. In 1931 the then Government Botanist, Charles Gardner, first visited the Cockleshell Gully - Mt. Lesueur area; subsequent visits were made in 1935, 1941 and 1946. In more recent times the area has come under intensive botanical study by wokers such as N.H. Speck (University of Western Australia), J.S. Beard (formerly Director, Kings Park Botanic Gardens), and others including staff members of the Western Australian Herbarium, Western Autralian Fisheries and Wildlife Department and the Western Australian Museum.

HUMAN OCCUPATION

At the time of European settlement, the northern sandplains had already been occupied by Aborigines for at least several thousand years. Historical records of their utilisation of the area are extremely fragmentary. It is only very recently that anthropologists and archaeologists have begun to discover the nature and extent of Aboriginal usage of the Australian continent.

In the area we will see, the Aborigines would have used the area for sources of food - fish and shellfish on the coast, kangaroos, smaller mammals, lizards, birds, insects and plants further inland. It is very likely that fires, deliberately or accidentally lit would have burned the vegetation from time to time.

The first areas to be settled by Europeans were in the east near Moora and New Norcia, and in the north from Dongara to Geraldton. Both areas were settled during the mid 19th century. Cereal growing and grazing livestock were the primary farming activities. Horse breeding, for both local use and for export to India and Mauritius, was a profitable business near Greenough during the 1860 to 1880 period. Drought, floods, infertile soils, and plant diseases such as"rust" made life especially difficult in the early European settlements. Plants poisonous to livestock were common but were not identified until 1890. Species of Gastrolobium and Oxylobium (Leguminosae) contained the poison monofluoroacetate which killed sheep and cattle but left native animals such as kangaroos unaffected.

The western parts, and some eastern areas were not found suitable for agricultural clearing until the mid 20th century. It was then discovered that the light sandy land could be made agriculturally productive if zinc, copper, and to some extent sulphur were added to the soil. This was in addition to large quantities of phosphorus and nitrogen that were also required.

Crops grown now include cereals, lupins, oilseeds, and subterranean clover (inoculated with Rhizobium to permit fixation of atmospheric nitrogen). Both beef cattle and sheep are raised on pastures improved by selected planting of species that provide good fodder and aid in soil improvement. Water for livestock comes largely from bores (50 to 150 m deep).

DESCRIPTION OF SITES

1. Yanchep National Park

Situated on the Swan Coastal Plain some 50 km north of Perth, this National Park caters for recreational needs of the metropolitan population. A range of captive Australian birds and mammals are on display in the gardens. The park contains good samples of Banksia woodlands on sand and Tuart (Eucalyptus gomphocephala) open forest on limestone soils that typify the coastal plain. Loch McNess is another feature of interest, with fine stands of Flooded Gum (Eucalyptus rudis) fringing its margins. This species intergrades with River Gum (Eucalyptus camaldulensis) over a 250 km cline from Yanchep northwards to the Irwin River. Flooded Gum has rough grey bark on its trunk, whereas that of River Gum has smooth white bark. An intermediate population will be seen at lake Indoon (Stop No.), while pure River Gum occurs on the Irwin River at Depot Hill (Stop No.).

The park lies on quaternary, partially-consolidated limestone.

2. Gingin Shire Cemetery

Situated on the edge of the Dandaragan Plateau overlooking the Swan Coastal Plain, the cemetery contains a large hybrid population of kangaroo paws (Anigozanthos manglesii, Haemodoraceae) and catspaw (A. humilis) that ha become a tourist attraction because of the spectacular display of colours. A. manglesii occupies the lower well-watered slopes of the cemetery ground, while A. humilis occurs on the drier central rise. Easily recognisable hybrids are confined to the ecotonal midslopes, primarily due to stringent spatial limitations on interspecific pollen flow imposed by bird pollinators.

3. Moore River National Park

This stop features Banksia-open-woodlands on the inland side of the coastal plain. The vegetation grows on quaternary, unconsolidated quartz sand. The area is renowned for its outstanding roadside populations of Yellow Morrison (Verticordia nitens, Myrtaceae), which flower in November. Banksia laricina, a small shrub of restricted distribution whose fruits are harvested for sale in dry floral arrangements, is another feature of the park.

4. Badgingarra National Park

A good selection of the dissected lateritic plateau country of the northern heathlands is included in this park. The vegetation is typically dense low heath less than 1.5 m tall. Badgingarra mallee Eucalyptus pendens is a rare species of weeping habit that occurs in very small geographically isolated populations in the area. The richness of the flora is apparent at this stop, with, for example, five species of Banksia and four of Conostylis (Haemodoraceae) occurring together (sympatry).

5. Woodland West of Mount Benia

This stop overlooks the rugged lateritic landforms of the Mount Benia-Mount Lesueur region, an area that has in excess of 30 endemic species in a number of genera. Open woodland of wandoo (Eucalyptus wandoo) and marri (E. calophylla) occurs here in outlying populations far removed from the main stands of these species from Gingin southwards. The relatively rich loam favoured by wandoo carries an understorey flora that differs dramatically from that seen in the surrounding lateritic uplands and sandplains.

6. Kingia and Macrozamia - Cockleshell Gully Road

The cycad, Macrozamia reidlei, and the arborescent monocotyledon Kingia australis are featured at this stop on the coastal plain north of Jurien Bay. The associated shrubland differs noticeably in species composition from that seen previously on the coastal plain at Yanchep (Stop) and Moore River (Stop) National Parks. The soils are a complex of colluvial sand, gravel and clay.

7. Cockleshell Gully

An excellent view of dissected lateritic landforms is available up and down Cockleshell Gully some 500 m south of where the bus stops. Low shrubland on ferrugineous sandstone with sand occurs on the top of the plateau, and blackboys (Xanthorrhoea reflexa) are prominent. The slopes of the gully carry small stands of emergent marri (Eucalyptus calophylla) and mallees (E. drummondii).

8. Lake Indoon

Semi-permanent fresh water wetlands are of considerable interest as they are rarely found in the northern heathlands. Lake Indoon is perched on a clay basin and surrounded by quartz dunes. It has magnificent specimens of River Gum - Flooded Gum hybrids (Eucalyptus camaldulensis x rudis) on its margins, backed by woodland of Banksia prionotes with scattered cycads, Macrozamia reidlei, present in the understorey.

9. Banksia hookerana - East of Lake Indoon

There are now 71 species of Banksia recognised and 50 of these are endemic to the south west of Western Australia. Several species, B. hookerana included, support a lucrative trade in the sale of fresh cut flowers. This stop gives an indication of the spectacular display of colourful inflorescences typical of many banksias. Large numbers of birds and honey possums may be found feeding on the inflorescences at certain times. The stop also offers views of open pit sandmining at Eneabba, and recent agricultural development, two activities posing serious threats to the conservation of the flora of the northern heathlands.

10. Mount Adams - Vacant Crown Land

This area is one of the few large tracts of vacant land left in the northern heathlands. A proposal for it to become a Nature Reserve is under consideration, but strong opposition has been voiced from some local farmers. The Mount Adams area has extensive sandplains and dissected, lateritic plateaus. It supports several endemic, or geographically restricted species. Eucalyptus macrocarpa, which has woody fruits up to 7 cm in diameter, occurs in small stands throughout the area.

11. Greenough Historic Village

Situated on a narrow coastal plain that has River Gums (Eucalyptus camaldulensis) with trunks bent at right angles by the strong salt-laden prevailing winds. Geeenough is a hamlet that serviced one of the earliest farming settlments north of Perth.

12. Geraldton

A large country town and port. This stop will include a display of local wildflowers prepared by members of the local branch of the Western Australian Wildflower Society.

13. Depot Hill

This lateritic hill lies beside the Irwin River in a small reserve surrounded by land cleared for wheat and sheep farming. The vegetation contains a number of elements typical of the arid interior of Western Australia, with the dominance of Acacia species being particularly noticeable. Carpets of colourful everlastings (Helipterum and Waitzia, Asteraceae) are also prominent in good seasons. A superb view of the Irwin River lined by River Gums (Eucalyptus camaldulensis) will reward a climb to the top of the hill.

14. Coastal Dunes - Dongara

An opportunity to examine one of Western Australia's sandy beaches and adjoining calcareous dune vegetation. A clear sequence in the vegetation can be seen from the beach inland.

15. Three Springs

A major country town servicing an established wheat-farming district. Broa. streets and typical Australian "pubs" are to be seen.

16. Yarra Yarra Lakes

Salt lakes are a feature of the subdued landscape of the south western plateau. Many lie in recognisable watercourses that have long since ceased to flow except in years of exceptionally high rainfall. Halophytic vegetation, dominated by samphires (Chenopodiaceae), occupies the margin of Yarra Yarra Lakes.

17. Yellow Sandplain - south of Yarra Yarra Lakes

Yellow sandplains are a feature of the inland regions of the south west. A rich flora is to be seen, with many genera and species in common with the kwongan further to the west. Adenanthos stictus (Proteaceae) is an unusual dominant of restricted geographical range, at this stop.

18. Jack's Wildflower Nursery and Farm

The development of wildflower farming is receiving increased attention locally in the face of diminishing wild stocks available for harvesting, combined with strong international competition in the market place from Hawaii, Israel and South Africa. Mr. Brian Jack is one of the first successful wildflower farmers in Western Austraia. He will be available to discuss his venture and to show the group some of his nursery facilities.

19. Mallee-Tootbardi Road

Situated in the dissected lateritic landforms of the Herschell Range, this stop features very rich kwongan with emergent mallees of Eucalyptus gittensii and E. drummondii. Open woodland of E. wandoo occurs a few hundred metres downslope at the bottom of the valley. A number of rare plants occur here, including Spirogardnera rubescens (Santalaceae).

20. Moora

A large country centre (population 1,545) situated in salmon gum woodland (Eucalyptus salmonophloia). The bark of this tree changes colour with the seasons (red in summer, grey-green in winter). The Moora district is especially rich in Acacia species, with over 100 so far recorded.

21. New Norica

A town established in 1846 by Benedictine monks. It has an outstanding art gallery and museum.

22. Jarrah Forest

Jarrah (Eucalyptus marginata) is Westen Australia's foremost hardwood timber tree. This stop highlights many species typical of the jarrah forest. Eucalyptus drummondii, seen at Cocklesheell Gully (Stop) as a small mallee 3 m tall, is here a tree up to 18 m. The jarrah forest typically grows on lateritic gravel and massive laterite formed on the Precambrian Shield, as at this site.

SPECIES LISTS FOR IBC TOUR 11

A. Yanchep NP - limestone east of entrance.
Tuart dominated open woodland with dense low sclerophyllous understo:

Acacia cylops
Banksia attenuata
B. grandis
B. littoralis
B. menziesii
Caladenia patersonii
Callitris robusta
Casuarina fraserana
Chamaelaucium uncinatum
Conospermum triplinervium
Conostylis candicans
C. teretifolia
Dianella revoluta
Diuris longifolia
Dryandra sessilis
Eucalyptus calophylla
E. gomphocephala
E. marginata
Grevillea thelemanniana
G. vestita
Hakea prostrata
Hibbertia hypericoides
Jacksonia furcellata
Macrozamia reidelei
Nuytzia floribunda
Phyllanthus calycinus
Xanthorrhoea reflexa

B. Moore River NP
Banksia open woodland with occasional Eucalyptus todtiana low open heath understorey.

Acacia blakleyi
Adenanthos cygnorum
Anigozanthos humilis
Astroloma xerophyllum
Banksia attenuata
B. ilicifolia
B. laricina
B. menziesii
Beaufortia elegans
Blancoa canesens
Calytrix empetroides
Conospermum acerosum
C. incurvum
Conostephium sp.
Conostylis aurea
C. teretifolia
Cryptandra humilis
Dampiera sp.
Drosera pycnoblasta
Eremaea pauciflora

B. contd

Eriostemon spicatus
Eucalyptus todtiana
Hakea costata
Hibbertia hypericoides
Isotropis cuneifolius
Jacksonia floribunda
Patersonia occidentalis
Petrophile linearis
P. macrostachya
Schoenus curvifolius
Stirlingia latifolia
Synaphea polymorpha
Verticordia nitens

C. Badgingarra HP (Eucalyptus pendens)
Low shrubland to low open heath

Adenanthos cygnorum
Anigozanthos humilis
Banksia attenuata
B. candolleana
B. ilicifolia
B. menziesii
B. spp.
Blancoa canescens
Calothammus sanguineus
C. torulosus
Casuarina humilis
Conospermum acerosum
Conostylis aurea
C. crassinervia
C. teretifolia
C. sp.
Conothamnus trinervis
Daviesia divaricata
D. nudiflora
D. quadrilatera
Drosera erythrrorhiza
D. leucoblasta
Dryandra shuttleworthiana
D. sp.
Eriostemon spicatus
Eucalyptus macrocarpa
E. pendens
Grevillea rudis
Haemodorum sp.
Hakea conchifolia
H. flabellifolia
H. incrassata
H. ruscifolia
Hibbertia hypericoides
Isopogon linearis
Jacksonia carduacea
Labichea punctata
Lambertia multiflora
Leptospermum spinescens

C. contd

Macropidia fuliginosa
Melaleuca sp.
Oxylobium reticulatum
Petrophile drummondii
P. macrostachya
P. media
Pityrodia bartlingii
P. verbascena
Sphaerolobium sp.
Strangea cynanchicarpa
Synaphaea spinulosa
Thomasia grandiflora
Xanthorrhoea preissii

D. Woodland West of Mt. Benia
Wandoo-Marri woodland with low open understorey

Acacia pulchella
Astroloma serratifolia
Baeckea crispiflora
Burchardia unbellata
Caladenia flava
C. huegelii
C. patersonii
Calothamnus quadrifidus
Casuarina microstachya
Comesperma volubile
Conostylis aculeata
Conostephium pendulum
Craspedia sp.
Dampiera spicigera
Drosera spp.
Eucalyptus calophylla
E. wandoo
Gastrolobium plicatum
Grevillea acerosa
Hakea trifurcata
Hibbertia hypericoides
H. polystachya
Hypocalymma ericifolia
Melaleuca platycalyx
M. radula
Petrophile chrysantha
P. seminuda
Sowerbaea laxiflora
Stackhousia pubescens
Stylidium calcartum
Synaphea petiolaris
Verticordia densiflora
Viminaria juncea
Xanthorrhoea reflexa

E. Kingia site Cockleshell Gully Road
Low open heath

Kingia australis
Macrozamia reidleii
Xanthorrhoea reflexa

F. Cockleshell Gully (north)
Low open heath on laterite

Anigozanthos humilis
Baeckea grandiflora
Burchardia umbellata
Calothamnus torulosus
Conostylis androstemma
Dampiera spicigera
D. neildiana
D. sanguinea
Daviesia epiphylla
D. pectinata
D. pedunculata
Dryandra armata
Eucalyptus calophylla
E. drummondii
Gastrolobium sp.
Grevillea synaphea
Haemodorum sp.
Hakea stenocarpa
Hibbertia hypericoides
Isopogon dubius
Mirbelia florbunda
M. spinosa
Scaevola canescens
Stylidium adpressum
S. diuroides
S. pychnostachyum
Synaphea polymorpha
Xanthorrhoea reflexa

G. Illyarrie (Eucalyptus erythrocorys) (Limestone west of Lake Indoon)
Open woodland with low open heath

Acacia lasiocarpa
Acacia spathulifolia
A. xanthina
Banksia attenuata
B. prionotes
B. spaerocarpa
Beaufortia squarrosa
Calothamnus quadrifidus
Casuarina humilis
Conostylis candicans
Dryandra sessilis
Eucalyptus erythrocorys
Hakea lissocarpha
H. prostrata
H. trifurcata
Helichrysum bracteatum
Hibbertia hypericoides
Jacksonia furcellata
Lechenaultia lineroides
Leucopogon spp.
Melaleuca acerosa
Nuytzia floribunda
Scaevola sp.

H. Lake Indoon

Banksia attenuata
B. elegans
B. menziesii
B. prionotes
Eucalytus camaldulensis x E. rudis
Jacksonia sternbergiana
Macrozamia reidlii

I. Banksia hookerana, East of lake Indoon
Low open heath - open shrubland

Actinostrobus acuminatus
Andersonia sp.
Baeckea grandiflora
Banksia attenuata
B. hookerana
B. menziesii
Beaufortia elegans
Calothamnus sanguineus
Calytrix spp.
Cassytha sp.
Casuarina humilis
Conospermum triplinervium
Conostylis aurea
C. crassinervia
C. teretifolia
Dampiera spicigera
Darwinia neildiana
D. speciosa
Dryandra nivea
Eremaea acutifolia
E. violacea
Hakea cinerea
H. costata
Hypocalymma xanthopetalum
Isopogon trilobus
Jacksonia floribunda
Leucopogon striatus
Lysinema ciliatum
Melaleuca sp.
Mesomelaena stygia
Monotaxis grandiflora
Petrophile drummondi
Pileanthus filifolius
Stirlingia latifolia
Stylidium crossocephalum
S. spp.
Verticorida grandiflora
Xylomelum angustifolium

J. Burma Road
Low open heath with thickets of Acacia on road side which is unburnt

Acacia auronitens
A. blakleyi
A. lasiocarpa

J. contd

A. spathulifolia
Banksia prionotes
B. scabrella
Boronia coerulescens
Burchardia umbellata
Calothamnus sanguineus
Conospermum sp.
Conostylis androstemma
Dampiera juncea
D. sp.
Daviesia daphnoides
Diplolaena ferruginea
Ecdeiocolea monostachya
Eremaea acutifolia
Eriostemon spicatus
Geleznowia verrucosa
Grevillea paniculata
G. thelemanniana
Hakea trifurcata
Hibbertia hypericoides
Jacksonia ulicina
Leptospermum erubescens
Melaleuca holosericea
M. sp.
Mesomelaena stygia
Petrophile macrostachya
Scholtzia sp.
Stackhousia sp.
Stylidium crossocephalum
S. spp.
Xanthorrhoea reflexa

K. Depot hill

Acacia acuaria
A. acuminata
A. blakleyi
A. microbotrya
A. nyssophylla
A. tetragonophylla
Amyema fitzgeraldii
Avena sativa
Calandrinia sp.
Cassia chatelainiana
Casuarina campestris
Cheilanthes tenuifolia
Clematicissus sp.
Comesperma scoparium
Conostylis candicans
Dampiera spicigera
Dianella revoluta
Dodonaea sp.
Dryandra fraseri
Eucalyptus camaldulensis
E. eudesmoides
E. loxophleba

K. contd

Grevillea sp.
Hakea preissii
H. prostrata
Hibbertia rupicola
H. spicata
Helipterum davenportii
Jacksonia ulicina
Melaleuca unicinata
Pittosporum phylliraeoides
Podotheca gnaphalioides
Ptilotus obovata
P. sp.
Ramalina sp.
Sida sp.
Solanum sp.
Thryptomene sp.
Trymalium sp.
Waitzia acuminata

I. Sand plain south east of Yarra Yarra Lakes

Adenanthos strictus
Baeckea sp.
Banksia attenuata
B. burdettii
B. prionotes
B. sp.
Cassytha sp.
Conospermum triplinervium
Conostylis teretifolia
Cryptandra pungens
Dampiera spicigera
Drosera sp.
Ecdeiocolea monostachya
Eremaea pauciflora
Grevillea amplexans
G. leucopteris
G. sp.
Hakea circumalata
H. obliqua
Hibbertia sp.
Jacksonia ulicina
Lachnostachys eriobotrya
Leptospermum erubescens
L. spinescens
Melaleuca sp.
Mesomelaena stygia
Monotaxis sp.
Neurachne alopecuroidea
Petrophile ericoides
P. media
Pityrodia verbascina
Podotheca angustifolia
P. gnaphalioides
Scaevola canescens
Synaphea polymorpha

I. contd

Tetratheca sp.
Thysanotus patersonii
Verticordia grandis
V. picta
V. sp.
Xylomelum angustifolium

M. Herschel Range

Acacia alata
A. auronitens
A. multispicata
Anigozanthos humilis
Baeckea camphorosmae
B. sp.
Banksia sphaerocarpa
Beaufortia bracteosa
Boronia sp.
Borya nitida
Burchadia multiflora
Burchardia umbellata
Caladinia flava
C. gemata
Calothamnus longissimus
C. sanguineus
Calytrix fraseri
C. sp.
Casuarina campestris
C. microstrachya
C. ramosissima
Caustis dioica
Chamaescilla corymbosa
Conostylis aculeata
Conostylis androstemma
C. crassinervia
C. teretifolia
Cryptandra pungens
Darwinia neildiana
Drosera glanduligera
D. leucoblasta
D. macrantha
D. menziesii
D. stolonifera
D. subhirtella
Dryandra carlinoides
D. kippistiana
D. speciosa
Ecdeiocolea monostachya
Eucalyptus drummondii
E. gittensii
E. wandoo
Gastrolobium bidens
G. calycina
G. obovatum
G. sp.
Grevillea integrifolia

M. contd

G. rudis
Haemodorum sp.
Hakea auriculata
H. gilbertii
H. incrassata
H. trifurcata
H. undulata
Helichrysum sp.
Hibbertia acerosa
H. pachyrhiza
Hypoxis leptantha
Isopogon dubius
Jacksonia restioides
Lambertia multiflora
Lasiopetalum sp.
Lepidobolus
Lepidospermum pubisquameum
Leucopogon lasiostachys
Levenhookia dubia
Lyperanthus nigricans
Melaleuca hamulosa
M. platycalyx
M. radula
M. tricophylla
M. sp.
Mesomelaena stygia
Mirbelia ramulosa
M. spinosa
Neurachne alopecuroidea
Nuytzia floribunda
Olax phyllanthi
Orthosanthus laxus
Patersonia juncea
Petrophile chrysantha
P. inconspicua
P. megalostegia
P. seminuda
Rulingia grandiflora
Schoenus subflavus
S. sp.
Sowerbaea laxiflora
Sphaerolobium sp.
Spirogardnera rubescens
Stirlingia simplex
Stylidium adpressum
S. calcaratum
S. sp.
Synaphea polymorpha
Thysanotus dichotomus
T. patersonii
Trymalium wichurae
Velleia trinervis
Verticordia densiflora
V. grandiflora
V. pennigera
Waitzia paniculata

N. Jarrah Forest

Acacia latipes
A. pulchella
Adenanthos cygnorum
Anigozanthus humilis
Astroloma sp.
Banksia sphaerocarpa
Borya nitida
Bossiaea eriocarpa
Caladenia flava
Calothamnus sanguineus
Casuarina humilis
Chorizema sp.
Conospermum sp.
Conostylis setigera
Daviesia juncea
D. pectinata
D. preissii
Drosera macrantha
Dryandra nivea
D. polycephala
Eucalyptus calophylla
E. drummondii
E. marginata
E. wandoo
Gastrolobium spinosum
G. bipinnatifida
G. sp.
Hakea incrassata
H. lissocarpha
H, trifurcata
Hibbertia hypericoides
H. montana
H. sp.
Hybanthus floribundus
Lepidobolus sp.
Leptospermum erubescens
Lechenaultia biloba
Macrozamia reidlei
Mesomelaena stygia
Patersonia juncea
P. occidentalis
Petrophile striata
Stylidium piliferum
Synaphea petiolaris
Xanthorrhoea preissii

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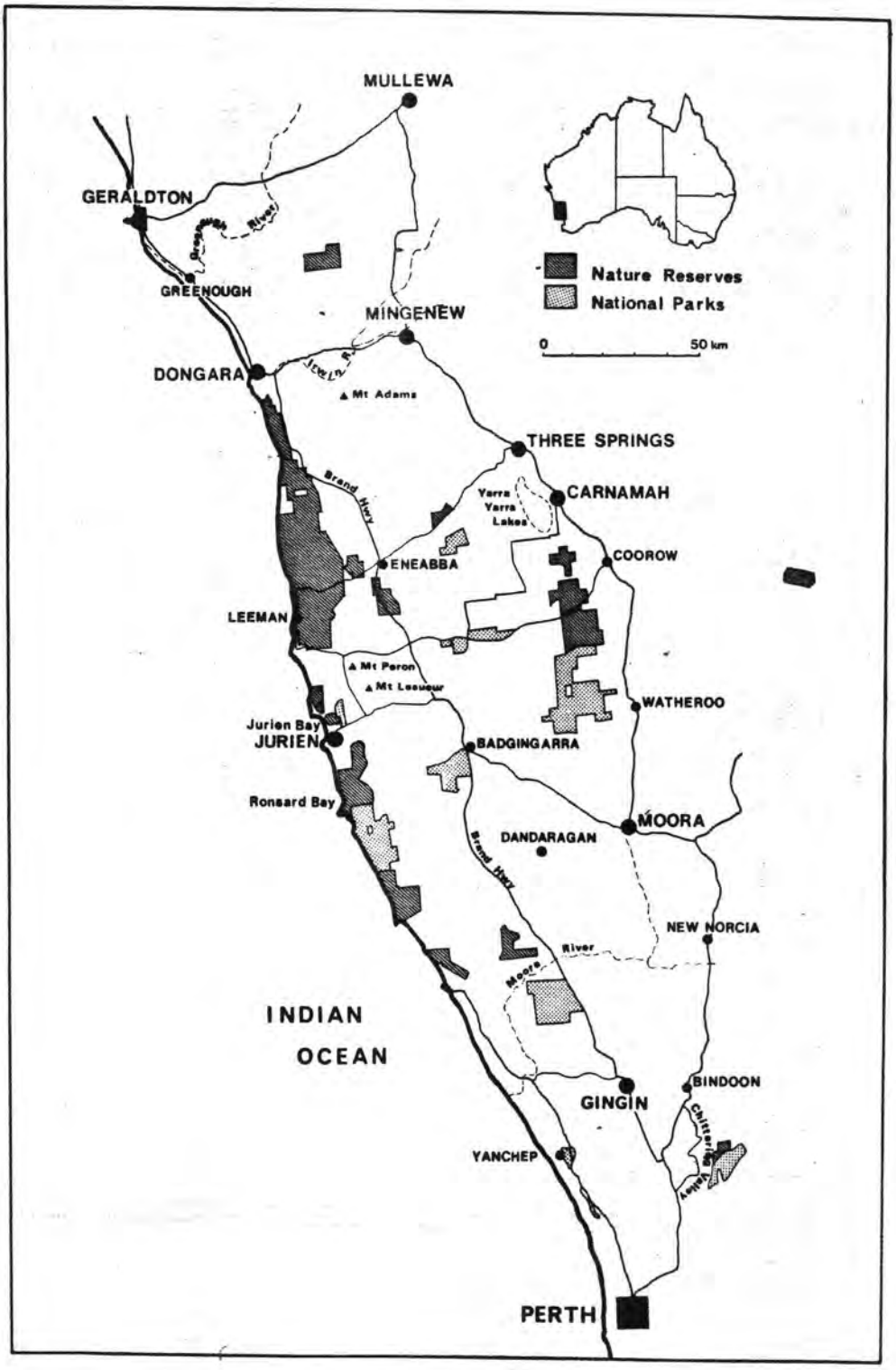
MULLEWA
GERALDTON
Greenough River
GREENOUGH
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DONGARA
Irwin R.
Mt Adams
THREE SPRINGS
Brand Hwy
CARNAMAH
Yarra Yarra Lakes
ENEABBA
COOROW
LEEMAN
Mt Peron
Mt Lesueur
WATHEROO
Jurien Bay
JURIEN
BADGINGARRA
Ronsard Bay
MOORA
DANDARAGAN
Brand Hwy
NEW NORCIA
River
Moore
INDIAN
OCEAN
BINDOON
GINGIN
Chittering
Valley
YANCHEP
PERTH
Nature Reserves
National Parks
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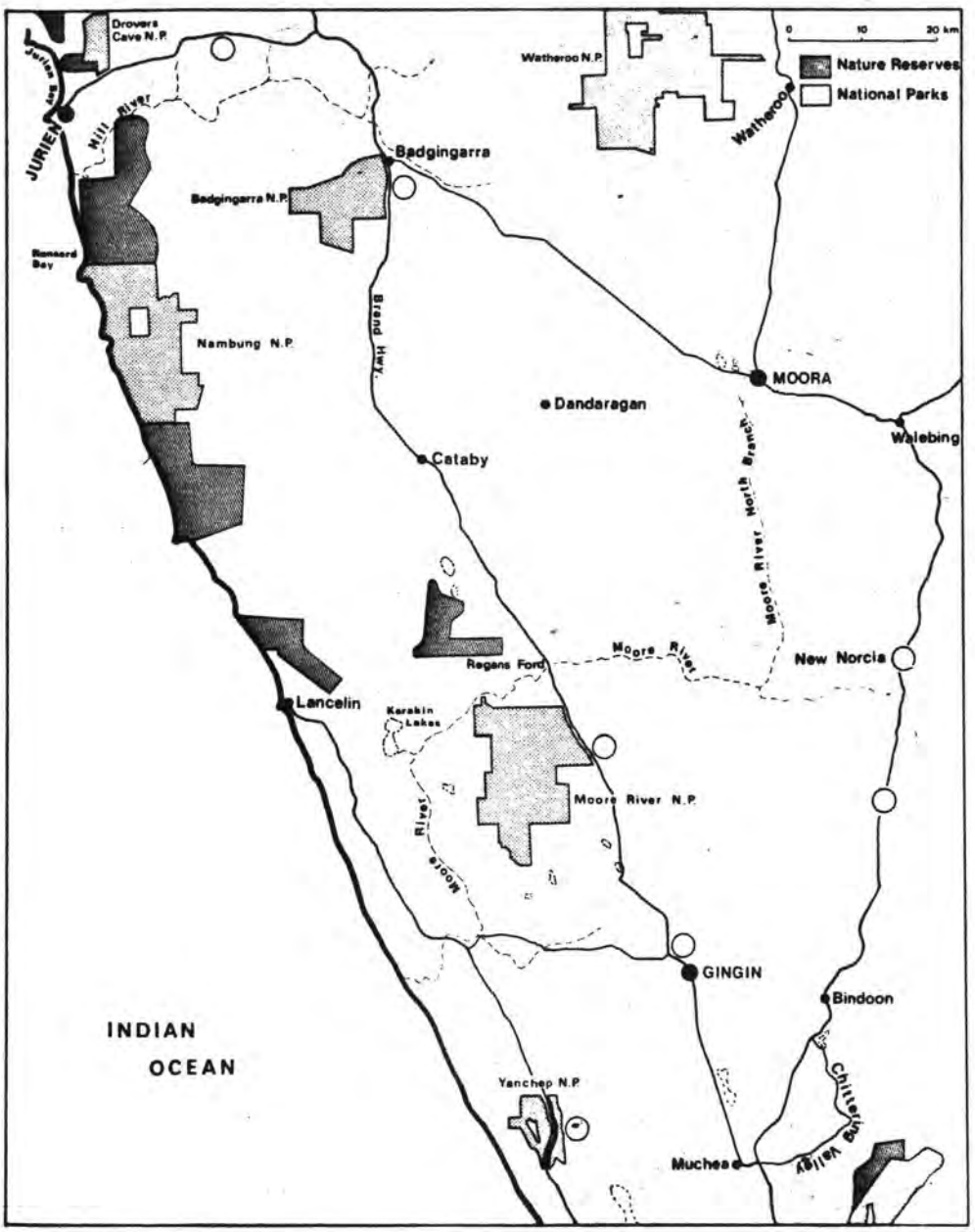
Drovers Cave N.P
JURIEN
Hill River
Badgingarra
Badgingarra N.P.
Nambung N.P.
Brand Hwy
Watheroo N.P.
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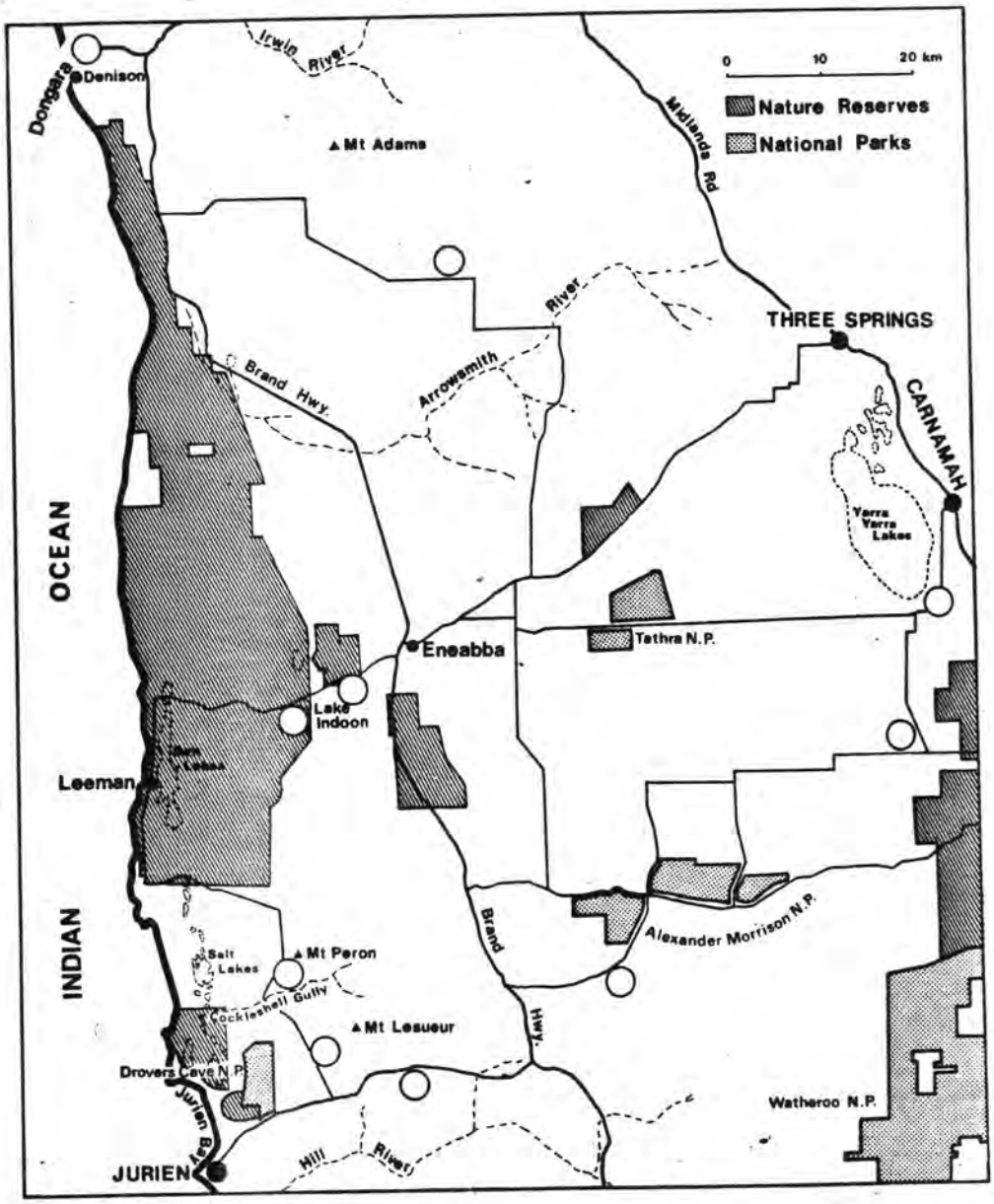
Nature Reserves
National Parks
MOORA
Dandaragan
Cataby
Walebing
Moore River North Branch
Regans Ford
Moore River
New Norcia
Lancelin
Karakin Lakes
Moore River N.P.
Moore River
GINGIN
Bindoon
INDIAN
OCEAN
Yanchep N.P.
Muchea
Chittering Valley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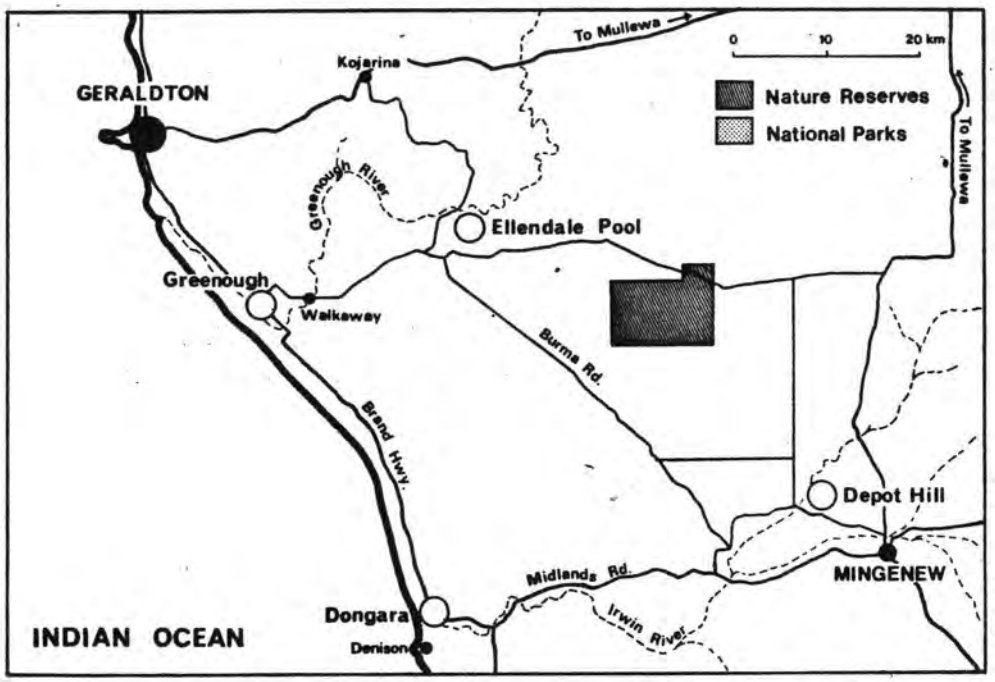
National Parks
Irwin River
Denison
Dongara
Mt Adams
Midlands Rd
River
THREE SPRINGS
Brand Hwy.
Arrowsmith
CARNAMAH
Yerra Yerra Lakes
OCEAN
Tathra N.P.
Eneabba
Lake Indoon
Leeman
INDIAN
Brand Hwy.
Alexander Morrison N.P.
Salt Lakes
Mt Peron
Cockleshell Gully
Mt Lesueur
Drovers Cave N.P.
Watheroo N.P.
Jurien Bay
JURIEN
Hill River


To Mullewa
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20 km
Kojarina
GERALDTON
Nature Reserves
National Parks
To Mullewa
Greenough River
Ellendale Pool
Greenough
Walkaway
Burma Rd.
Brand Hwy.
Depot Hill
Midlands Rd.
MINGENEW
Dongara
Irwin River
Denison
INDIAN OCEAN