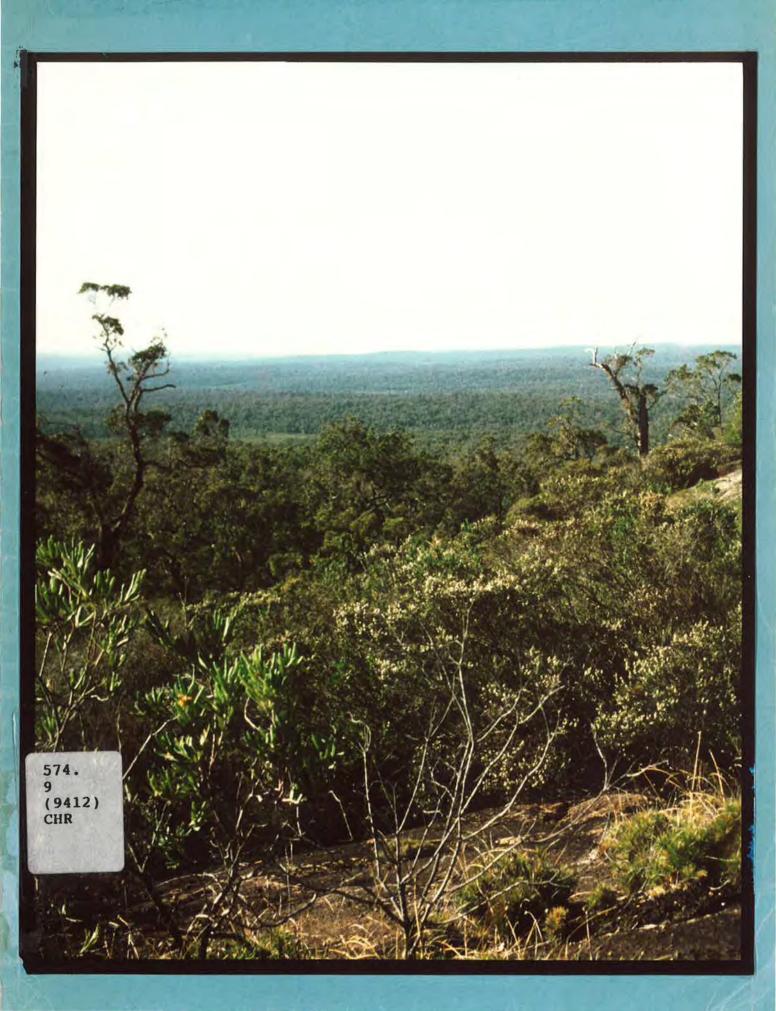
A FOREST WORTH PRESERVING



A report on a biological survey of the area of Vacant Crown Land situated immediately to the east of the Denmark River catchment. This report was prepared as a case for dedication of the area as State Forest.

P. Christensen PhD Senior Research Officer (Forests Dept. of W.A.) May 1980

Cover Photograph

View over the Mitchell river basin from a granite outcrop in the south-west of the survey area.

SUMMARY

A brief biological survey of the large tract of forested vacant crown land to the east of the Denmark river indicates that the area is unique. Much of it is overlain by tertiary deposits not represented with any State Forest areas or southwest forested reserves.

It contains an exceptional range of forest and plant communities supporting a rich vertebrate fauna and the Mitchell River basin, which occupies a large part of the area, may also have some potential as a future water catchment.

Large forested tracts with any one of the above attributes, let alone all of them, are rare. It is therefore recommended that the area be dedicated as State Forest to ensure its future protection.

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INTRODUCTION

During preliminary investigations associated with the preparation of a land use management plan for the southern forest areas, the future of the large tract of forested vacant crown land located to the east of the Denmark catchment (see map 1) came under consideration.

At the present time it is possible to travel west, from a point just east of the May river all the way to the west coast through natural forest, woodlands and sedgelands unbroken by clearing, a distance of approximately 150 kilometres. The transect includes wandoo woodland in the east, Banksia/Casuarina woodlands, stunted jarrah forest, high quality jarrah, marri/karri, karri and tingle forests, open sedgelands, swamps, coastal heath and massive granite monadnocks. Apart from timber cutting, mostly light selection cutting, little activity has taken place in these southern forests. This vast unbroken tract of forested land lying across the east west climatic gradient forms the single most important representation of natural forest ecosystems in Western Australia.

In order to ensure the future preservation of representative portions of this vast range of ecotypes a series of Flora, fauna and landscape M.P.A.'s have been formed (see map 1). Starting in the west the Lower Shannon M.P.A. represents Karri forest types, sedgelands and swamplands. Further to the east is the large Frankland M.P.A. comprising Mattle, Johnston-O'Donnell, Mitchell-Crossing and Soho blocks. Together these represent most of the ecotypes to the west of the Frankland

river. In addition silvicultural M.P.A.'s have been selected in the tingle forests near Walpole (App. 8).

In order to ensure adequate representation of ecotypes to the east of the Frankland river two further areas have been proposed as scientific, landscape, flora and fauna M.P.A.'s together with a further addition to the existing Frankland M.P.A. These are:

- (i) A scientific M.P.A. on the Kent River.
- (ii) A flora, fauna and landscape M.P.A. on the Mitchell River.

(see App. 8).

These areas have been chosen after examination of aerial photographs, field inspections and consultation with people familiar with the area so as to represent the widest possible range of forest ecotypes. Almost all of the area proposed to the east of the Frankland river is at present outside State Forest. However, it is understood that the Kent river catchment is awaiting dedication as State Forest.

The majority of the proposed Mitchell River M.P.A. is at present vacant Crown Land. The object of this report is to put forward a case for the inclusion of the entire area of vacant Crown Land to the east of the Denmark River catchment into State Forest (see App. 9).

Viewed in the context of an east west representation of a range of forest ecotypes as advanced above, it will be demonstrated that this area is substantially different from any area of State Forest, dedicated reserve area or National Park. It forms an addition to the system of flora and fauna M.P.A.'s and is a natural eastward extension of the present

area of State Forest. It is therefore important that the area should remain in its natural state.

The arguements advanced here are based largely on the conservation of natural ecosystems but there are other good reasons for the inclusion of the area in State Forest, for example protection. As a flora, fauna and landscape M.P.A. the area would receive protection which would ensure the conservation of the natural environment in perpetuity.

The ecological data presented here were collected during a brief biological survey of the area. A five man team spent five days in the area just before Easter 1980. Further brief visits were made to the area by a two man team during and after Easter. Most of the survey work was concentrated in the area to the east of the Denbarker Road.

Climate, Landforms, Soils and Water

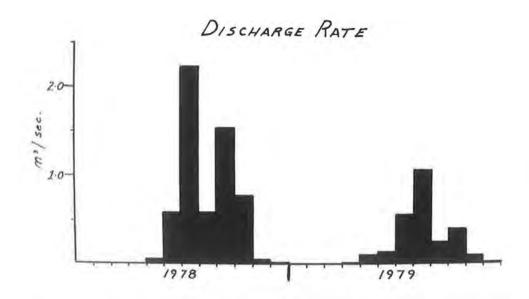
The area falls within the 889 to 1143 mm isohyet as does much of the area of State Forest to the east of the Frankland River. The north eastern corner however appears to be drier and may be outside the 889 isohyet. The mean summer and winter rainfall, annual evaporation and summer and winter temperatures are listed in Climatological survey of Western Australia, Region 12 and 16 of 1962 and 1965. These are very similar to areas of State Forest east of the Frankland River.

The bulk of the area is drained by the Mitchell River, a tributary of the Hay. With the exception of the headwaters of one small stream which arises in farmland to the north, the entire catchment of the Mitchell River is encompassed within the area. The north eastern portions of the area and the portion to the east of the Hay River is drained by a number of smaller tributaries of the Hay, the main one being Sheepwash creek. The only portion of the area outside the Hay River drainage system is a small section in the south western corner.

Rivers are generally seasonal, although there is permanent running water in the lower Hay and also in Sheepwash creek in the north east. The water in the latter however appears to dissipate further downstream as it does not reach the Hay. A few permanent pools also exist on the Hay and Mitchell Rivers.

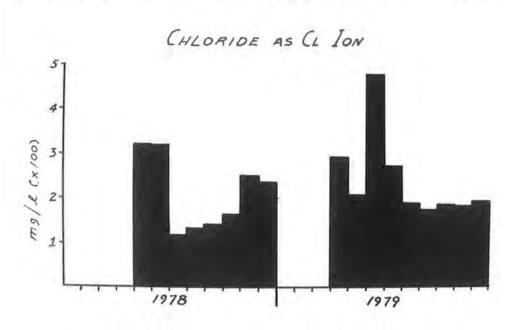
In spite of the fact that the Mitchell River appears to be seasonal, stream flow data (Fig. 1) suggests that a considerable volume of water is discharged annually from its catchment. The annual output compares favourably with that of other streams currently supplying some of the reservoirs of the south-west (Appendix 7).

Fig. 1 Mean monthly streamflow, Mitchell River



Data compiled from weekly measurements over the period 1978 - 1979 P.W.D. Stn. 6031003, Lower Mitchell River.

Fig. 2 Mean monthly chloride iron concentration Mitchell River



Data compiled from weekly samples taken at P.W.D. stn. 6031003, Lower Mitchell River.

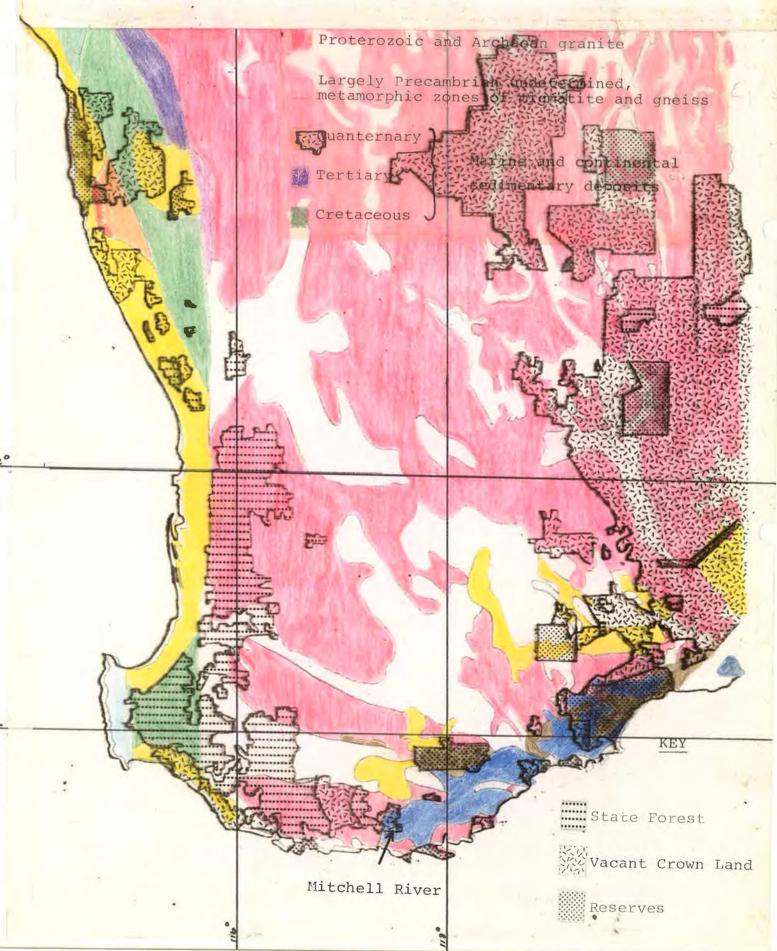
With almost no clearing within the catchment area, the water of the Mitchell River remains fresh and suitable for drinking purposes (Figure 2). However the level of Chloride irons present would suggest that any clearing or disturbance within the catchment is likely to result in a release of salt which could render the water unfit for human consumption.

The waters of the Hay River and Sheepwash creek which both have a considerable portion of their catchments cleared are highly saline.

A feature of the area is the very wide range of topography and landforms. The headwaters of the Mitchell River arise in country very similar to that further to the west on the Shannon and Deep river catchments. Thus large granite monadnocks, part of the Mount Lindesay complex, are a feature in the South-west of the area. Low undulating hills separate wide flat drainage lines over much of the rest of the area to the west of the Denbarker Road. To the east the topography changes, the country associated with the Mitchell River becomes more incised and shows greater relief. Smaller drainage lines are separated by more rounded hills. The topography associated with the Mitchell River itself is often steep. The north eastern portion of the area, drained largely by Sheepwash creek, is characterized by broad flat valleys as is that to the east of the Hay River. The soils and vegetation of the valleys to the east of the Hay River are however different from those to the west of the river.

The entire area is underlain by granite of proterozoic origin, these rocks are overlain in the eastern part of the

Overlay on geological map showing location and extent of major geological formations within State Forest, Vacant Crown Land and Reserves in the south-west. Note the occurrence of tertiary deposits with V.C.L. area proposed for dedication and the lack of representation of this type within either State Forest or forested Reserve areas.



area, approximately the portion to the east of the Denbarker Road, by tertiary sedimentary deposits (see Fig 3).

There are several quite distinct soil patterns similar to the Denmark pattern described by Hosking and Burvill (1938).

The better soils are associated with the higher country and the incised valleys where sandy loams, and in rare cases red earth (see McArthur and Clifton 1975), have developed. These soils support high open forest or Riverine forests of marri (Eucalyptus calophylla), jarrah (E. marginata), yate (E. cornuta) and blackbutt (E. patens) and occasionally karri (E. diversicolor).

Most of the upland soils are brown or grey sandy gravels with occasional duricrust remains. These soils generally support open forest of jarrah. In some areas, particularly to the south west, yellow podzolic soils (McArthur and Clifton 1975) support mixed open forests of jarrah and marri.

Shallow clay soils exist in places on the ridges and support stunted low open woodland of jarrah. In extreme cases open jarrah/kingia high open scrubland similar to that found in the Donnybrook sunklands with stunted jarrah, Kingia australis and C. humilis occur.

There are also occurrences of wandoo (E. wandoo) woodland on shallow clay soils overlying granite on the steep slopes of 'the pass' in the Hay river.

Strongly podzolized deep grey sands are common in the lower slopes, particularly to the east of the Denbarker road where they often occur on the ridges as well. These soils conform closely to the Wilbay sand of Hosking and Burvill (1938). The vegetation is typically an open woodland of sheoak (Casuarina fraseriana), (Banksia attenuata) and increasingly towards the east, Albany blackbutt (E. staeri).

A number of soils may be recognized in the drainage lines. Firstly what appears to be the normal and wet phases of the Plantagenet Peaty sands of Hosking and Burvill (1938). The normal phase, a sand with a high humus content, supports a very open woodland of jarrah, Albany blackbutt, Banksia ilicifolia and Christmas tree (Nuytsia floribunda). The wet phase, which has a layer of peat up to 30 centimetres in depth and is often waterlogged in winter, supports open sedgeland or scrubland of paperbark (Melaleuca sp.) and other species.

In the north east corner wide flat bottomed valleys contain shallow soils over clay supporting dense Melaleuca thickets. On the slightly more elevated portions, well developed wandoo woodlands occur and along the lower slopes E. decipiens is often present.

The Flora

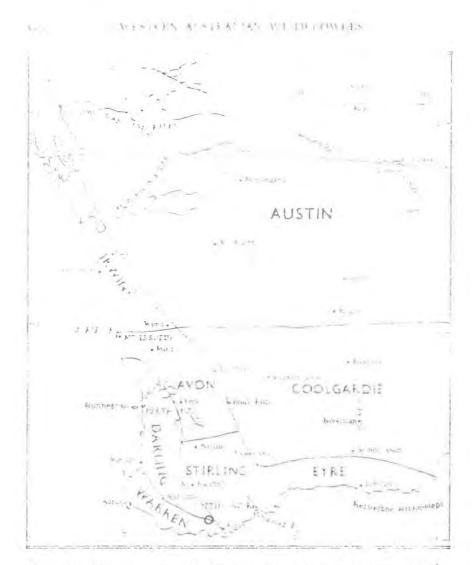
The area is unique because of the wide range of vegetation types contained within a comparatively small area; Karri forest, jarrah forest, yate, wandoo and Albany blackbutt woodlands, jarrah/kingia high open scrubland, open sedgelands and scrublands all occur within the area.

The richness of the flora appears to be due to the fact that three of the 6 botanical districts in the South-west botanical province meet within or very close to the area (Fig 4).

Thus the karri forest type is typical of the Warren botanical district, the E. staeri and E. occidentalis woodlands typical of the Stirling, whilst the wandoo woodlands represents elements more typical of the Darling or Avon botanical districts.

Fig. 4

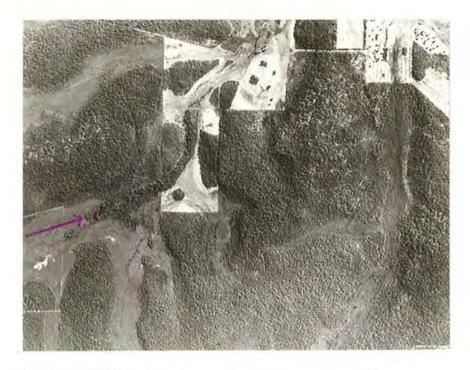
Map of the eight botanical districts of the south-west (From Blackall and Grieve 1965)



The eight botanical districts of the temperature regions of Western Australia. Man modified from Diels "Die Vegetation der Erde VII Die Phatsenweb von West Australier." (1906)

The location for the V.C.L. proposed for dedication as State Forest almost co-incides with the junction of the three botanical districts of Warren, Darling and Stirling.

O Approx. location of the area



Aerial view, east of the Hay River showing extensive sedgelands with karri (Eucalyptus diversicolor) forest outlier on outcrop of lateritic soil.



Karri (\underline{E} . diversicolor) forest outlier, (same as in aerial view above) note good regeneration of karri saplings.

Similarly individual species typical of each of these three districts may all be found in the area.

Thus karri (E. diversicolor) Kingia australis, Dasypogon bromeleafolius, Loxocaria flexuosa and Gastrolobium forrestii are all typical of the Warren or Darling districts. Whilst E. wandoo, E. descipiens, Banksia sphaerocarpa, Hakea ruscifolia and Trymalium ledifolium are more typical of the Darling/Avon districts. And E. occidentalis, E. decurva, E. anceps, B. occidentalis and B. prostrata are typical species in the Stirling botanical district.

In addition, many species occur in 'uncharacteristic' mixtures and associations found nowhere else in the forested areas of the south west. For example a karri forest understorey of Lepidosperma effúsum and Trymalium spathulatum may occur under a mixture of marri, jarrah, blackbutt (E. patens), wandoo and yate (E. cornuta).

A list of the more obvious species observed or collected in the area are presented in Appendix 1. Further, more intensive collections, would undoubtedly extend the list.

An indication of the richness of the flora may be gained by considering the fact that 16 species of eucalyptus and 9 banksias were located in the area. Such a range exists nowhere else in any similar sized area of State Forest.

Some noteworthy plant communities of the area are listed below;

1. The karri outliers. Some quite large karri trees occur in at least one place along the Hay River. More interesting though are two or three occurrences on a lateritic type of soil on very slightly elevated areas in the centre of



Albany blackbutt (E. staeri) woodland on sandy ridge soils east of the Hay River.



Woodland of flat-topped yate (E. occidentalis) on seasonally flooded clay flats on the Hay River.

- an open flat to the east of the Hay River. These occurrences are most interesting and wel worth preserving. They are badly fire damaged but good young regrowth is present which can be preserved with protection from fire.
- 2. Extensive areas of 'Albany blackbutt' woodland. These are represented nowhere within State Forest, some areas to the east of the Hay River in particular are almost pure blackbutt woodlands.
- 3. The souther-most extensive occurrence of wandoo woodland.

 At least 8 km of creek system in the north eastern portions of the area contains well developed wandoo woodland. In addition there is an occurrence reminiscent of wandoo woodlands in the Darling scarp at 'the pass' on the Hay River.
- 4. Yate woodlands. Some very fine occurrences of E. cornuta occur along the Hay F ver. In addition there are well developed flat topped yate (E. occidentalis) woodlands on some of the river flats.
- of this very attractive banksia occur in the flats to the east of Hay River. The species is sensitive to frequent burning and needs some protection.

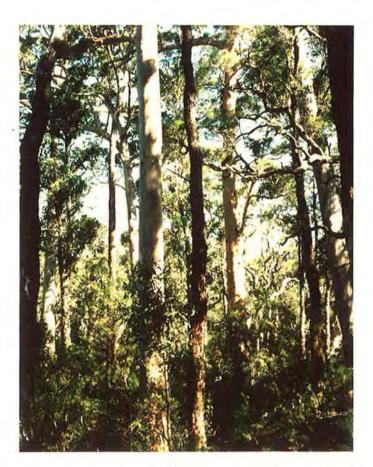
 The range and mixture of eucalyptus to be found in the area is unique and to be found nowhere else.

 The range and extraordinary mixture and combination, not only of eucalyptus but also other plant species, is considered to be a major feature of the area which gives it a very high conservation value.

The major vegetation formations and plant associations



 ${\tt Banksia\ occidentalis}$ on sedgelands east of the Hay River.



High open forest of karri ($\underline{\text{E. diversicolor}}$) on the Hay River.

to be found within the area have been classified according to the structural system used by Smith (1973) with further sub-divisions based on floristics

Vegetation Formations and Plant Associations

High Open Forest

Very limited areas of this class occur along the Hay River and on several tributaries, (see Riverine forest later) and in the Mt. Lindesay area. Small outliers of karri (Eucalyptus diversicolor) occur and are of interest as possible seed sources in tree improvement programmes. There is an isolated patch of good karri trees on the Hay River and two further patches in open flats to the east of the Hay. In the area examined to the east of the Hay the understorey consisted of Banksia littoralis, Eucalyptus patens and young karri saplings, the result of uncontrolled fires in the recent past. Mature trees were also showing signs of fire damage and some of the biggest trees had been burnt down and were lying on the ground.

Shrub species noted included <u>Rulingia corylifolia</u>, <u>Agonis</u>
<u>linearifolia</u>, <u>A. parviceps</u>, <u>Bossiaea linophylla</u>, <u>Pteridium</u>
<u>esculentum</u>, <u>Anigosanthos flavida</u>, <u>Oxylobium lanceolatum</u>,
<u>Lepidosperma effusum</u>, <u>L. tetraquetrum</u>, <u>Tremandra diffusum and</u>
<u>Melaleuca spp.</u>

The soil was a lateritic type, red in colour and in the middle of a large grey sand flat. The vegetation of the flat was Melaleuca spp., Pultenaea reticulata and Leptospermum crassipes and monocots.

Open Forest

Open forest was of the Jarrah-Marri type which was mainly found growing higher in the landscape on gravelly soil types or along the more inclsed valleys on sands. This type has been commercially exploited by both sawmillers and fence post cutters and numerous stumps testify to this past cutting.

Understorey tree species are Banksia grandis, Persoonia
longifolia, P. elliptica and Casuarina fraseriana. Shrub
species noted include Macrozamia reidlei, Lococarya flexuosa,
Kanthorrhoea preissii, X gracilis, Dasypogon bromeliaefolius,
Hakea amplexicaulis, Adenanthos obovata, Bossiaea ornata,
B. linophylla, Xanthosi: rotundifolia, Dryandra carduacea and
Lindsaya linearis.

Woodland

Woodlands of Eucalyptus vandoo with some patches of Flat-topped Yate (Eucalyptus occidentalis) occur on clay soils in some of the wider valleys in the north-eastern portions of the area, one such area extends for some kilometres along Sheepwash Creek. Other species which occur in this type are Eucalyptus rudis, E. patens, E. decipiens and E. calophylla.

This woodland supports an unusual and surprising mixture of shrub species and some of those recorded are Lepidosperma effusum, Casuarina humilis, Dryandra nivea, Trymalium ledifolium, Brachysema sericium, Leucopogon australis, Hakea lissocarpha, H. prostrata, Acacia divergens, A. pulchella, Astartea fasicularis, Acacia extensa, Bossiaea linophylla, Agonis undulatum, Viminaria juncea, Melaleuca spp., Boronia sp., Thomasia sp., Hypocalymma



Open forest of jarrah (E. marginata) heavily cut over. Note dense regrowth of saplings.



Wandoo woodland in Sheepwash creek in the drier north-eastern sector. Note the comparatively dense understorey of low woody scrubs.

angustifolium and Santalum sp.

Low Woodland

Three different plant associations were found which may

be included under this class:- Casuarina fraseriana/Banksia

attenuata, Eucalyptus staeri/

Banksia attenuata, Eucalyptus

occidentalis.

The Casuarina fraseriana/Banksia attenuata type of woodland occurs on the deep grey sands in dryer situations. Shrub species growing in association include Pultenaea reticulata, Adenanthos sericea, Burtonia sp., Hypocalymma strictum, Beaufortia anisanda, B. decussata and Anarthria scabra.

Low woodlands of <u>Eucalyptus staeri/Banksia attenuata</u>
grow in a similar situation to the previous type but generally
there is a proportion of laterite mixed with the sand. Amongst
the shrub species are <u>Beaufortia anisanda</u>, <u>Hypocalymma strictum</u>,
Anarthria scabra, Cyathochaete avenacea, Adenanthos cuneata.

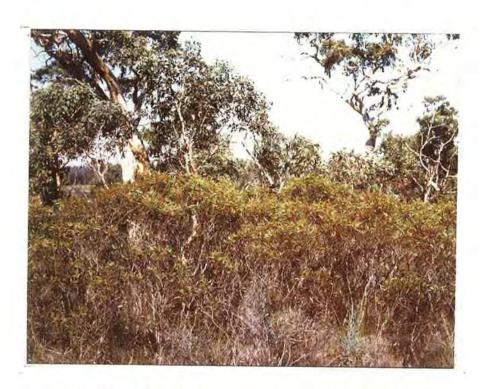
Low woodlands of Eucalyptus occidentalis grow in a completely different situation to the previous types. E. occidentalis grows in seasonally wet clay flats, low in the landscape, understorey is generally scattered Melaleuca spp. and monocot spp.

Low Open Woodland

Low open woodlands of <u>Eucalyptus marginata</u> and <u>E. patens</u> and of <u>Melaleuca spp.</u> occur in the area. These types are generally on the grey sand flats and species composition depends on available moisture. Understorey consists of Anarthria scabra,



Low woodland of jarrah (E. marginata) growing on shallow ridge-top soils.



High shrubland of the mallee (E. anceps) bordering on woodland of wandoo at 'the Pass'.

Evandra aristata, Beaufortia sparsa and Dasypogon bromeliaefolius.

High Shrubland

A small area of this type which consisted of a mallee form of Eucalyptus decipiens, Eucalyptus anceps and an unidentified Eucalyptus sp. is growing on broken granite at 'the Pass'.

Closed Scrub

Areas of closed scrub consisting of Kunzea ericifolia and

Banksia quercifolia occur on some of the wetter grey sand sites.

The vegetation type is very dense and generally borders on seasonally watercovered swamps.

Jarrah/Kingia High Open Shrubland

Areas of high open shrubland occupies some gravelly clay sites, solid clay is very close to the surface and scattered very small Eucalyptus calophylla and Eucalyptus marginata,

Kingia australis and Xanthorrhoea preissii are the larger species.

Smaller species include Dryandra armata?, Cesuarina humilis and Banksia sphaerocarpa.

Open Heath

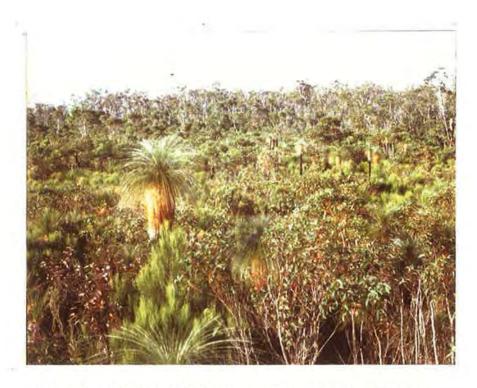
Areas of open heath were associated with the wandoo flats, these consisted of Melaleuca spp.

Sedgeland

Sedgelands occur on the sand flats, the main species being either Anarthria scabra in association with Beaufortia sparsa, or where more humic material was present in the sand with



Seasonal swamp with monocots and Melaleuca sp. closed scrub of Kunzea ericifolia, Banksia quercifolia and others. The ridges in the background are covered in open forest of jarrah (E. marginata).



Jarrah/Kingia High Open Scrubland growing on hill side covered with a shallow yellow clay soil.



Open heath of young Melaleuca viminea growing along Sheepwash creek. Note the wandoo woodland in the background. The tammar wallaby (Macropus eugenii) occurs in similar habitat on the Perup River further to the north.



Sedgeland, flowering species are Beaufortia sparsa and Leptospermum firmum. The Honey possum (Tarsipes spencerae) was collected from this habitat.

improved water retention, Evandra aristata is the main species.

This latter type shows more variation in associated species which may be scattered plants of Callistemon speciosus,

Le tospermum firrum, Banksia occidentalis or Banksia quercifolia.

Riverine

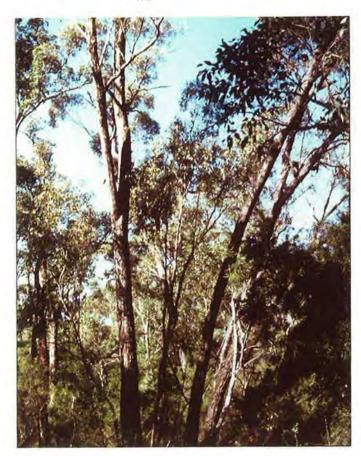
Associated with the major drainage streams in a narrow band of deposition soils is a distinctive forest type generally falling within the Open forest type, in some areas it could be described as tall open forest. Major species are <u>Eucalyptus calophylla</u>, <u>E. rudis</u>, occasionally <u>E. cornuta or E. diversicolor</u>. Understorey tree species are <u>Banksia littoralis</u>, (both forms) but generally the river banksia form, <u>Melaleuca spp.</u>, and <u>Agonis juniperina</u>. Shrub species <u>Agonis linearifolia</u>, <u>Oxylobium lanceolatum and Lepidosperma tetraquetrum</u>.

Lithic Complex (granite monadnocks)

In the west of the area granite capped hills are a feature of the landscape.

These hills with large expanses of bare rock and associated pockets of soil support quite distinct plant communities. Bullich, (Eucalyptus megacarpa) is the main tree species around the rock while Acacia triptycha, Verticordia sp., Andersonia sprengeloides, Hemigenia sp., Stypandra sp., Borya nitida, Cryptostylis ovata and Dryandra formosa were typical smaller plants. A yellow flowered Grevillea sp. was common around the outcrops. This may be an undescribed sp. (W.A. Herbarium).

Away from the granite sheets the vegetation cover varied from a typical Open Forest of Jarrah-Marri through a High



Riverine open forest of yate (E. cornuta) on the Hay River.



Granite outcrop, note bullich (E. megacarpa) growing amongst the rocks in the background. The mardo (Antechinus flavipes) has been trapped in similar habitats further to the west.

Open Shrubland to an Open Heath of Banksia grandis, B. prostrata, Beaufortia sparsa, Eucalyptus marginata, E. megacarpa, Casuarina fraseriana and C. humilis. Vegetation types appeared to be dependent on soil, much of which is either shallow or very sandy although pockets of better soil do occur which support the better growth.

The Fauna

Data on the fauna of the area was collected using a variety of techniques. Trapping with, box traps, breakbacks, pits and pits with drift fence. Spotlighting, shooting, scat collection, observation and searching techniques were all used. In addition to this museum records were examined for mammal records from the area or close vicinity.

In the short time available it was not possible to make complete collections. The lists are therefore not complete for any group of animals. The bird list in particular is missing some species e.g. migrants such as the cuckoos which had already left he area.

Individually there is nothing remarkable about the vertebrate fauna of the area. However, together they form a group with a variety unequalled elsewhere in the southern forested area.

The main elements of the fauna are animals typical of the Warren botanical district. In addition however there appears to be a northerly influence due to the drier woodlands of the north-eastern corner. For example the presence of the skinks Leiolopisma trilineatum, Morethia obscura and Menetia greyi, the different relative abundance of certain species of birds

and the presence of the two large species of possum is more typical of the northern jarrah forest. The presence, albeit in the past, of the tammar, numbat and the woylie in very close proximity to the area lends support to this idea. It is considered that further collections, particularly in the north-eastern wandoo sector, which was largely neglected during the survey will confirm these observations.



Honey possum (Tarsipes spencerae) on Banksia occidentalis.



Pit trap line with drift fence in woodland of <u>Casuarina</u> fraseriana and Banksia attenuata.

The Fauna

Mammals

- I. Order Marsupialia
- A. Family Macropodidae
- Western grey kangaroo (<u>Macropus fulic nosus</u>)
 This species is common throughout the area. It was sighted frequently during the day and at night on spotlight surveys.
- 2. Brush wallaby (Macropus irma)
 The species occurs in the area but it does not appear to be common, only one animals was sighted. There are no museum records from the area.
- Tammar wallaby (Macropus eugenii)

 This species was not recorded but suitable habitat exists in the wandoo woodland along Sheepwash creek in the north east and it could occur there. A museum record exists from within 20 km to the east. (M1743 coll. 1933)
- 4. Quokka (Setonix brachyurus)

 No definite colonies were located however it seems almost certain that this species is present. Melaleuca swamp thickets identical to others in which this species has been found recently (1978 F.D. survey) on the Frankland River exist in many places particularly in the south and south-west. There are museum sightings within 20 km to the east. (M1726 and 1728 coll. 1933)
 - B. Family Phalangeridae
- 5. Common or brush-tailed possum (Trichosurus vulpecula)

A low population appears to be present in the area. Fur identified (hair analysis) as belonging to this species was found in the wandoo on Sheepwash creek. A 'possum tree' was also located on the Hay River. None were seen on spotlight surveys. There are no museum records for the area.

- 6. Western ring-tail possum (Pseudocheirus peregrinus)

 A drey was located in a Melaleuca tree on the Mitchell

 River. No animals were sighted on spotlight surveys. A

 museum record exists from within 20 km to the east.

 (M1791 coll. 1933)
- 7. Honey possum (Tarsipes spencerae)

 This species appears to be common in the area. A total of 5 animals were caught, three in Casuarina/banksia woodland and two on a Beaufortia sparsa flat. There are numerous museum records to the south and east of the area.
 - 8. Pigmy possum (<u>Cercartetus concinnus</u>)

 This species was not located but there is a museum sighting from the Hay River within the area (Museum number not known).

C. Family Peramelidae

9. Short nosed bandicoot (Isoodon obesulus)

The characteristic diggings made by this species were seen all through the area, particularly in the grey sand around the edges of dense Melaleuca thickets. Two specimens were collected, one was caught in a Lepidosperma effusum thicket on the Mitchell River, the other, a road casualty, was found on the Denbarker Road. Museum specimens exist from

areas immediately to the north, east and south.

D. Family Dasyuridae

10. The Mardo (Antechinus flavipes)

No specimens were collected however it is almost certain that they occur in the area. Similar habitat to that in which they have been caught further to the west exists on the massive granite outcrops near Mr Lindesay. There are museum records within 20 km to the south east of the area. (M1401, M1689 and M1822)

- II. Brush-tailed phascogale (Phascogale tapoatafa)
 No specimens were collected but it is likely that it occurs in the area. Museum sightings exist from within 20 km to the south-west of the area. (M2424 and 2493 coll. 1940 and 1941).
- 12. Common Dunnart (Sminthopsis murina)

 One specimen was collected from a 'stick' ants nest in a

 Melaleuca swamp. The species does not appear to be as

 common as it is further to the west. Museum records

 exist from the area immediately to the south. (M1005,

 1006, 2702 and 3319)
- 13. Western native cat (Dasyurus geoffroii)
 No specimens collected. A relatively recent museum record exists within 10 km for the area immediately to the south.
 (M6769 coll. 1964)
 - II. Order Rodentia
 - E. Family Muridae
- Western Water rat (Hydromys chrysogaster)

No specimens collected. A few permanent pools in which it could occur exist on the Hay River. There are museum records within 10 km from the area immediately to the north, (M118), another immediately to the south (M9829) and another to the east (M1097 coll. 1929).

15. Southern bush rat (Rattus fuscipes)
This is the common small mammal in the area. It was trapped in all habitats where a dense ground cover exists.
There are no museum records from within the area but records exist from within 10 - 20 km to the north, east and south of the area.

III. Order Chiroptera

- F. Family Vesperitilionidae
- 16. Tasmania pipistrelle (Pipistrellus tasmanienis)
 Two specimens were collected from the area. There are no museum records from the area.
- 17. Little bat (Eptesicus regulus)

 One specimen was collected. There are no museum records from the area.
- 18. Goulds wattled bat (Chalinolobus gouldii)
 One specimen was collected. There are no museum records for the area.
- 19. Greater Long-eared bat (Nyctophilus timoriensis)

 No specimens collected. A museum record exists from within 20 km to the north. (M3396)
- 20. White-striped bat (<u>Tadarida australis</u>)

 No specimens collected. A high pitched squeak emmited by a high flying bat believed from past experience to be

T. australis was recorded. No museum records exist for the area.

21. Lesser Long-eared bat (Nyctophilus geoffroyii)
No specimens collected. A museum record exists within
20 km to the north. (M3396)

Introduced Eutherian mammals

- 22. The European fox (<u>Vulpes vulpes</u>)

 Footprints made by this species were observed in sandy areas and three scats were collected.
- 23. Feral cat (Felis catus)
 Footprints of this species were recorded.
- 24. Rabbit (Oryctolagus cuniculus)

 Fur identified (hair analysis) as belonging to this species

 was collected from the dry bed of the Mitchell River. A

 burrow was also observed in a bulldozer 'scoop' in white

 sand on the edge of a flat, and piles of scats were

 found in several places.
- 25. Rat (Rattus rattus)

 Two animals were caught in dense vegetation on the Hay

 River and one in Casuarina/banksia woodland.
- 26. House mouse (Mus musculus)

 Two animals were caught in pit traps in Casuarina/banksia woodland.

In addition to those species recorded, museum records taken together with the types of habitat present in the area make it almost certain that the quokka (S. brachyurus), Mardo (A. flavipes), Pigmy possum (C. concinnus) the Phascogale

(P. tapoatafa), and the three bats N. geoffroyi, N. timoriensis and T. australis occur within the area.

It is very likely that the Water rat (H. chrysogaster) and the native cat (D. geoffroi) also occur there. The numerous record of the latter is a recent one from 1964. In addition to these species there appears to be limited areas of habitat suitable for the tammar (M. eugenii) and perhaps the numbat (Myrmecobius fasciatus) and the echidna (Tachyglossus aculeatus). The numbat was last collected to the east of the area in 1934 and the tammar in 1936.

In summary, a total of 11 species of native mammals were recorded in the area. These, together with the 7 further species which it is though are almost certain to occur there and the two likely ones make a combined total of 20 species of native mammals.

The mammal fauna of the area is therefore impressive and comparable with the best in the southern forest areas. If the wandoo woodland element of three further possible species, viz, the numbat, tammar and echidna, is also considered, the area is second only to Dryandra and the Perup forest areas as a refuge for forest fauna. Trapping data and a list of species are present in Appendix 2.

Birds

Bird sightings and calls were recorded at all times particularly in the early mornings whilst checking the trap lines.

The quantitative data, i.e. number of individuals recorded in each forest type or in the area as a whole in only approximate.

There was no attempt at direct comparison between forest types for example. Some forest types were visited less frequently than others e.g. the wandoo woodlands, and some birds were more conspicuous at the time of the survey e.g. the honeyeaters. Nevertheless the number of birds give an indication of the relative status of each species in the area (see App.3).

Autumn is not the best time of the year for bird records and there are no permanent wetlands in the area. These two factors account for the comparatively short bird list, 57 species. In fact bird recording proceeded with difficulty until following the first day of autumn rain whereupon sightings became more frequent and numerous.

Whilst the assembleage of birds is fairly typical for the southern forests, some interesting features were noted which indicate a northern jarrah forest influence. Thus the comparative scarcity of the white-browed scrub wren and the white breasted robin, the relatively high numbers of the Western thornbill as compared to the inland thornbill, and the high numbers of the grey fantail.

Most of the birds were congregated along the riverine vegetation and on the edges of the flats. This was partly due to the fact that the river banksia (B. littoralis) and Banksia occidentalis and the bottlebrush (Beaufortia sparsa), were in full flower and attracted both nectar and insect eaters.

The wandoo woodlands in fact support a rich bird assembleage but they were only visited briefly and deserve further work. The banksia/casuarina and E. staeri woodlands were disappointing. A considerable amount of time was spent in them searching and trapping but the bird fauna appeared to be somewhat depauporate.

As far as individual species are concerned no birds of paricular interest were noted. The relatively scarcity of the parrots, the Western rosella, Port lincoln ringneck and Red-capped parrot is interesting and there seems to be no obvious explanation for this.

It should be noted in passing that one of the last sightings of the rare ground parrot (Pezoporus wallicus) in 1952 was in the flats not far to the south, on the Bow river near Irwin Inlet. Several large flats still exist to the east of the Hay river which could be habitat for this species.

REPTILES

L total of 18 species were collected, one gecko, a goanna,

11 skinks and four snakes and the long-necked tortoise. A

further snake collected in the area previously, the Bardick

(Denisonia curta) takes the total to 19 (App. 4).

Most of the species collected are typical of the southern forest area. However three of the skinks collected have previously been found by Forests Department surveys to be more common further north in the more northern type jarrah or along the west coastal areas. The species in question are Leiolopisma trilineatum, Morethia obscura and Menetia greyi which were found associated with the wandoo and woodland areas and low scrubby jarrah forest sites.

The record of Muellers snake (Rhinoplocephalus bicolor) further extends the range of this snake.

AMPHIBIA

At least 9 species of frog were collected, a small Crinia

sp. of the insignifera group remains unidentified. The common
frog in the area is the burrowing frog (Helioporus ayrei)
(App. 5).

Once again there is some indication of a northern jarrah influence in the presence of <u>Pseudophryne guentheri</u>. Forests Department surveys suggest that this species may be more common in the more northern drier jarrah forest than in the south.

FISH

A total of 5 species were collected (App. 5). The absence of the mud minnow (Lepidogalaxias salamandroides) is noteworthy. This species extends further eastward along the coast but may be absent further inland. The record of the Swan River gobby Lizagobius alorum is the only one from south of the Blackwood River by Forests Department survey teams.



Burning windrows of \underline{E} . staeri woodland species on land being cleared for agriculture to the east of the Hay River.



Granite rock plant communities are very fragile and easily damaged by vehicle movement. Even occasional and infrequent visits by off-road vehicles to the rocks have been sufficient to cause the severe damage illustrated here.

DISCUSSION

Over the last ten years the Forests Department Ecology
branch has carried out Biological surveys in many forest areas.
In comparison with other areas surveyed in the past the Hay/
Mitchell River forest has a greater range of forest types and
probably also of plant species than any other similar sized
area of south-west forest thus far surveyed.

The location of the area appears to be the main reason for the diverse flora. Much of the area is typical of the Marren botanical district, being sub-coastal and falling within the 1143 mm isohyet. The north eastern sector however is considerably drier and more typical of the Darling/Avon district, whilst some of the eastern portion appears more typical of the Stirling botanical district.

This unique situation has resulted in the exceptional diversity of forest types and plant associations to be found within the area.

It is not known what influence, if any the tertiary deposits have on plant communities in the area, however it would appear that the distribution of the <u>E. staeri</u> woodland communities, may be related to the occurrence of the tertiary sands.

It has long been recognized that the variety of animals to be found in any area is often directly related to the diversity of plant communities which exist there. The area surveyed is no exception. The full range of species typically associated with the high rainfall southern forests are present in the area. In addition there appears to be an element typical of the lower rainfall dry sclerophyll forest communities.

The vertebrate fauna is more diverse than that of any area

surveyed so far with the exception of Dryandra and the Perup forest.

Although the flow is seasonal the Mitchell River produces a considerable volume of good water, a rare commodity in Western Australia. The basin of this river, which occupies a large part of the area, may therefore have some value as a future water catchment.

The diversity of forest types and landforms which make the area ecologically unique also contribute to its scenic appeal.

There are magnificient views from some of the granite outcrops and some of the woodlands and sedgelands are spectacular when the wildflowers are in full bloom.

Blue Lake, a well known local attraction, the area forms a vast expanse of forest of great ecological and scenic value. The proposed flora, fauna and landscape M.P.A. encompassing this entire complex would form one of the most magnificient tracts of unspoilt 'wilderness' to be found anywhere in the south-west.

These unique values of area remain in danger of being lost forever as long as the Hay/Mitchell River area remains vacant Crown Land. Land to the east, forested only a few years ago, is being cleared for agricultural purposes. The unique flora on some of the granite outcrops is already being threatened by the indisciminate use of off-road vehicles.

Only protection by legislation will ensure that the area remains in an unspoilt condition in perpetuity.

CONCLUSION

In recent years much of the remaining forested land in the south-west has been cleared. Large areas of comparatively undisturbed forest are at a premium and the area of vacant crown land in the Hay and Mitchell rivers considered in this report, is one of the largest in the south-west which remains uncommitted to a specific land use.

The evidence collected during a comparatively brief
biological survey indicates that the area is unique. It contains
an exceptional range of forest vegetation communities which
support a range of vertebrates unequalled in any similar sized
area of the southern forests.

Its geographical location at the junction of three major botanical districts, together with the occurrence of tertiary deposits, not represented elsewhere in the southern forests, would appear to be the reason for this high diversity of flora and fauna. The area has some timber potential since a considerable volume of jarrah has been removed from there in the past and good regeneration was observed in most places.

It may also have some values as a future water catchment. There is a considerable flow of water in the Mitchell river during the winter months, and salt levels are within the limits tolerated for drinking purposes. However, the salinity is such as to suggest that any clearing or major interference within the area would seriously prejudice its potential as a water catchment in the future.

The area is seen as a valuable eastward extension to the Forests Department's flora, fauna and landscape Management Priority

Areas in the south. The relatively undisturbed drainage basin of the Mitchell river and surrounding areas together with the Mt. Lindesay lithic complex represent an unparalleled natural asset. Such intact ecosystems encompassing entire river catchments are rare in the south-west and every effort should be made to preserve the area in as near natural a state as possible in perpetuity.

RECOMMENDATIONS

The Forests Department has both the means and the capacity to protect the area and to manage it as a flora, fauna and landscape M.P.A., as defined in Forests Department General Working Plan 86 of 1977, with the secondary and tertiary values of water production and passive recreation respectively. It is therefore recommended as follows:

- The entire area of vacant Crown Land as shown in Appendix 9 should be dedicated as State Forest.
- 2. The entire area mentioned above, together with the Mt. Lindesay lithic complex and the Blue Lake area (see App. 8) should be made a flora, fauna and landscape M.P.A. The secondary and tertiary priorities in this M.P.A. would be water production and passive recreation respectively.
- 3. A management plan providing for management in accordance with the stated priorities of the area should be prepared.

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Appendix 1

Plant Species - a list of the plants collected or observed during the survey.

KEY

A - High Open Forest Karri

B - Open Forest Jarrah - Marri

C - Woodland Wandoo

D - Low Woodland Casuarina / B. attenuata

E - Low Woodland Euc. staeri

F - Low Woodland Euc. occidentalis

G - Low Open Woodland Jarrah, Blackbutt, Melaleuca

H - Mallee

I - Closed Shrub - Kunzea

J - High Open Shrub Jarrah / Kingia

K - Open Heath Melaleuca

L - Sedgelands

M - Riverine

N - Granite Outcrop

Plant species not recognized were identified using Forests Department Herbarium specimens and Blackall, W.E. and Grieve, B.J. (1954 - 65).

SPECIES	À	В	C	D	E	F	G	Н	1	J	K	Ĺ	М	N
Polypodiaceae														
Lindsaya linearis Pteridium esculentum Cheilanthes tenuifolia	×	x												x
Cycadaceae														
Macrozamia riedlii		х		х										
Podocarpaceae														
Podocarpus drouyniana		×		х									х	
Sheuchzeriaceae														
Triglochin sp.													×	
Graminae														
Amphipogon sp.		x											X	
Cyperaceae														
Cyathochaete avenacea Lepidosperma effusum Lepidosperma tetraquetrum Lepidosperma longitudinale Lepidosperma angustatum Lepidosperma leptostachyum Mesomelaena tetragona Evandra aristata Gahnia trifida	××	x x x x	×	х	x	x						×××	x x x	
Restionaceae														
Anarthria scabra Loxocarya flexuosa Restio sp.			x	×			×	×				Х		
Juncaceae														
Juncus acutus	×												×	
Liliaceae														
Dianella revolutus Agrostocrinum scabrum Borya nitida Johnsonia lupulina Stypandra grandiflora		×××		х	30								x	×
Xanthorrhoeceae														
Xanthorrhoea preissii		х	Х	х	х		х			×		x		x

Xanthorrhoea gracilis					_							_			
Ringia australis	SPECIES	A	В	Ċ	D	E	F	G	H	Ī	Ĵ	K	L	M	N
Baemodoraceae	Xanthorrhoea gracilis		×		×	×									
Haemodorum spicatum Anigosanthos flavida Ziridaceae Patersonia sp. Zcaladenia aphylla Eriochilus dilatatus Cryptostylis ovata Pterostylis vittata Casuarinaceae Casuarina humilis Casuarina fraseriana Casuarina decussata Dryandra armata Dryandra carduacea Dryandra carduacea Dryandra carduacea Crevillea occidentalis Hakea amplexicaulis Hakea amplexicaulis Hakea florida Hakea florida Hakea florida Hakea florida Hakea lissocarpa Hakea lassantha Petrophile diversifolia Banksia ilicifolia Banksia litoralis swamp form Banksia litoralis river form Banksia grostrata Banksia joccidentalis Banksia grostrata Banksia occidentalis Banksia grostrata Banksia joccidentalis Banksia prostrata Banksia prostrata Banksia joccidentalis Banksia joccidentalis Banksia joccidentalis Banksia joccidentalis Banksia joccidentalis Banksia joccidentalis Banksia prostrata		×									х				
Anigosanthos flavida	Haemodoraceae														
Patersonia sp.												х			
Caladenia aphylla Eriochilus dilatatus Cryptostylis ovata Pterostylis vittata Casuarinaceae Casuarina humilis Casuarina fraseriana Casuarina decussata Proteaceae Dryandra armata Dryandra carduacea Dryandra corduacea Cryptostylis vittata Proteaceae Dryandra nivea Dryandra carduacea Casuarina decussata X X X X X X X X X X X X X	Iridaceae														
Caladenía aphylla	Patersonia sp.		×	×											
Eriochilus dilatatus Cryptostylis ovata Pterostylis vittata Casuarinaceae Casuarina humilis Casuarina fraseriana Casuarina decussata Proteaceae Dryandra nivea Dryandra armata Dryandra formosa Grevillea occidentalis Hakea ruscifolia Hakea amplexicaulis Hakea ambigua Hakea varia Hakea oliefolia Hakea prostrata Hakea prostrata Hakea prostrata Hakea undulata Hakea ceratophylla Hakea ceratophylla Hakea ceratophylla Hakea ceratophylla Hakea lasiantha Petrophile diversifolia Banksia littoralis swamp form Banksia littoralis river form Banksia sphaerocarpa Banksia occidentalis Banksia occidentalis Banksia occidentalis Banksia occidentalis Banksia prostrata Banksia occidentalis Banksia occidentalis Banksia occidentalis Banksia prostrata	rchidaceae														
Casuarina humilis	Eriochilus dilatatus Cryptostylis ovata					-									×
Casuarina fraseriana	Casuarinaceae														
Dryandra nivea Dryandra armata Dryandra carduacea Dryandra formosa Grevillea occidentalis Proteaceae sp. Hakea ruscifolia Hakea amplexicaulis Hakea ambigua Hakea varia Hakea oliefolia Hakea florida Hakea lissocarpa Hakea prostrata Hakea undulata Hakea ceratophylla Hakea lasiantha Petrophile diversifolia Banksia littoralis swamp form Banksia littoralis river form x Banksia sphaerocarpa Banksia prostrata Banksia prostrata X X X X X X X X X X X X X X X X X X	Casuarina fraseriana	х		x	×	×			x					×	
Dryandra armata Dryandra carduacea Dryandra formosa Grevillea occidentalis Proteaceae sp. Hakea ruscifolia Hakea amplexicaulis Hakea ambigua Hakea varia Hakea oliefolia Hakea florida Hakea florida Hakea prostrata Hakea undulata Hakea ceratophylla Hakea lasiantha Petrophile diversifolia Banksia ilittoralis swamp form Banksia sphaerocarpa Banksia occidentalis Banksia prostrata Banksia prostrata X X X X X X X X X X X X X X X X X X	Proteaceae														
Dryandra formosa Grevillea occidentalis Proteaceae sp. Hakea ruscifolia Hakea amplexicaulis Hakea ambigua Hakea varia Hakea oliefolia Hakea florida Hakea florida Hakea prostrata Hakea undulata Hakea ceratophylla Hakea lasiantha Petrophile diversifolia Banksia ilitoralis swamp form Banksia littoralis river form x Banksia sphaerocarpa Banksia occidentalis Banksia grandis X X X X X X X X X X X X X X X X X X	Dryandra armata			х							×				
Hakea ruscifolia	Dryandra formosa					×									x
Hakea amplexicaulis			X	X											
Hakea ambigua														×	
Hakea varia				X	X	×									
Hakea oliefolia				-											
Hakea florida Hakea lissocarpa K Hakea prostrata Hakea undulata K Hakea ceratophylla Hakea lasiantha Petrophile diversifolia Banksia ilicifolia Banksia littoralis swamp form Banksia littoralis river form Banksia sphaerocarpa Banksia occidentalis Banksia prostrata Banksia grandis															
Hakea lissocarpa			X.					46						X	
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Hakea undulata														-0-	
Hakea ceratophylla Hakea lasiantha Petrophile diversifolia Ranksia ilicifolia Ranksia littoralis swamp form Ranksia littoralis river form Ranksia sphaerocarpa Ranksia occidentalis Ranksia prostrata Ranksia grandis															
Hakea lasiantha												×	×		
Banksia ilicifolia	그리고 하는 것이 되었다. 그 아이들이 가지 않아 다른 사람들이 아이들이 하는 것이다.		X												
Banksia ilicifolia														×	
Banksia littoralis swamp form					×	×						X			
Banksia littoralis river form x x x x x x x x x x x x x x x x x x x							X	×.		×			×	×	
Banksia sphaerocarpa X X X X X X X X X X X X X X X X X X X	Banksia littoralis river form	×												X	
Banksia prostrata x x x x x x x x			×	×							X				
Banksia grandis x x x x x x													×		
Banksia attenuata x x			X		X	×					X			X	
	Banksia attenuata				x	x									

Banksia quercifolia Adenanthos obovata Adenanthos cuneata Persoonia microcarpa Persoonia longifolia Persoonia elliptica Synaphaea sp.	А	B	С	D × x	E	F	G	H	-	J	K	-	M	N
Adenanthos obovata Adenanthos cuneata Persoonia microcarpa Persoonia longifolia Persoonia elliptica		×			v		×							
Adenanthos obovata Adenanthos cuneata Persoonia microcarpa Persoonia longifolia Persoonia elliptica		×			v		X							
Adenanthos cuneata Persoonia microcarpa Persoonia longifolia Persoonia elliptica		×		- 74					X	x		×		
Persoonia microcarpa Persoonia longifolia Persoonia elliptica				X	X		X							
Persoonia longifolia Persoonia elliptica		-		-	**		x		x			×		
Persoonia elliptica		X		X	x		-							
Synaphaea sp.		x		x	X									
plumburg pl		X		X	X									
Franklandia fucifolia		X												
Santalaceae														
Leptomeria cunninghamii Santalum spicatum		х	x x											
leaceae														
Olax phyllanthi		×		x	×									
Loranthaceae														
Warner of a Character of a					4.5	4.7				x				
Nuytsia floribunda Loranthus sp.		X	×	х	×	X				A		X		
Lauraceae														
Cassytha sp.											x	×	Х	
Pittosporaceae														
Billardiera sp.		х	х		X									
Mimosaceae														
Albizzia lophantha		X												
Acacia divergens	x	X	X							X			x	
Acacia extensa				×	×									
Acacia myrtifolia	×	×												
Acacia pentadenia									Х					
Acacia pulchella	X	X	X	X	X					×			x	
Acacia drummondii		X		30	**								X	
Acacia browniana Acacia hastulata		X		X	X								X	
Acacia masculata														
Papilionaceae														
Brachysema sericeum		×	х											
Brachysema sp.		×	X											
Oxylobium lanceolatum	×	×											X	
Burtonia sp.		X		X	X									
Jacksonia sp.		X		X	X									
Viminaria juncea		X	X	v		X								
Daviesia spp. Pultenaea reticulata		X	A	X	x				х					
Hovea elliptica	x	x			-									

7.4.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7														
SPECIES	A	В	Ċ	D	Ė	F	G	H	I	J	K	L	M	N
Bossiaea linophylla	×	х	х		х								×	
Bossiaea ornata Gastrolobium forrestii Gastrolobium bilobum		x x		×	×				X				×	
Rutaceae														
Boronia sp. Crowea dentata												Х		х
Tremandraceae														
Tremandra stelligera		2												
olygalaceae														
Comesperma confertum									Х			2	X	
Myrtaceae														
Actinodium cunninghamii Calythrix sp.		×										×		
Astartea fasicularis		x										x	x	
Hypocalymma strictum		x		×	×							7.	X	
Hypocalymma angustifolium		x	×											
Hypocalymma cordifoium	X												×	
Agonis linearifolia	X	x											x	
Agonis juniperina													X	
Agonis parviceps		X										X		
Agonis undulata												X		
Leptospermum crassipes												X		
Leptospermum sp.		X												
Leptospermum firmum									×			×		
Darwinia citriodora													X	
Kunzea ericifolia									×			X		
Callistemon speciosus Beaufortia decussata				v	v							X		
Beaufortia sparsa				X	×							×		
Beaufortia andisandra				X	x									
Calothamnus sp.												×		
Melaleuca cuticularis							x		x				X	
Melaleuca thymoides		x		X	X									
Melaleuca striata		X		X	×									
Melaleuca preissii							x		X				X	
Melaleuca rhaphiophylla							Х		X				X	
Melaleuca polygaloides			X											
Melaleuca viminea			X											
Melaleuca acerosa			×											
Eucalyptus marginata		×		X	X		X			X	X		X	
Eucalyptus staeri				X	×									
Eucalyptus patens		X	.21				X			26	22		X	
Eucalyptus calophylla		X	X				X			X	X		X	
Eucalyptus wandoo			×					X						
Eucalyptus diversicolor Eucalyptus cornuta	×												x	

SPECIES	А	В	C	D	E	F	G	Н	1	J	К	L	М	N
Eucalyptus occidentalis														
Eucalyptus occidentairs Eucalyptus rudis		x	X			X							×	
Eucalyptus decipiens		X	X					x						
Eucalyptus decurva		X												
Eucalyptus anceps								X						
Eucalyptus megacarpa Eucalyptus sp. (insufficient to identify)		Х											×	
Eucalyptus doratoxylon Eucalyptus falcata		X												
Sapindaceae														
Dodonea attenuata		x											×	
Dodonea sp.		×								×			-	
Rhamnaceae														
Trymalium spathulatum Trymalium ledifolium	×	x	х										х	
Sterculiaceae														
Rulingia corylifolia Thomasia sp.	х	х	х											
Dilleniaceae														
Hibbertia amplexicaulis Hibbertia sp.	х	х			х									
Thymelaeaceae														
Pimelia sp.	×	×												
Apiaceae														
Xanthosia rotundifolia		х			x									
Epacridaceae														
Astroloma sp.		x	×							×				
Leucopogon australis	20	X										×	X	
Leucopogon oxycedrus		×												
Leucopogon sp.		×												
Lysinema ciliatum				Green .							X	×		
Andersonia sp. Cosmelia rubra		X		X	x		Х					X		
Gentianaceae														
Villarsia sp.													x	

SPECIES

ABCDEFGHIJKLMN

Stylidiaceae

Stylidium imbricatum

X

Asteraceae

Craspedia sp. Gnaphalium sp.

X

X X

X

TOTAL 170

MAMMALS (After Ride (1970))

Mammals recorded on survey

	Forest	and	Woodland	Scrub	and	ле
	Open Fc	Woodland	Low Woo	Closed	Sedgeland	Riverine
Western Grey Kangaroo (Macropus fuliginosus)	SO	so	so		so	so
Western Brush Wallaby (Macropus irma)			S			
Brush-tailed Possum (Trichosurus vulpecula)		0				
Ringtail Possum (Pseudocheirus peregrinus)	0					
Short-nosed Bandicoot (Isoodon obesulus)			0		0	TO
Southern Bush Rat (Rattus fuscipes)	T		T,	T	T	T
Common Dunnart (Sminthopsis murina)			0		so	
Honey Possum (Tarsipes spencerae)			T		TS	
Little Bat (Eptesicus regulus)						T
Goulds Wattled Bat (Chalinolobius gouldii)						T
Tasmanian Pipistrelle (Pipistrellus tasmaniensis)						T
Eutherean mammals						
Fox (Vulpes vulpes)	0	0	0	0	0	0
Cat (Felis catus)	Q	0			0	
Rabbit (Oryctolagus cuniculus)		0				0
Ship Rat (Rattus rattus)			T			T
House Mouse (Mus musculus)	T		T			

- T Trapped or shot
- S Sighted (Daylight or spotlight, includes those caught while searching.

Native mammals not recorded on the survey, but almost certain to occur within the area.

Ouokka (Setonix brachyurus) Native Squirrel (Phascogale tapoatafa) 241 Mardo (Antechinus flavipes) M Pigmy Possum M (Cercartetus concinnus) Native Cat 1.4 (Dasyurus geoffroi) Water Rat (Hydromys chrysogaster) M Lesser Long-eared Bat (Nyctophilus geoffroi) M Greater Long-eared Bat (Nyctophilus timoriensis) M White-striped Bat (Tadarida australis)

M - W.A. Museum records within 15 km of the area.

Native mammals which would possibly occur within the area, and for which there are limited areas of suitable habitat.

- X Tammar Wallaby (Macropus eugenii)
- X Numbat (Myrmecobius fasciatus)

Echidna (Tachyglossus aculeatus)

** These 2 species were last collected to the east of the survey area in 1934 - 36.

BIRDS (After RAOU List)

SPECIES	Open Forest (Jarrah)	Woodland (Wandoo)	Low Woodland nksia/Casuarina	Closed Shrub	Sedgeland	Riverine	Total	
9			Ban	O				
Emu (Dromaius novaehollandiae)	6	1			1	1	9	
Little Pied Cormorant (Phalacrocorax melanoleucos)						2	2	
White-faced Heron (Ardea novaehollandiae)					i		1	
Pacific Heron (Ardea pacifica)					1		1	
Pacific Black Duck (Anas superciliosa)						5	5	
Brown Goshawk (Accipiter fasciatus)					1		1	
Brown Falcon (Falco berigora)	1						1	
Wedge-tailed Eagle (Aguila audax)	1						1	
Whistling Kite (Haliastur sphenurus)	1						1	
Nankeen Kestral (Falco cenchroides)					1		1	
Collared Sparrowhawk (Accipiter cirrhocephalus)					1		1	
Stubble Quail (Coturnix novaezelandie)	4					6	10	
Painted Button-quail (Turnix vaia)				1			1	
Brush Bronzewing (Phaps elegans)	8		4	1		1	14	
Purple-crowned Lorikeet (Glossopsitta porphyrocephala)	10		15		35	21	81	
White-tailed Black Cockatoo (Calyptorhynchus baudini)	50					140	190	

SPECIES	Open Forest (Jarrah)	Woodland (Wandoo)	Low Woodland Banksia/Casuarina	Closed Shrub	Sedgeland	Riverine	Total	
Red-tailed Black Cockatoo (Calyptorhynchus mangificus)			2			6	8	
Western Rosella (Platycercus icterotis)	8	8	8	1	2	5	32	
Pot Lincoln Ringneck (Barnardius zonarius)	2		2			2	6	
Elegant Parrot (Neophema elegans)	30						30	
Red-capped Parrot (Purpureicephalus spurius)	2						2	
Pallid Cuckoo (Cuculus pallidus)			1				1	
Tawny Frogmouth (Podargus strigoides)	7		1				8	
Australian Owlet-nightjar (Aegotheles cristatus)	1					2	3	
Laughing Kookaburra (Dacelo novaeguinae)	7	2	11		100	7	3.0	
Welcome Swallow (Hirundo neoxena)					15		15	
Richard's Pipit (Anthus novaeseelandiae)					1		1	
Black-faced Cuckoo-shrike (Coracina novaehollandiae)		4	2		7		13	
Splendid Fairy-Wren (Malurus splendens)		3		4	7	6	20	
Inland Thornbill (Acanthiza apicalis)		3	1			3	7	
Western Thornbill (Acanthiza inornata)	8		11	2	5		26	
Yellow-rumped Thornbill (Acanthiza chrysorrhoa)						4	4	
White-browed Scrub-wren (Sericornis frontalis)						3	3	

SPECIES	Open Forest (Jarrah)	Woodland (Wandoo)	Low Woodland Banksia/Casuarina	Closed Shrub	Sedgeland	Riverine	Total
Scarlet Robin (Petroica multicolor)	12	3	12		8	7	42
Western Yellow Robin (Eopsaltria griseogularis)	5		1				6
White-breasted Robin (Eopsaltria georgiana)	3	2	2			4	11
Grey Fantail (Rhipidura fuginosa)	16	8	15	5	8	14	66
Willie Wagtail (Rhipidura leucophrys)					1		1
Restless Flycatcher (Myiagra inquieta)	1						1
Golden Whistler (Pachycephala pectoralis)	1	3			1	7	12
Rufous Whistler (Pachycephala rufiventris)			4				4
Grey Shrike-thrush (Colluricincla harmonica)						2	2
Varied Sittela (Dapheonositta chrysoptera)						12	12
Rufous Tree-creeper (Climacteris rufa)						3	3
Spotted Pardalote (Pardalotus punctatus)		3	3				6
Silvereye (Zosterops lateralis)			10	6	16	10	42
Brown Honeyeater (Lichmera indistincta)			2		2		4
White-naped Honeyeater (Melithreptus lunatus)		1				2	3
Western Spinebill (Acanthorhynchus superciliosus)			3		13		16
New Holland Honeyeater (Phylidonyris novaehollandiae)	4		22	10	55	24	115

Sighting TOTAL	203	60	153	32	237	317	1002
No. Individual Species	27	14	25	9	26	30	57
Australian Raven (Corvus coronoides)		1	3		2	6	12
Australian Magpie (Gymnorhina tibicen)	Ţ				7	2	13
Grey Currowong (Strepera versicolor)	5		11			5	21
Dusky Woodswallow (Artamus cyanopterus)	4	18			41		63
Australian Magpie-lark (Grallina cyanoleuca)	2				2		4
Red-eared Firetail (Emblema oculata)			1	2			3
Red Wattle Bird (Anthochaera carunculata)			6			5	11
SPECIES	Open Forest (Jarrah)	Woodland (Wandoo)	Low Woodland Banksia/Casuarina	Closed Shrub	Sedgeland	Riverine	Total

REPTILES (After Storr, W.A. Museum identification)

Reptiles recorded on survey

	Open Forest	Woodland	Low Woodland	Closed Scrub	Sedgeland	Riverine
Goannas						
(Varanus gouldii)	S					
Geckoes						
Marbled Gecko (Phyllodactylus marmortus)		S	S		5	
Skinks						
Bobtail (Tiliqua rugosa)			0			
Mourning Skink (Egernia luctuosa)						T
King Skink (Egernia kingii)						T
Smiths Skink (Egernia napoleonis)	T	S	TS	T	S	S
Frys Skink (Egernia pulchra pulchra)			T	T	S	
Red Legged Skink (Ctenotus labillardieri)	T	S	TS	T	TS	
(Ctenotus catenifer)		S	T		T	
Burrowing Skink (Hemiergis peronii peronii)	T	S	TS		S	
New Holland Skink (Leiolopisma trilineatum)			T			
(Mentia greyi)		S				
(Morethia obscura)			S			
Snakes						
Muellers Snake (Rhinoplocephalus bicolor)			S	T		

	Open Forest	Woodland	Low Woodland	Closed Scrub	Sedgeland	Riverine
Crowned Snake (Denisonia coronata)			T		S	
Bardick * (Denisonia curta)			S			
Tiger Snake (Notechis scutatus occidentalis)			0			
Dugite (Demansia nuchalis affinis)			0			
Long-necked Tortoise (Chelodina oblonga)						0

^{*} Collected in the area previously by Forests Department personnel.

FROGS (W.A. Museum identification)

Frogs recorded on survey

	Open Forest	Woodland	Low Woodland	Closed Scrub	Sedgeland	Riverine
Guenthers toadlet (Pseudophryne guentheri)	S					
Moaning Frog (Heleioporus eyrei)	TS		TS	T	T	6.0
(Heleioporus inornatus)			T		T	
Banjo Frog (Limnodynastes dorsalis)	S		S			
Green and Gold Tree Frog (Hyla moorei)	S		5			
Slender Tree Frog (Hyla adelaidensis)	S		S			
(Crinia georgiana)	T		T	T	T	S
(Crinia leai)			T			
(Crinia spp.)						TS

FISHES (W.A. Museum identification)

Striped Minow (Galaxiella munda)

Common Minow (Galaxias occidentalis)

Night Fish (Bostockia porsa)

Western Pigmy Perch (Edelia vittata)

Swan River Gobby (Lizagobius alorum)

	Open	Open Forest		Closed Shrubland		Sedgeland		Riverine		Woodland	
SPECIES	Pit B	Breakback	Pit	Breakback	Pit	Breakback	Pit	Breakback	Pit	Breakback	Drift
MAMMALS											
Rattus fuscipes		3		5		4		4		14	
Isoodon obesulus								1			
Tarsipes spencerae					2						2
Rattus rattus								2		1	
Mus musculus		1								a-	2
REPTILES											
Ctenotus labillardieri	. 1		1		3				5		12
Ctenotus catenifer					3						Ĩ
Egernia pulchra				2						2	
Egernia napoleonis		1		2							
Egernia luctuosa								2			
Egernia kingii								2			
Hemiergis peronii pero	onii 1										1
Leiolopisma trilineatu	ım										3
Denisonia coronata											1
Rhinoplocephalus bicol	or		1								
FROGS											
Heleioporus spp.	1		2		11				3		29
Crinia spp.	1 2		1		3		4				18
BIRDS											
Malurus splendens						1.					
TOTALS	5	5	5	9	21	5	4	1.1	8	17	69
	Pit Traps Breakback	- 5.2% - 9.6%			TOT	AL CATCHES	- 1	59: (Pit Brea	kbac	- 43 k - 47	
	Box Trap	- Nil						Box	Tran	- Nil	
	Drift Fence		100							nce - 69)	

Appendix 7

Water production of the Mitchell River compared with that of some south-west streams currently supplying reservoirs

River	P.W.D. Station No.	Years Sampled	Mean annual 3 flow mill m	Location
Mitchell River	6031003	78 79	14.489	Annual flow, figures supplied by P.W.D. Water Resources Section.
Scabby Gully	607052	1956 - 1974	1.56	Manjimup Water Supply
Tanjannerup Creek	609056	1956 - 1960	1.83	Prior to Nannup Water Supply Dam being built
Canning River	616065	1950 - 1975	27.3	Upstream from Canning Weir
Helena River	616216	1966 - 1975	10.0	
Little Darkin River	616010	1969 - 1975	1.84	Man Janina Waisa
Rushy Creek	616007	1969 - 1975	2.15	Mundaring Weir
Darkin River	616002	1968 - 1975	8.62	
Collie River	612002	1969 - 1975	144.	Wellington Res.
Angove Creek	602187	1963 - 1975	1.78	Albany Water Supply Pumping Station

Data in this table after P.W.D. Streamflow Records of Western Australia to 1975.



