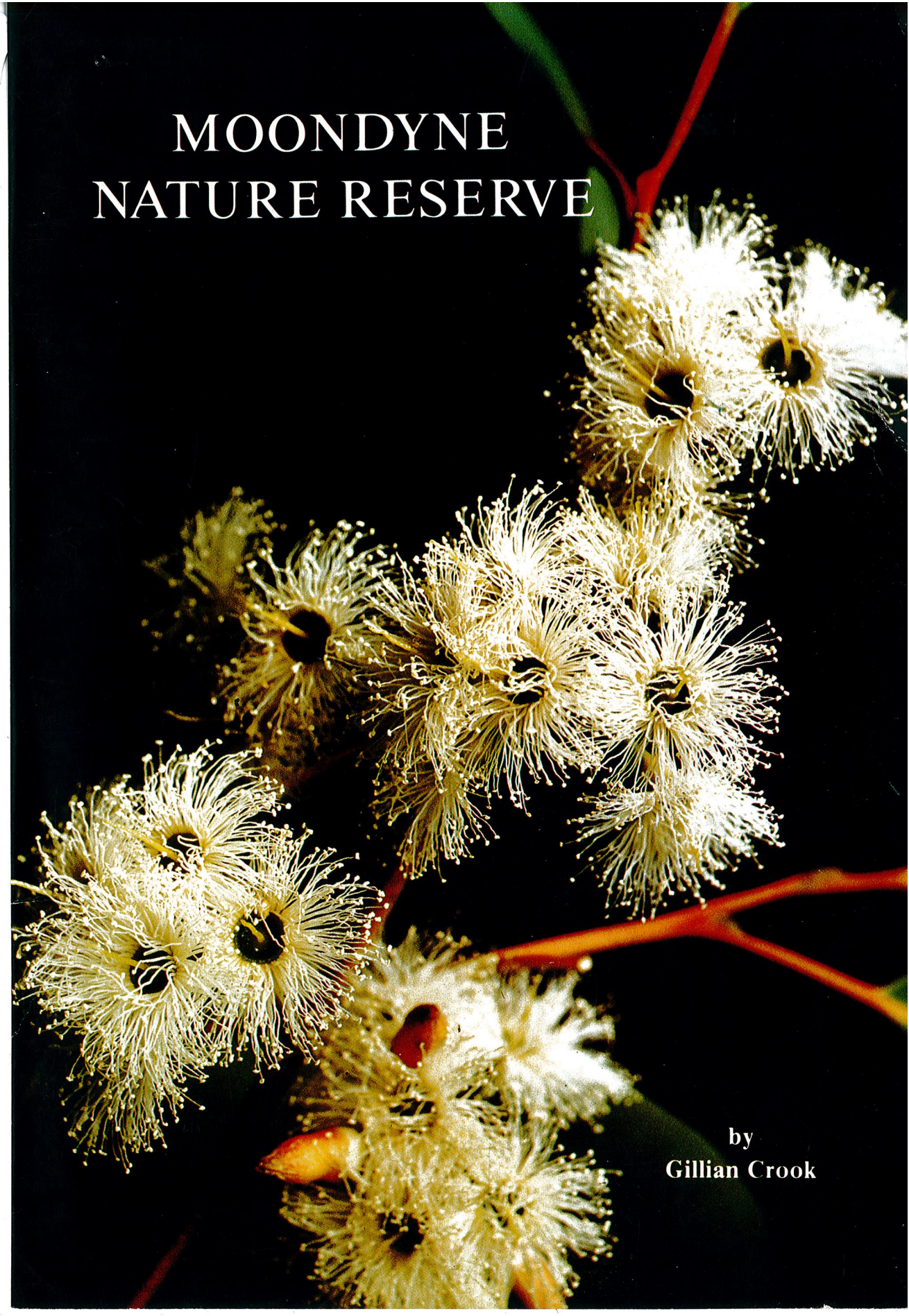
MOONDYNE NATURE RESERVE



by
Gillian Crook

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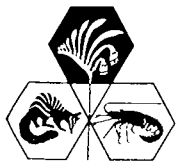
Front cover—jarrah flowers
Photo: Bill van Aken



MOONDYNE NATURE RESERVE

A Guide

by
Gillian Crook

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Photography. Ian G Crook
Design and illustrations. Gillian Crook

"Every day the science of ecology is making clearer the factual aspect as it demonstrates those more remote interdependencies which, no matter how remote they are, are crucial even for us"

Joseph Wood Krutch

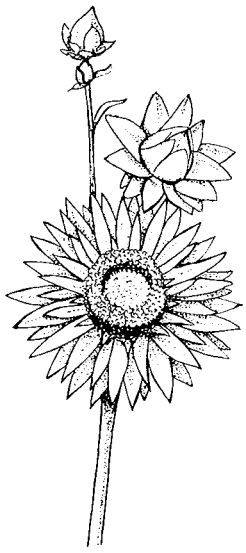
PREFACE

Western Australia has over 1 000 nature reserves which vary in size from a few hectares to thousands of square kilometres. This extensive network of nature reserves has been set aside especially for the conservation of flora and fauna.

Western Australia, unlike many places with longer histories of European settlement, is fortunate in that many of the reserves have remained relatively "natural". Those near the centres of human activities have generally suffered the greatest modification. The ones in the agricultural areas of the south-west and the near-Perth region are under the greatest pressure.

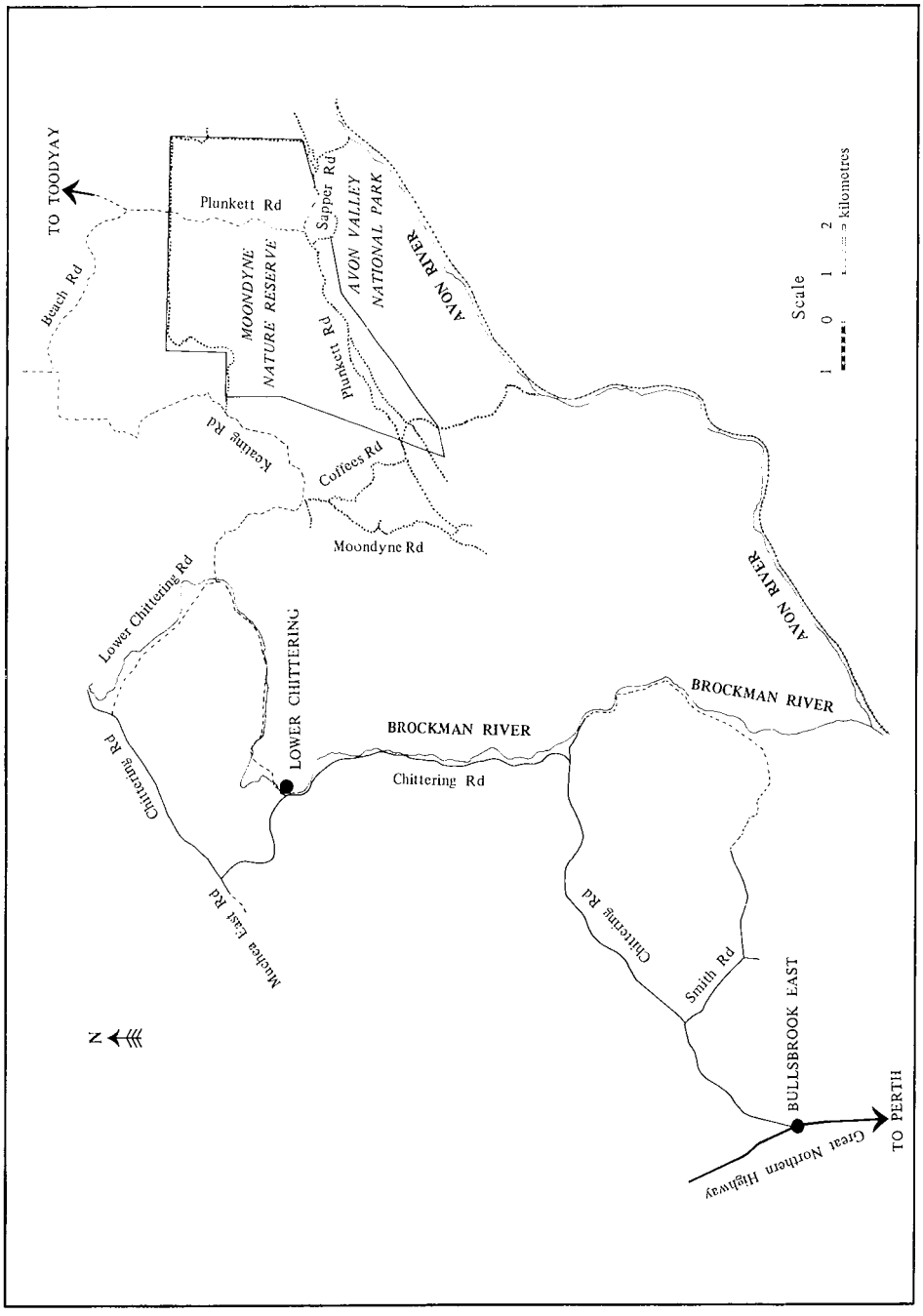
Moondyne is one of the nature reserves near Perth, and its environments have been changed to an appreciable extent. Much of it has been cut-over for jarrah and wandoo timber. Parts have been grazed, and for many years it was used for military exercises. Nevertheless, nature reserves like Moondyne are of great value as refuges for flora and fauna and as examples of complexes of vegetation in the process of restoration to something approaching their original form. Moondyne, for example, supports populations of nearly 300 species of native flowering plants.

Nature reserves are unique because conservation of flora and fauna is paramount in their management. In nature reserves we, the people, are guardians, not exploiters. Conservation of native animals and plants is the purpose of the nature reserve system. The Western Australian flora and fauna are sources of enormous interest, and contribute a great deal to the aesthetic qualities of our Western Australian environment. Nature conservation through reserves is well worthwhile, but without appreciation of their beauty, variety and intricate interdependencies, one whole side of the value of nature reserves is lost. Without appreciation they become just so many tracts of unnamed land. It is hoped that this guide to Moondyne Nature Reserve will give those who take time to look a glimpse of a few elements of the Australian countryside and play its own small part in enhancing the quality of life for this and future generations.



The bushy everlasting Helichrysum bracteatum.

HOW TO GET THERE

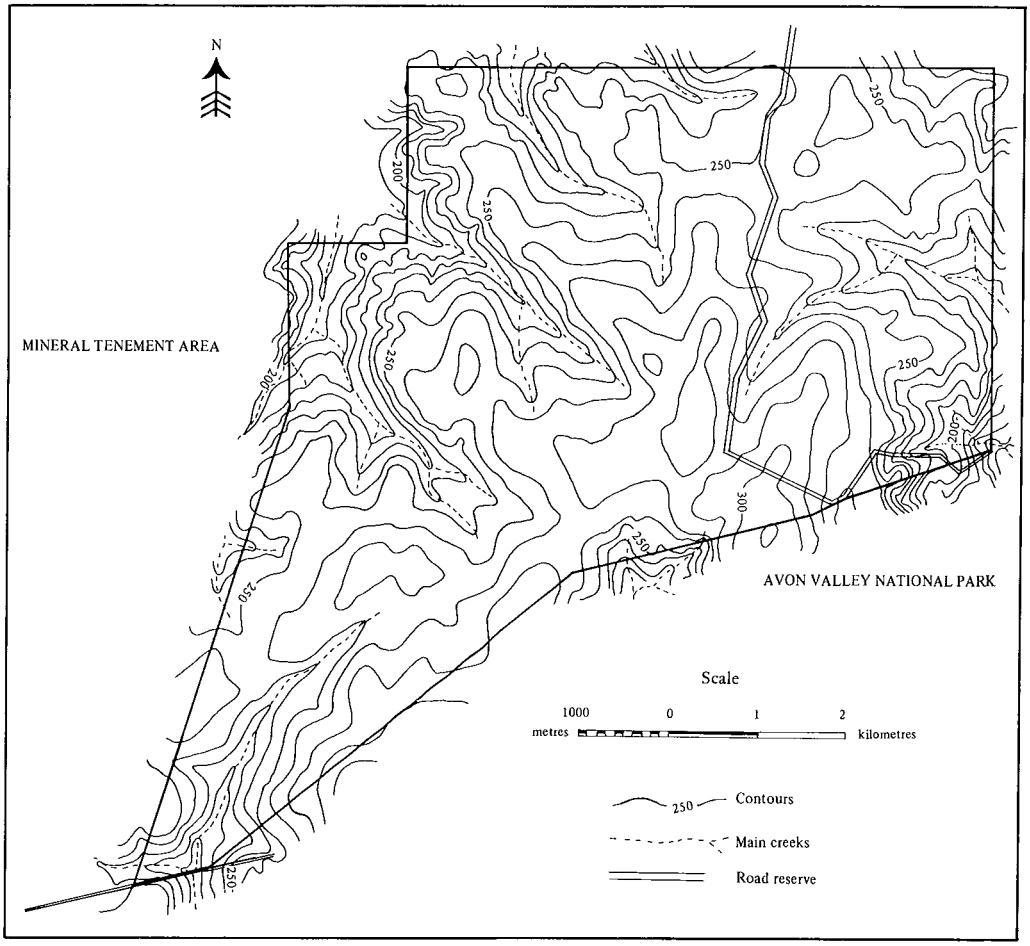


Moondyne Nature Reserve is located approximately 80 kilometres north-east of Perth. It can be reached by taking the Great Northern highway out of Perth to Bullsbrook East where Chittering road can be found branching off in a north-easterly direction. Just over five kilometres out of lower Chittering, Keating road branches off to the right onto a bridge crossing the Brockman river, then up a hill, bearing left at the intersection with Moondyne road to the Reserve two and a half kilometres further on.

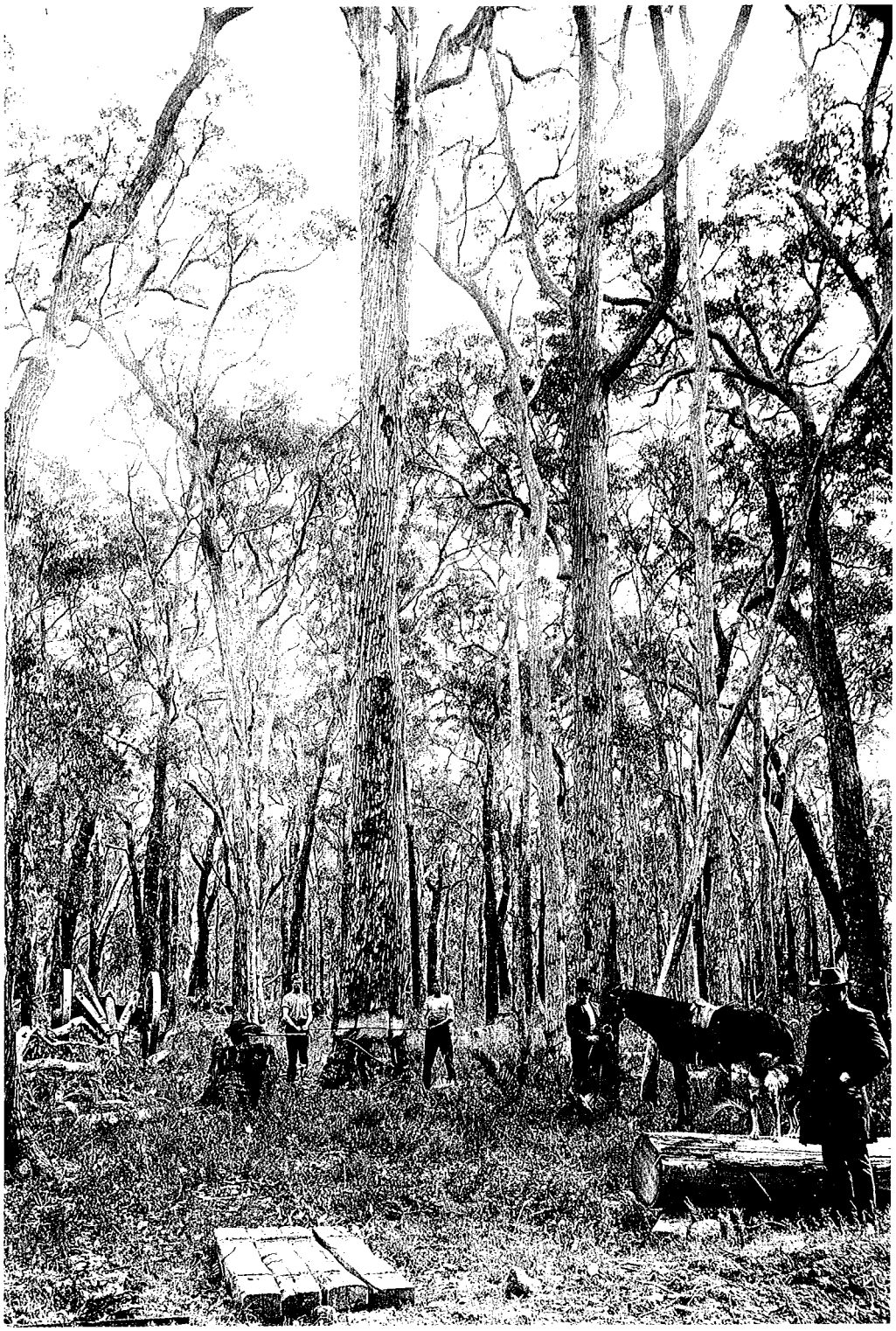
INTRODUCTION

Moondyne is one of the nature reserves of the Perth region. It is close enough to Perth to be visited in a day. The Reserve covers about 1 990 hectares of the central, higher rainfall (800-1 400 mm per year) area of the northern Darling Range.

Moondyne is situated just north of the Avon river and abut 13 kilometres east of Lower Chittering (see map). There is farmland to the north and east of the Reserve. Farming is mainly confined to cereal crops and pasture, and there are also some citrus orchards. On the southern boundary is the Avon Valley National Park and to the west, Crown land covering mineral tenements for bauxite.



Contour map of Moondyne Nature Reserve showing streams and road reserve.

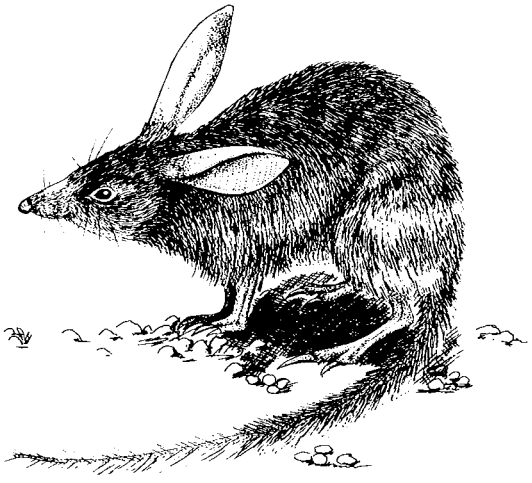


Logging jarrah in the Darling Range at the turn of the century.

HISTORY OF THE RESERVE

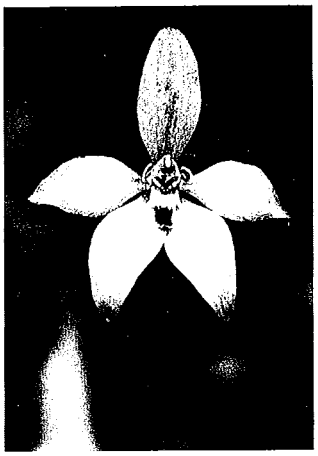
The land now occupied by the Reserve, the Avon Valley National Park, a timber reserve south of the Avon river and the area of mineral tenements west of the Reserve was previously a single block of Commonwealth land with a water reserve adjacent to it. The Commonwealth land was used as a military training area and evidence of this past use can still be seen on the Reserve today. Exploitation of the jarrah trees probably began in the early days of the Swan River Colony when the trees were called "Swan River Mahogany". The timber is extremely durable and this resulted in many thousands of tonnes being shipped to Europe before the turn of the century. Evidence of timber felling can be seen throughout the Reserve.

In 1965 representations were made by the Chief Secretary to the Minister for Lands suggesting that the whole area should be acquired from the Commonwealth to establish a national park and fauna reserve. Further representations were made during subsequent negotiations pointing out the value of the flora and fauna of the area. Among the animals thought to occur on the Reserve, at the time, was the dalgyte (*Macrotis lagotis*). Dalgytes were quite common in the region until about 1926 but suffered a massive decline with increased agricultural activity. Probably already long gone by that time, the dalgyte played an important part in ensuring that a disused training camp became a nature reserve of major importance.



The dalgyte (rabbit-eared bandicoot or bilby) lives in a burrow and is a powerful digger. The front paws are armed wth strong claws and earth is pushed out of the burrow by the hind feet. Dalgytes are carnivorous, eating small animals and insects.

An ephemeral creek.



Many species of orchid, such as this species of Caladenia, *can be found on the Reserve.*

Relic of the past.

The land was finally acquired and subdivided in 1970 with the gazetting of the national park, timber and nature reserves.

The name "Moondyne" was suggested because this is an area where the notorious "Moondyne Joe" operated. Moondyne Joe was not a very successful bush ranger and horse rustler but he was very adept at escaping from prisons. He used parts of the Reserve as hiding places and stockades to hold his stolen horses. The name "Moondyne" was officially adopted for the nature reserve on 29 May 1981.

THE RESERVE

Moondyne Nature Reserve is on a ridge in the Darling Range which separates the Avon and Brockman river valleys (see map). The Reserve is made up of a series of gently sloping ridges and gullies covering two catchments. One drains north and west into the Brockman river valley and the other south and east into the Avon. This variety of landforms and aspects ensures the Reserve has an interesting diversity of habitats for plants and animals.

SOILS

The soils are mainly derived from laterite and the underlying granite. They are lateritic gravels and loams and some sandy loams. There are also small pockets of alluvial soils in the small stream valleys. Lateritic gravels formed when the original rock weathered. They have a high iron and aluminium content.

In the south-eastern corner of the Reserve, on the more steeply sloping edge of the Avon river valley, there is a particularly interesting area where outcrops of granite are partly covered by red loams.

LATERITE AND LATERITISATION

Laterite is a profile which may be up to 50 metres thick. It consists of four layers:

(a) A surface layer containing aluminium and iron. This is usually called the duricrust and sometimes "the laterite".
(b) A sub-surface layer of clay called a mottled clay zone.
(c) A deep pallid clay zone.
(d) Unweathered parent rock. In the case of the Darling Range this is granite.

Laterite forms by accumulation of iron and aluminium in the surface. The iron and aluminium arrives as a solution.

The process of lateritisation began many millions of years ago (since Paleozoic times), when the Australian continent was part of Gondwanaland. The land was subject to weathering by wind, water and the sun for many millions of years. The surface mantle was weathered exactly where it was and this is why there is such a depth of weathered granite in Western Australia.

With the break-up of Gondwanaland, Australia became independent and from the Eocene times the land surface of Western Australia was reduced to a plateau of low relief (peneplain). Towards the end of the era, when the land surface was being weathered and flattened, the drainage became restricted and large areas of land probably became swampy. This is when the iron and aluminium oxides would have been leached out of the parent rock into solution (mobilised).

In this flat landscape, swamps dried out and re-formed with the seasons, allowing the leached iron and aluminium oxides to precipitate out and form gravels in the surface. The oxides precipitated around a nucleus of parent rock growing as nodules season by season. This is why they have a circular appearance. However, these gravels are not stable as iron and aluminium oxide will go into solution very easily. During this time the landscape consisted of a leached sandy surface with gravels overlying a clay sub-soil.

In more recent times, at about the beginning of the present (Quaternary) era, this lateritic landscape of low relief was modified by erosion. Different layers were exposed to become parent materials for a new generation of soils. These were often covered with a mixture of material formed from the breakdown of laterite and granite. Today many soils in Western Australia have a gravelly surface layer over mottled zone or pallid zone clays (see diagram).

The massive duricrust of the Darling Range appears to have formed as a secondary feature, probably in the late Quaternary, by cementation of iron rich gravels mixed with iron and aluminium oxides. But the actual segregation of aluminium to form bauxite is not fully understood.

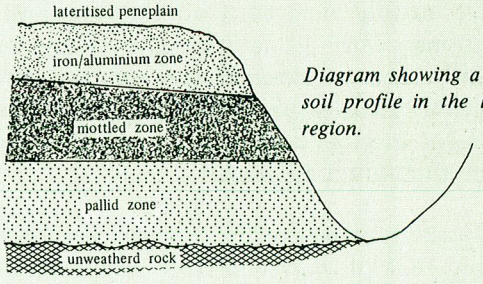
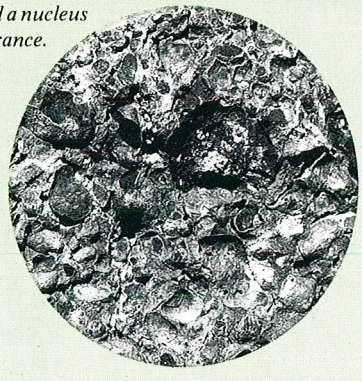


Diagram showing a typical soil profile in the lateritic region.

Laterite is formed around a nucleus and has a circular appearance.



A wandoo—most of the other trees in this area are much younger and have grown since timber cutting ceased.

*Blackboy (*Xanthorrhoea *sp.) overhanging an ephemeral creek.*

VEGETATION

John S. Beard, who has compiled vegetation maps for the whole of Western Australia, divided the vegetation of the Perth area into different "Systems". According to his classification Moondyne Nature Reserve is near the junction of the Darling System and the Chittering System, both of which are in the Darling Botanical District.

The Darling System covers the northern jarrah forest, north of Collie, and some of the most important features of this System are also represented on Moondyne Nature Reserve. They include rock outcrops, jarrah forest and marri/wandoo woodland.

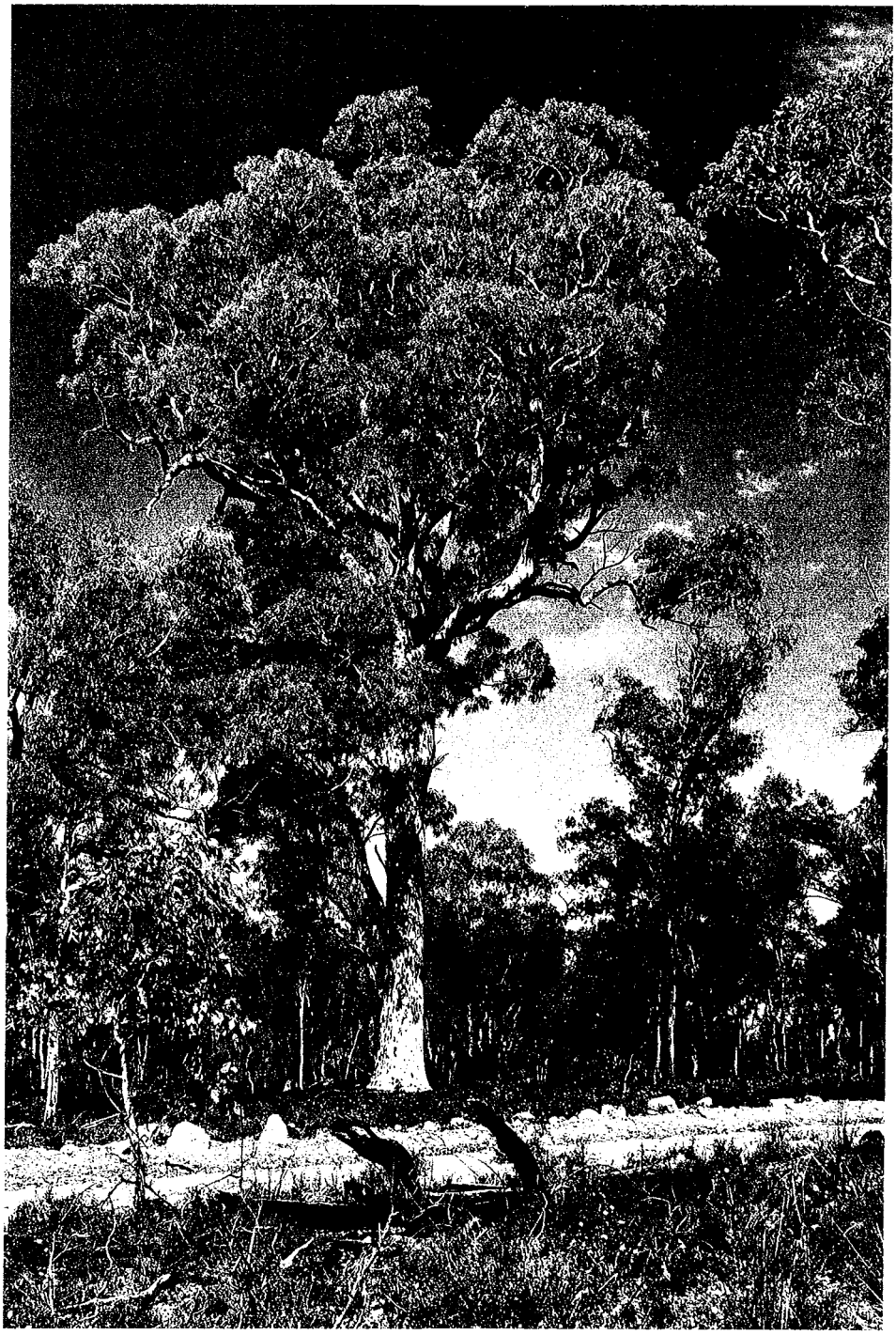
The Chittering System lies immediately to the north of the Darling System. The landscape is similar with a laterite crusted plateau interrupted by deeply cut valleys. However, the plateau is considerably more dissected in this area and the decline in rainfall in a northerly direction means that jarrah forest of the plateau is replaced with a more open community—a woodland in which jarrah and marri are joined by wandoo (*Eucalyptus wandoo*) and powderbark wandoo (*E. accedens*), and where York gum (*E. loxophleba*) appears in the valleys. While wandoo and powderbark wandoo occur on Moondyne Nature Reserve there is no York gum. This species can be found 12 kilometres east-north-east of Moondyne on Rugged Hills Nature Reserve.

Jarrah buds and fruit.

Because the Reserve is at the junction of two Systems there is a great diversity in its vegetation, a factor contributing greatly to its value as a nature reserve.

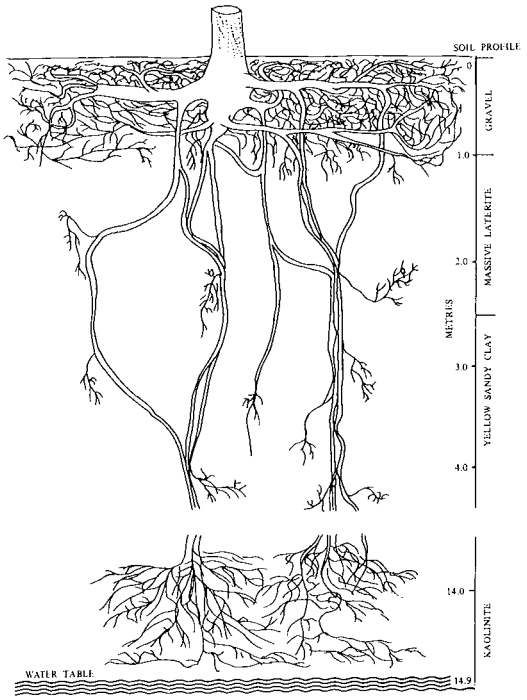
Most of the large jarrah trees on the Reserve have been removed for timber and this, together with the use of the area for military training and frequent fires prior to it becoming a Nature Reserve, probably account for much of the "openness" found there.

The best examples of jarrah "forest" as such (areas where the trees are close enough to give a 30 per cent canopy cover) are on the main ridges and south facing slopes. There is more powderbark wandoo on the drier, sunnier northern slopes. One interesting feature of jarrah forest, in general, is that it is typically dense and tall, yet it grows on the inhospitable laterite duricrust of the Darling plateau. The root system of jarrah is adapted to penetrate



"Johns tree"—a magnificent powderbark wandoo which can be seen on the edge of the Reserve. It was named after a famous British physicist who visited the Reserve in 1979.

the duricrust into the deep-weathered zone beneath. Roots may go down as much as 21 metres to tap deep reserves of moisture during the summer.



The jarrah roots are long and able to tap deep reserves of groundwater.

(after Kimber, 1974)

Jarrah sprouting after a fire.
Photo: Bill van Aken

Their deep roots allow jarrah trees to continue growing throughout the year. Soils of the scarp and valleys, where the deep-weathered zone has been stripped off, actually provide much less water storage than the plateau. It is for this reason that they support trees like wandoo and powderbark wandoo which appear able to tolerate greater extremes of soil moisture content. The jarrah is also sensitive to soil type and probably cannot grow on the pallid zone without the duricrust.

Much of the jarrah forest on the Reserve also contains marri (*E. calophylla*). In many areas, also, the jarrah is small and the trees sparse and can be considered more of a woodland.

Open forests of powderbark wandoo with varying amounts of jarrah and marri are found mainly on the north and north-west slopes of the Reserve. "Johns tree", on the north-east corner is a particularly fine example of a powderbark wandoo. Areas of open wandoo forest and *Acacia acuminata/Allocasuarina huegeliana* woodland are not so large.

Wandoo is one of the major eucalypts of the south-west and its prime occurrence is in a belt inland of the jarrah forest, on heavier soils. Wandoo usually grows on soils underlain with clay and where drainage may be impeded to some degree.

The pattern of the natural regeneration of wandoo is like that of jarrah, and seems to be, in part, an adaptation to fire. New leaf growth begins in January and February, and new flower buds form in the axils of the leaves. Twelve months later, these buds mature and flower. It takes a further 12 months for the seed in the capsule to ripen. A heavy fall of seed follows a fire, and seed seems to germinate most satisfactorily on a bed of ashes. As with jarrah, the young seedling does not at once grow to a sapling; several stems make a low bush, and the next phase of development is underground, where a lignotuber increases steadily in size. A single stem does not begin to dominate and develop into a "tree" until 10 years or so of ground work. Throughout this period, the young tree can regenerate easily from the rootstock after a light fire.

Open wandoo forest.

Some of the most attractive flowers on the Reserve belong to the *Lechenaultia* family, Goodeniaceae. One of the most well known is blue lechenaultia (*L. biloba*), which has flowers of various sky blue shades. Species of *Dampiera* such as common dampiera (*D. linearis*), have flowers of a more intense royal blue. The generic name honours William Dampier who was the first person to remark on the prevalence of blue-coloured flowers in the flora of "New Holland". Another blue-coloured member of the family is the broad-leaved fanflower (*Scaevola platyphylla*). In all of these blue-flowered species, white-flowered variants are sometimes found.

*Fanflower (*Scaevola platyphylla*) is a small shrub with broad leaves.*

One of the nine members of the Family Goodeniaceae found on the Reserve.

Sundews are common.

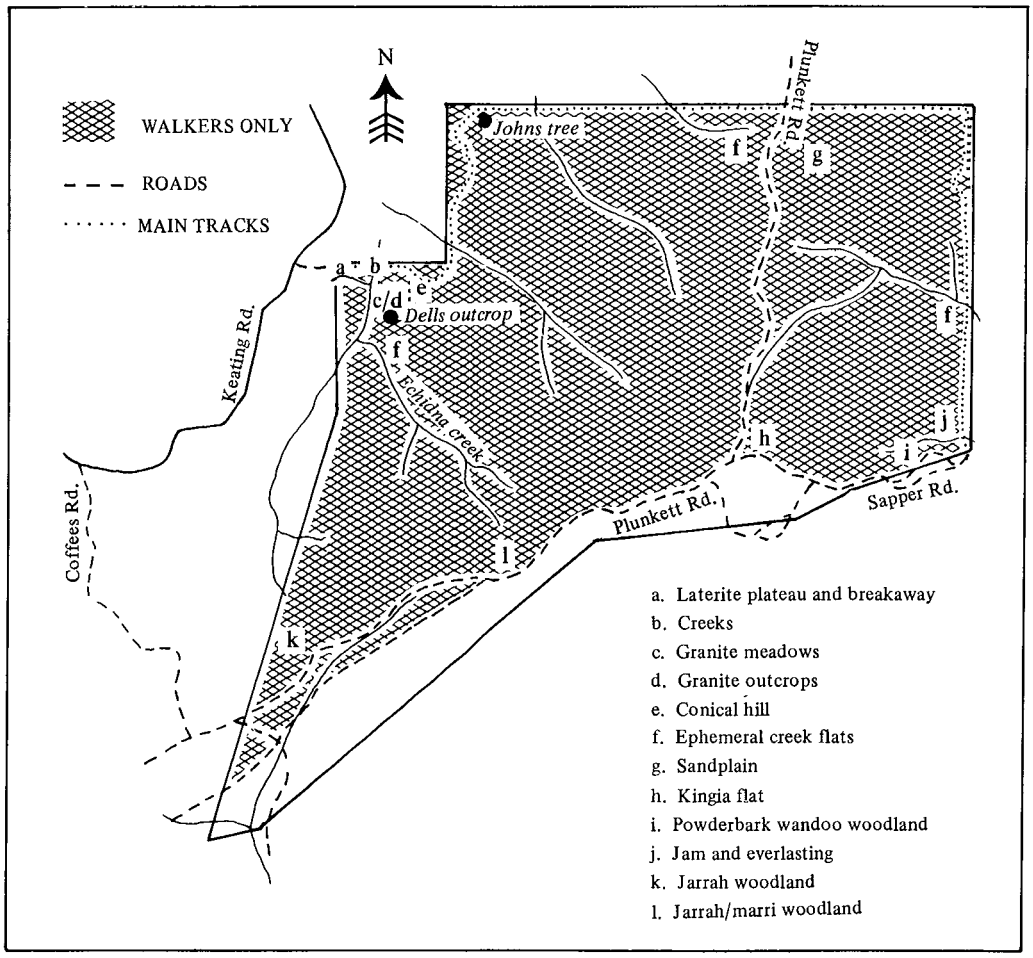
A species of Hibbertia.

Powderbark on laterite.

One of the burrowing frogs found on the Reserve.

AREAS OF SPECIAL INTEREST

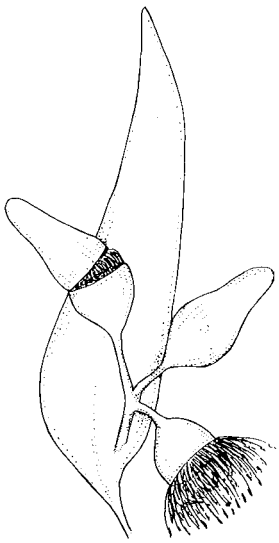
Moondyne contains many areas of special botanical interest and 12 are examined here in detail (see map). These have been selected because they are near designated roads or are easy to get to along major walking tracks or through areas of open bush. However, similar, and in some cases better examples are found throughout the Reserve and it is well worth the trouble to seek them out.



The 12 areas of special interest.

The 12 areas selected show characteristics found in many areas of the Darling Range and particularly in the Darling and Chittering Vegetation Systems. The Reserve contains a number of habitats representative of a very large biogeographical unit.

(a) Laterite Plateau and Breakaway



Jarrah bud opening.

A good example of a laterite plateau and breakaway can be found near the north-west corner of the Reserve. Here the lateritic duricrust supports an open jarrah woodland.

Jarrah flowers irregularly, mainly between December and February. An attractive feature is the small pixie-like cap which lifts and turns yellow as the cream coloured flowers open. The name *Eucalyptus* refers to this cap or operculum found in all eucalypt species. It comes from the Greek, *eu* meaning well and *kalyptos* meaning covered. Honeyeaters, insects and small marsupials are attracted to the flowers which are full of nectar. The fruits of jarrah, when ripe, are small and woody.

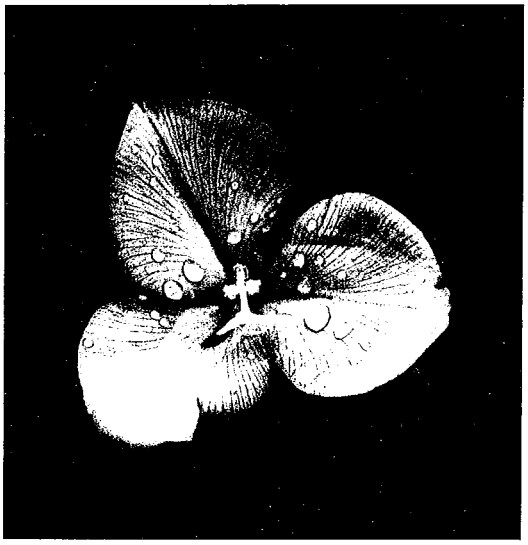
*Laterite plateau and breakaway—blackboys and zamia palms are common in this area and there is a rich variety of herbs. The laterite has previously been used by apiarists, and honey bees (*Apis mellifera*) are currently utilizing the hollow root base of a fallen tree.*
Photo: Bernie Dell

On the edge of the plateau there is a small laterite "breakaway". The exposed conglomerate boulders and skeletal soils of the laterite breakaway provide micro-habitats for a rich variety of plants. In this particular area there are a number of species of *Hibbertia*; a large number of triggerplants, for example, *Stylidium amoenum, S. calcaratum* and *S. hispidum; Conostylis setosa* (cotton-head); *Burchardia umbellata* (milkmaids); *Scaevola platyphylla* (broad-leaved fanflower); an orange pygmy sundew *Drosera platystigma* and the blue lady orchid *Thelymitra crinita.*

Hibbertia polystachya *on laterite—the flowers are borne on a one sided spike. The genus* Hibbertia *was named after George Hibbert, a nurseryman from Clapham, London.*

Photo: Bernie Dell

Black-eyed sundew (Drosera leucoblasta) *the flowers of this pygmy sundew vary in colour from pink to apricot with a black centre. It can be found in large colonies on the laterite gravel.*



Purple flag (Patersonia *sp.*) *is common on the Reserve. The flowers only stay open for about a day.*

SUNDEWS

Over half the world's sundews or *Drosera* occur in Australia and most are found in Western Australia. The botanical name *Drosera* means "dewy". Some sundews have a rosette of reddish leaves at ground level, for example *Drosera erythrorhiza*, while others, for example *D. pallida*, scramble from shrub to shrub and have leaves growing along the lengths of their stems.

When pressed many *Drosera* will produce a rich coloured liquid and the early settlers often used it for ink.

The upper surface of each leaf is covered with tentacles. Each tentacle is made up of a shaft with an expanded head at the end. The cells of the shaft are long with thickened walls, and the outer layer contains glandular hairs. The heads of the tentacles are nearly always enclosed by a drop of liquid which is viscid and sticky.

In sunlight the whole leaf appears covered with jewels—shining drops of mucilage. These are so sticky that when an insect comes into contact with a leaf it finds it practically impossible to get free again.

When the tentacles on the margins of the leaf are stimulated either by direct contact with an insect, or indirectly by stimulation of other tentacles on the leaf, the marginal tentacles start to bend over. In doing so they trap the insect against the surface of the leaf and it eventually becomes buried under the clustered heads of the marginal tentacles. The tentacles secrete chemicals to break down the insect. They remain bent over during digestion and until the soluble products of the insect have been absorbed by the plant. The tentacles then open out again and the leaf is ready for another victim.

During hot dry summers the plants appear to die. They survive this resting period in many different ways. The commonest method is by bulb or tuber. Some reproduce from suckers or runners and others, for example the pygmy sundews (*Drosera leucoblasta*), grow offspring from the old leaves.

There is one insect, called an assassin bug (*Pristhesancus* sp.) which can walk over the sticky tentacles of *Drosera* without causing the plant to react at all. The assassin bug lives on *Drosera* plants and has camouflage colours of green with red spots so it merges in with the sundew's leaves. The bug hides on the underside of the stem until it is hungry, when it will run up and down in search of food. Once it finds a trapped insect among the tentacles of a leaf, it will sink its long proboscis into the body and feed on the body juices so depriving the plant of nourishment. What the plant gets out of this association is not known.

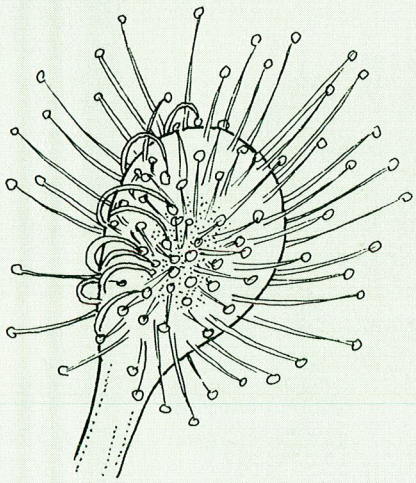
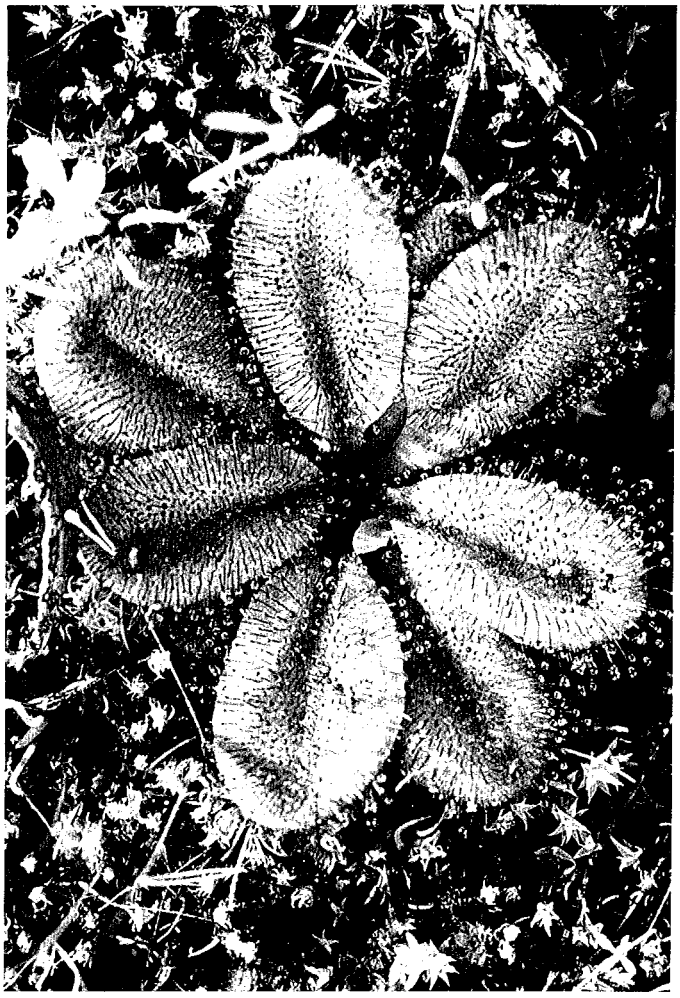


Illustration of sundew leaf showing the tentacles curling over.



A rosette sundew.

A scrambling sundew.

Towards the breakaway, jarrah gives way to powderbark wandoo which grows on the eroded surface of the soft pallid zone beneath the duricrust. Where these two soil types meet there are extensive stands of the shrubby crinkle-leaf poison *Gastrolobium villosum*. Further down the slope, below the breakaway, powderbark wandoo grades into wandoo on the broad valley floor.

POISON PLANTS

There are a total of 33 poisonous species of *Gastrolobium* and *Oxylobium* in Western Australia. The poison which occurs naturally in these plants is monofluoroacetic acid, a chemical better known by its commercial name "compound 1080" or simply "ten eighty".

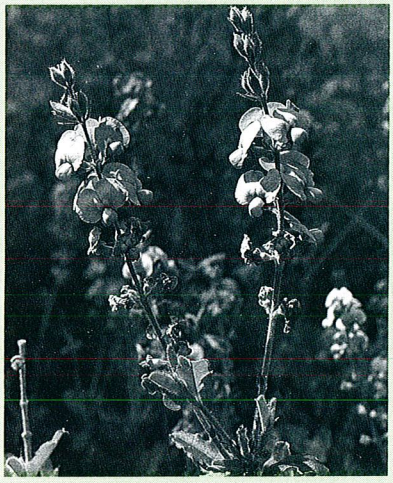
In about 1840 there was much discussion in the Colony over the cause of death of so many sheep and cattle, particularly in the foothills and hills of the Darling Range. After an experiment using a goat, the culprit was identified as *Gastrolobium calycinum*, known as York road poison.

Species of *Gastrolobium* occur on the Reserve and they are readily eaten by herbivores. Native animals feed on them and appear to be able to tolerate high dosages of fluoroacetate. Livestock, on the other hand, are very susceptible to 1080 and outbreaks of poisoning still occur from time to time. The balance between the tolerance of native animals to the poison and the fact that plants need it as a deterrent against being grazed too heavily is a delicate one. The two are in balance and the levels of fluoroacetate in the plants and the tolerance of animals to it have evolved together over many thousands of years. The poison plants and marsupial herbivores which use them for food are a classic and elegant example of co-evolution of animals and plants.

There is a great advantage, even for generalised herbivores, in being able to feed on these poison plants. They are legumes, members of the "pea" family, and very nutritious. The brush-tailed possum (*Trichosurus vulpecula*) which occurs on the Reserve can tolerate high levels of fluoroacetate. However, this tolerance will not allow possums to browse exclusively for a long time on the flowers and young leaves of poison plants, parts of the plant vital for its survival and areas where there is greatest concentration of the poison. Nevertheless, this degree of tolerance would allow a possum to include some of this material in its diet.

The tolerance of the brush-tailed possum to 1080 is purely a local, Western Australian phenomenon. Eastern states members of the same species do not share the ability to eat these poison plants, indeed populations of possums established in New Zealand from Victorian and Tasmanian sources are actually controlled by poisoning with 1080.

Unlike many Australian shrubs which are coarse, tough, spiny or otherwise physically adapted to resist grazing pressure, many *Gastrolobium* and *Oxylobium* species are soft and succulent. This is in addition to their being highly nutritious. These plants rely solely on the fact that they are poisonous for protection from overgrazing which could lead to their eventual extinction.

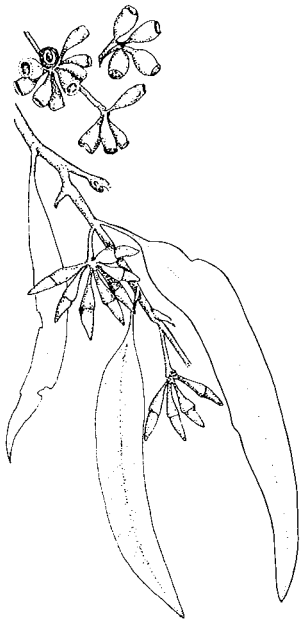


Crinkle-leaf poison (Gastrolobium villosum).

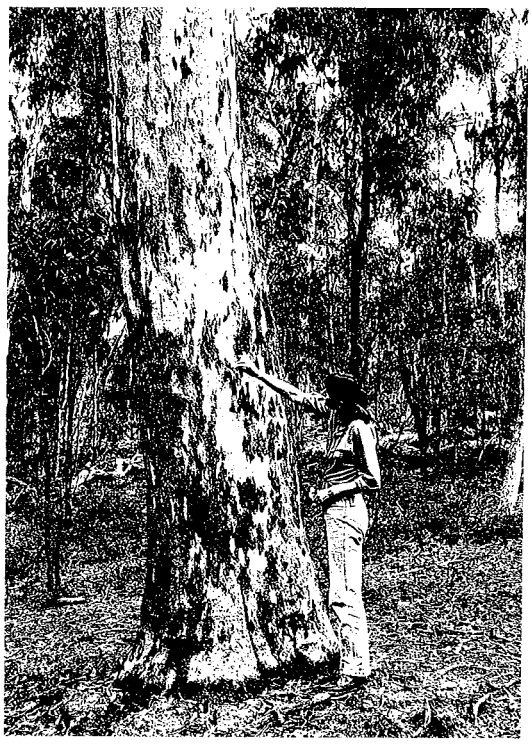
Wandoo is a handsome smooth barked tree growing up to 20 metres high. Wandoo lacks the persistent bark of jarrah, but the deciduous bark is usually thick (up to 25 mm). The new autumn bark is creamy in colour changing to white with grey spots as it ages. The tree sheds its bark (decorticates) unevenly to leave small rusty-brown or grey patches of persistent outer bark (for this reason the tree is sometimes known as "spotted gum"). Wandoo flowers are small and white, and the flower bud has a slender horn-shaped cap. Fruits are tiny and cylindrical or pear shaped.

It is possible, but difficult, to distinguish wandoo from powderbark wandoo from a distance. The wandoo tree is grey and white (sometimes yellow-brown) and the dark blotches of the persistent bark can often be seen. Powderbark wandoo, on the other hand, is more evenly white or greyish-white with a powdery surface.

Wandoo buds and fruit.



Wandoo provides high grade honey and along with marri and jarrah is of great value to beekeepers. Indeed this area has been used for hive sites and evidence of an old one can be found near the bottom of the hill, 200 metres from the north-western corner of the Reserve.



Wandoo bark with its characteristic blotchy appearance.

*Kangaroo paw (*Anigozanthos bicolor*)—a smaller kangaroo paw than* A. manglesii, *the floral emblem of Western Australia. The derivation of* Anigozanthos *is obscure though C. A. Gardner derived the name from the Greek* anisos *unequal* + anthos *flower, apparently referring to the manner in which the flower tube splits open leaving six lobes on one side. However, D. Don derived the name from the Greek* anicho *to elevate* + anthos *flower, "from its flowers being elevated on a naked stem." The shape of the kangaroo paw flower is ideally suited to pollination by honey-eating birds.*

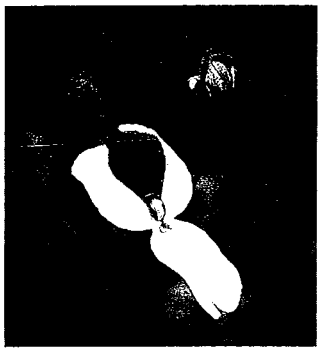
*Honeypot (*Dryandra nivea*) grows close to the ground and is common throughout the Reserve. Ants can often be seen scrambling over the flowers.*

The triggerplant *Stylidium caricifolium*, with long grass-like leaves, grows in clumps on the breakaway slopes and the bearded orchid *Calochilus robertsonii* is also present.

The laterite plateau and breakaway, a common feature of the Darling plateau, is an excellent area for examining the effect of soil types, depths and drainage on vegetation. This is not only reflected by a change in the dominant tree species but also by the contrasts in the understorey. The laterite duricrust, both on the plateau and breakaway, has a diverse and relatively dense understorey. The pallid zone clays, on the other hand, have fewer species and the vegetation is rather sparse. While the contrast can be seen at this point in the Reserve, recent fires have tended to mask it as different densities of understorey also experience different intensities of effect from fire.

Moondyne is being managed to minimise the risk of unintentional fire. As the years go by the real difference between the understorey of plateau and valley slopes will become more evident.

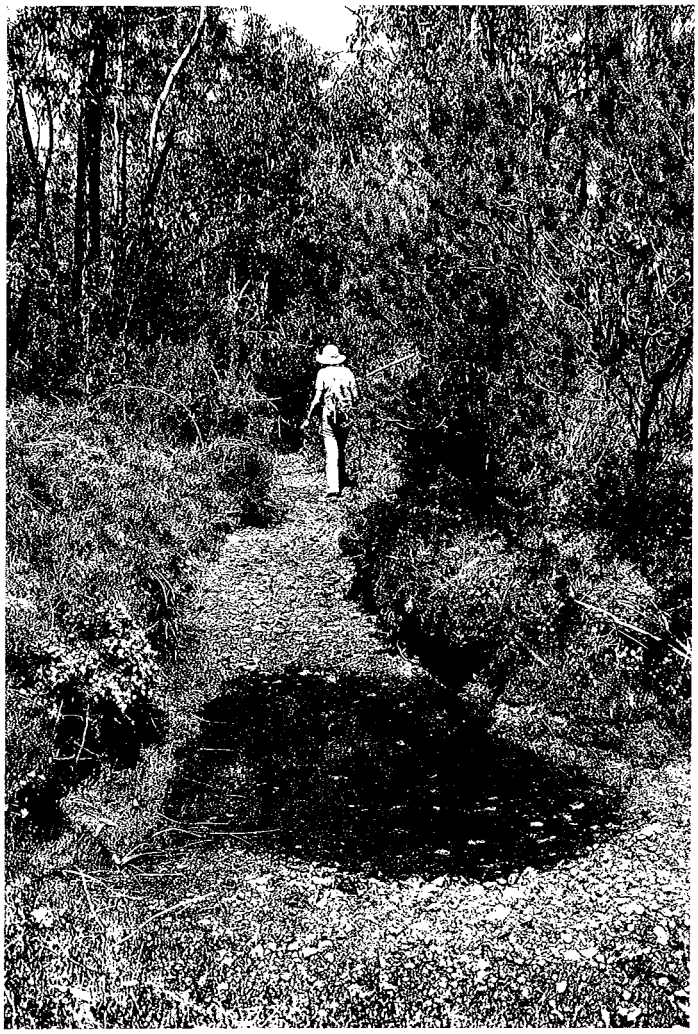
*Triggerplant (*Stylidium *sp.)—17 species of triggerplant have been recorded on the Reserve.*



Triggerplant flower with sensitive column curled back. The column bears both anthers and the stigma which mature at different times.

The column has flicked over. Pollen would be deposited on a visiting insect. After a short time the column curls back, re-setting itself.

(b) Creeks



A creek photographed in November. Only a few pools remain in the creek bed.

A number of creeks occur on Moondyne and one of the easiest to get to ("Echidna creek") flows north and across the northern boundary. It can be reached by walking approximately 600 metres along the track from the north-west entrance. The creek only flows in winter and spring.

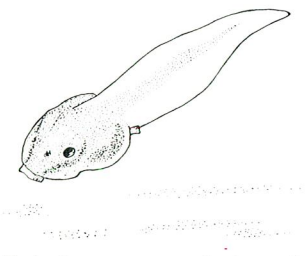
Small waterfalls and deep pools form in the creek after the winter rains. The pools contain a number of sedges including *Leptocarpus coangustatus, Loxocarya cinerea* and *Lepidosperma longitudinale*. The pools also contain *Triglochin procera*, a quillwort *Isoetes drummondii* and a large fresh water alga *Chara* sp.

ISOETES DRUMMONDII

***Isoetes*, often called quillwort, is a primitive plant and a member of the Order Lycopodiales, commonly called club mosses because they have club-shaped spore-bearing cones. *Isoetes drummondii* is unusual in this Order because it lives in areas that are dry for part of the year. The long, narrow, grass-like leaves are crowned on a short tuberous stem.**

It was during the Devonian that plants similar to *Isoetes* evolved. Today all living members are small plants, but in earlier times they included many trees, and many tree-like lycopods dominated the Carboniferous vegetation.

Small waterfall along "Echidna creek".



Tadpoles are common in the pools.

The smallest triggerplant on the Reserve, *Stylidium despectum*, grows on the fertile creek banks in this area. It is only about three centimetres tall when in flower.

In spring the creeks are full of tadpoles, and burrowing frogs (*Heleiporus albopunctatus*) can be heard calling from the damp vegetation. Bats of several species, such as the lesser long-eared bat (*Nyctophilus geoffroyi*), may be seen winging their way through the trees at dusk. Water rats (*Hydromys chrysogaster*) are often present near pools.

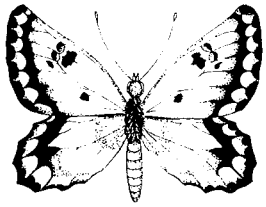
Left: Fungi can be seen growing in the damp moss along the banks of the creek.

Right: Liverworts are primitive plants and their reproductive "umbrellas" can be found in the spring.

Some of the most common birds seen feeding in the shrubs along the creek banks are wrens such as the splendid wren (*Malurus splendens*). The irridescent blue of the male is a brilliant sight as he feeds in flocks with the drabber females.

In places the creek winds between steep banks of loam which support a peripheral band of tall shrubs (for example the pink flowered *Kunzia recurva*) under spreading wandoo trees. In the shelter of these creek banks occur stands of creeping liverwort and the fern *Cheilanthes tenuifolia.*

The wood white butterfly (Delias aganippe)*—the mature larva is dark brown with numerous white raised spots each of which has a white hair. The head is black, with white hairs also.*



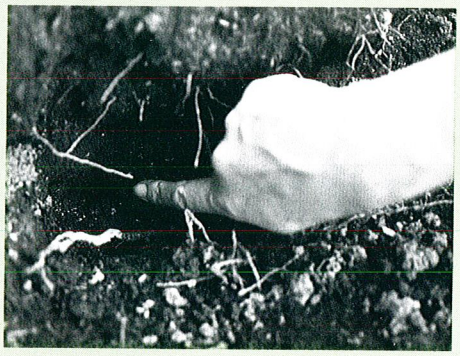
Two orchids, *Microtis unifolia* and *Thelymitra pauciflora* grow in the creek banks. Away from the creek are numerous clumps of the pink flowered *Boronia scabra.* It is in these areas that small holes made by the probing snout of the echidna (*Tachyglossus aculeatus*) often can be seen. The areas of low shrubs also abound with butterflies in the spring such as the wood white (*Delias aganippe*), the wedge skipper (*Anisynta aphenosema*), and several brown xenicas (*Geitoneura klugii, G. minyas*).

(PLEASE TAKE CARE AS THE EDGES OF THE CREEK ARE VERY FRAGILE AND CAN BE DAMAGED EASILY BY WALKERS.)

ECHIDNA OR SPINY ANT-EATER (*Tachyglossus aculeatus*)

The word echidna is Greek and means adder or viper. It was probably given to our echidna because of its long snout. The echidna is seldom seen, yet it is one of the most successful and widely distributed mammals in Australia today. The long beak-like muzzle has a small mouth at the end. The echidna can open its mouth just wide enough to allow free movement of its long extensile tongue and the insect prey on which it feeds. Echidnas have short legs and long strong claws used for digging. One of the claws on the hind foot is particularly long; the echidna uses it for preening between the spines on its back and sides. Echidnas eat both termites and ants. They also take in a considerable amount of earth when feeding, so the presence of an echidna can often be recognised by its droppings. These are cylinders of earth filled with the remains of insects which cannot be digested. The droppings are not rounded, but broken off abruptly at the ends.

The echidna is immensely strong, and a good burrower. When surprised its immediate reaction is to burrow and because of its shape, its strength and its spines, an echidna between rocks is almost impossible to dislodge.

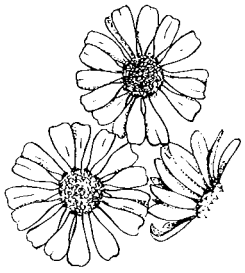


The holes made by the probing snout of an echidna have a characteristic pointed end.

(c) Granite Meadows

Granite meadow with a large stand of Allocasuarina huegeliana *behind.*
Photo: Bernie Dell

An extensive outcrop of granite ("Dells outcrop") occurs near the side of "Echidna creek", 400 metres upstream from the northern boundary. It can be approached by walking along the side of the creek. Where soils are very shallow over the granite, seepage and winter rains allow ephemeral meadows to establish. These are meadows that contain plants that only appear for a few months of the year—in this case winter and spring. The meadows contain mixtures of plants 5-10 centimetres high including two insectivorous bladderworts (pink petticoats) *Polypompholyx multifida* and *P. tenella.* Interspersed between the pink petticoats are ephemeral triggerplants, for example, *Stylidium pulchellum* and the Swan river daisy *Brachycome iberidifolia.*

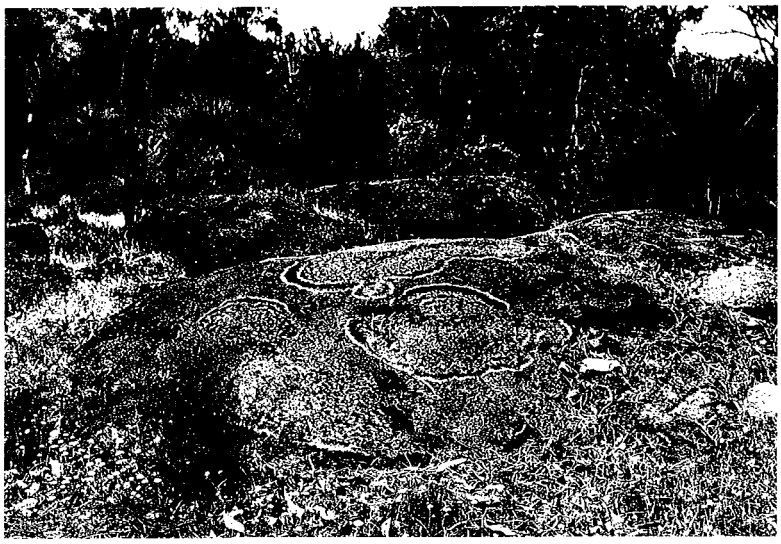


Swan river daisy.

The large white flowered shrubby sundew *Drosera gigantea* occurs in this area. A similar type of vegetation can be found on clay flats near Perth (for example Cannington). Deeper soils support stands of *Allocasuarina huegeliana* with patches of *Leptospermum erubescens.*

Detail of a granite meadow showing pink petticoats and the Swan river daisy.

Photo: Bernie Dell



Lichens form interesting patterns and textures on granite boulders. Most of the flowers at the base of the boulders are everlastings.

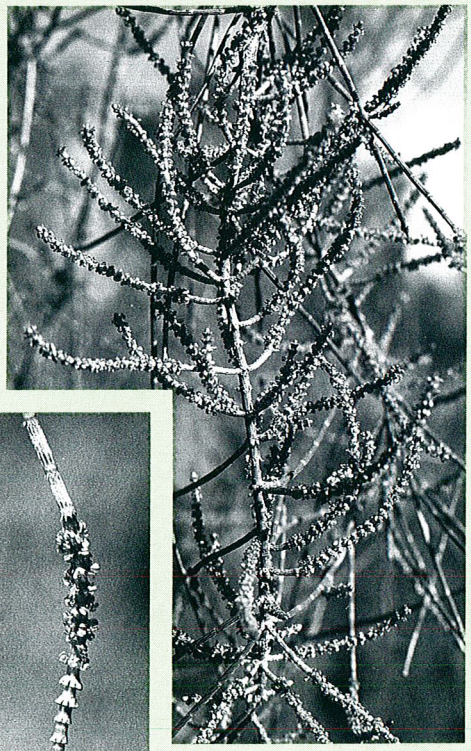
THE SHEOAK—*CASUARINA (now ALLOCASUARINA)*

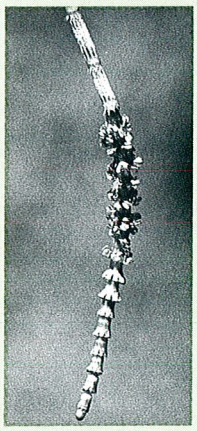
The botanical name *Casuarina* comes from the resemblance of the foliage to the drooping tail feathers of the cassowary, *Casuarius casuarius,* the ostrich like flightless bird of northern Australia. The popular name, sheoak, came from settlers in the early days supposedly because wide rays in the wood reminded them of their native oak.

The "foliage" of the trees consists primarily of thin, green, flexible, jointed branchlets called cladodes. These function as leaves. The true leaves are minute triangular scales which encircle the joints of the cladodes at regular intervals. Sheoaks are highly specialised for wind pollination which is unusual in Australian trees and shrubs. The female flowers are cone shaped and consist of a single ovary with two long, red styles, surrounded by a few brown scales. When mature the styles protrude to catch the wind-borne pollen grains from the male trees. The male flower consists of a single stamen surrounded by bracts and is usually borne in small, terminal spikes at the end of the cladodes. The rusty or gold-brown anthers colour the whole tree when it flowers. After fertilization, the female inflorescence matures into the characteristic woody "cone", which later releases winged seeds, especially after fire.

The branchlets are shed at the end of their functional life and as a result a very thick layer of litter may develop underneath each tree. This litter layer modifies the acidity of the soil so that few other species of plant can survive.

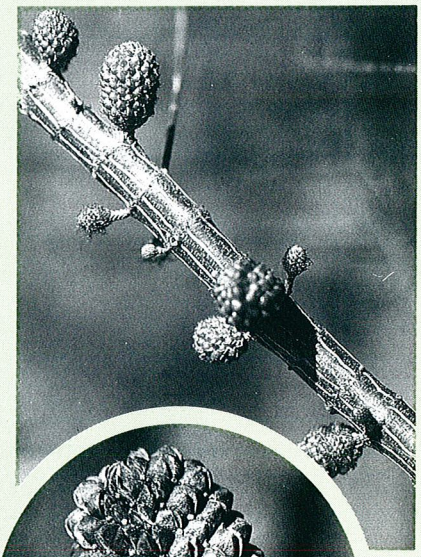
Male flowers of the sheoak.

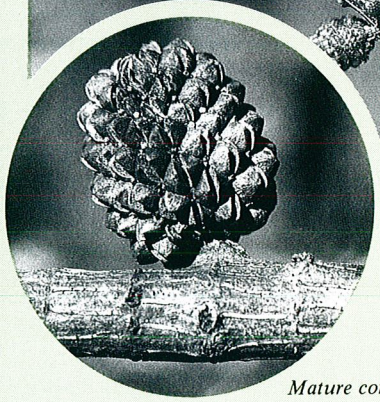




Detail of male flowers—the jointed branchlets or cladodes can be seen.

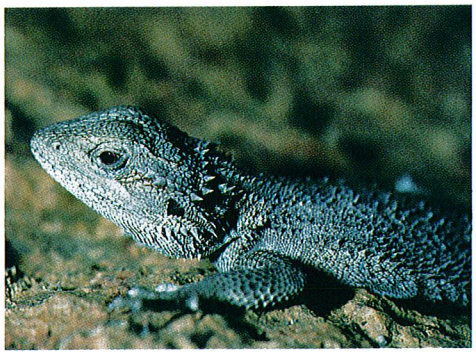
Female flowers and "cones" in various stages of maturity.





Mature cone.

Spring on Moondyne.

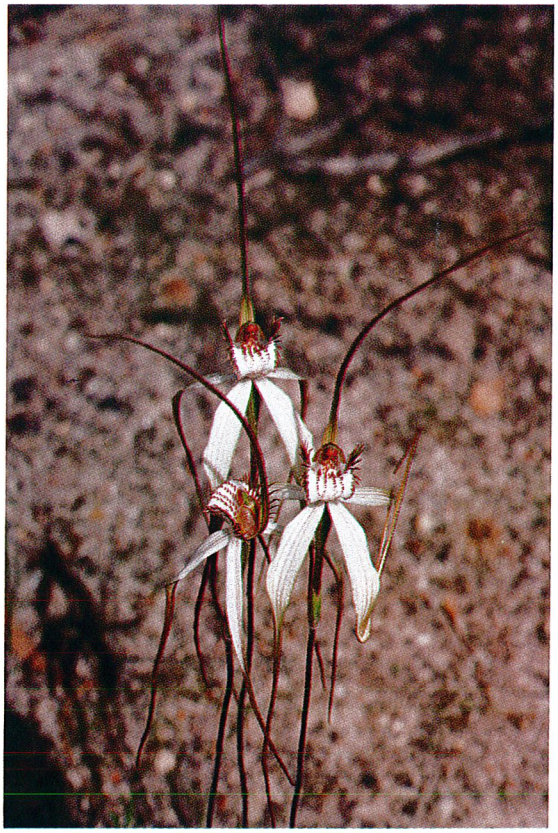


Dragon lizard.

Lichens.

Caladenia flava.

Pygmy sundew in flower.

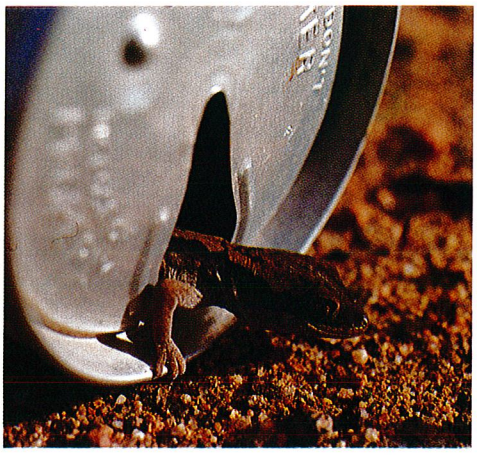


Caladenia patersonii—*a spider orchid.*

The honeypot dryandra.

Grevillea bipinnatifida.

Cat's paw.
Photo: Bill van Aken



An unusual gecko refuge.

Ephemeral stream.

Everlasting flower.

(d) Granite Outcrops

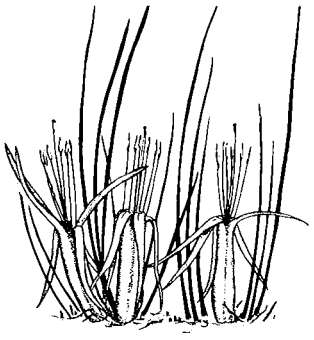
The Darling Range has many granite outcrops and a number occur on Moondyne Nature Reserve. Each outcrop differs in slope, aspect, soil depth and drainage; every one of which has a decided influence on the vegetation that develops. Generally, because of the wide range of habitats to be found on and around these rocks, they support a great diversity of plants.

"Dells outcrop", already mentioned in relation to granite meadows, has been selected as an example because it contains a particularly wide variety of the plants characteristic of the Reserve (and the Darling Range). The vegetation here is very dense and dominated by the Family Proteaceae. The rock provides a catchment for water and a source of minerals. The deeper layer of soil over granite in this area and the flat or gently sloping terrain also help to make the area surrounding the outcrop especially rich in plants. Important members of the flora are listed below:

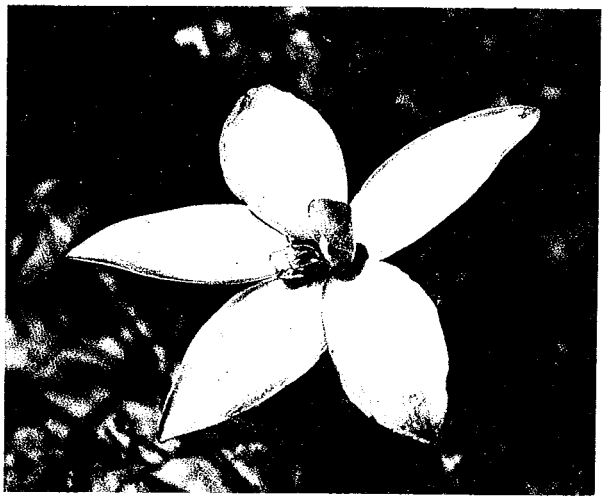
The brilliant red hairy jugflower, (Adenanthos barbigerus) *is a member of the Family Proteaceae and common on the Reserve. The name* Adenanthos *comes from the Greek* aden *gland* + anthos *flower and refers to the glands at the base of the ovary.*

Shrubs: *Dryandra fraseri, Melaleuca radula* (the graceful honey myrtle), *M. scabra* (rough honey myrtle), *Verticordia huegelii* (variegated featherflower), *Gastrolobium calycinum* (York road poison).

Herbs: *Anigozanthos bicolor* (kangaroo paw), *Conostylis androstemma* (trumpets), *Drosera leucoblasta* (pygmy sundew), *Elythranthera emarginata* (pink enamel orchid), *Isotoma hypocrateriformis* (Woodbridge poison—has a milky sap), *Jacksonia alata, J. restioides, Lobelia winfridae* (little lobelia), *Podolepis lessonii, Pimelia imbricata, Pterostylis vittata* (banded greenhood orchid), *Stylidium bulbiferum* (circus triggerplant), *S. pubigerum, S. pycnostachyum, Sowerbaea laxiflora* (purple tassels) and *Thelymitra antennifera* (lemon orchid—one of the few strongly scented ground orchids).



*Trumpets (*Conostylis androstemma*), one of the two* Conostylis *species with long, solitary flowers. The plant is a perennial with wiry leaves and flowers from 2-3 centimetres long.*

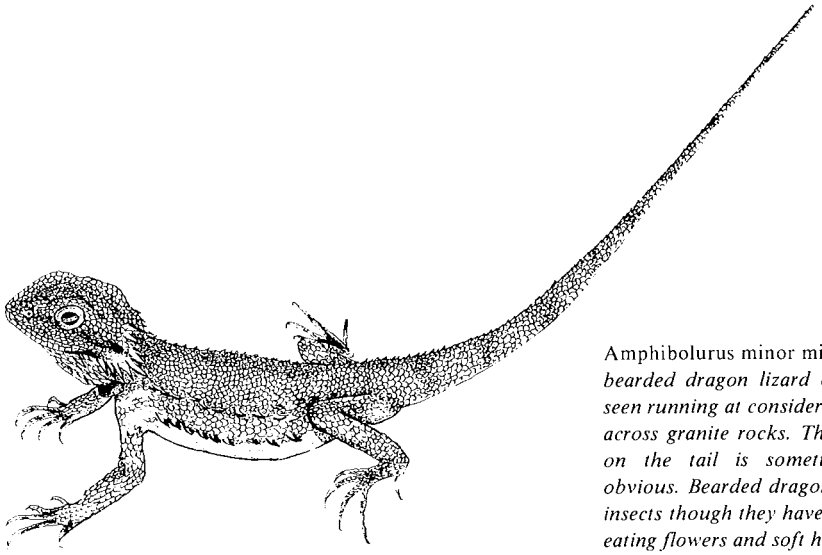


Pink enamel orchids (Elythranthera emarginata) *can be found around the granite outcrops on the Reserve.*

Photo: Bernie Dell

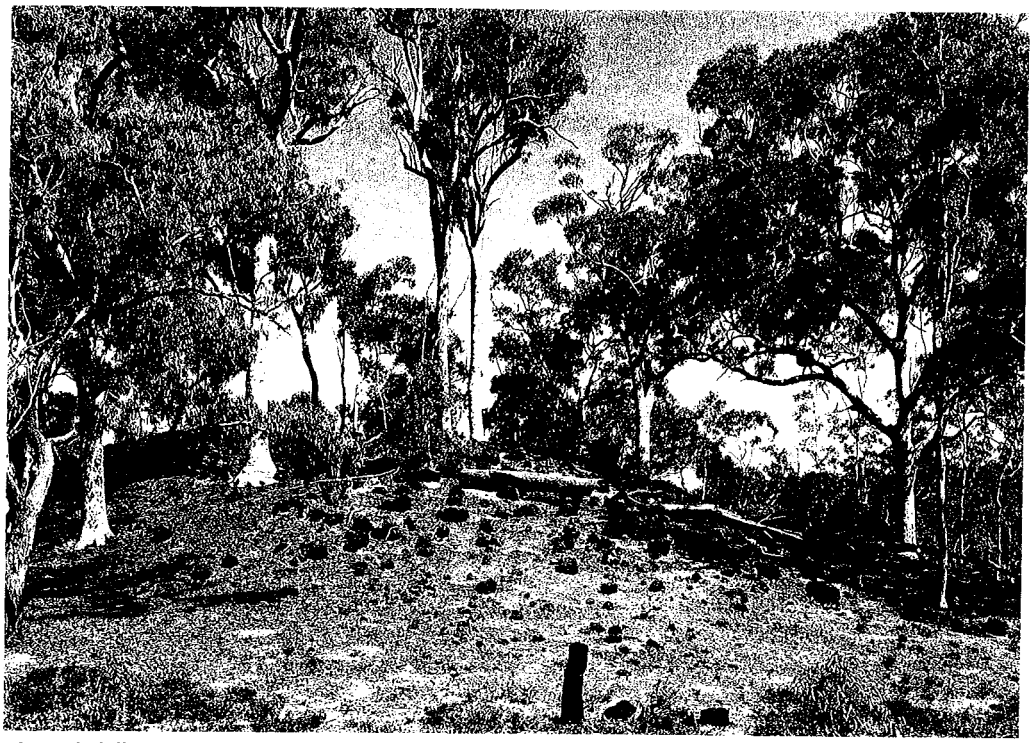
Tribonanthes uniflora *is a member of the kangaroo paw family Haemodoraceae. There are five known species of* Tribonanthes *and all are endemic to south-west Australia.* Tribonanthes uniflora *is common on the Reserve on moist areas around granite rocks.*

It is appropriate here to mention some of the reptiles that may be found on granite outcrops in particular and Moondyne in general. Attractive bearded dragon lizards (*Amphibolurus minor minimus*) basking on the rocks will race away from intruders that enter their territory. The scale footed or legless lizards, for example Burtons snake lizard (*Lialis burtonis*), are true lizards but have no front legs and hind legs reduced to flaps. They are often mistaken for snakes and, unfortunately, killed. Several species of skink, ranging from small active skinks such as *Ctenotus schomburgkii*, to the sleepy harmless bobtail (*Tiligua rugosa*) may be observed on the granite outcrops. The small soft velvety bodied geckos, for example the beautiful *Diplodactylus pulcher*, and the thick-tailed gecko (*Phyllurus milii*) hide under the loose rocks. (IF ANY OF THESE ROCKS ARE TURNED THEY SHOULD BE PUT BACK EXACTLY AS THEY WERE.) Of the snakes, the largest is the carpet snake (*Morelia spilotes*). These are non-poisonous and may be found in hollows of trees. Their food consists largely of mice and rats. The olive brown mulga (*Pseudechis australis*) and gwardar (*Demansia nuchalis*) are the most common of the large venomous snakes. The mulga snake is near the western limit of its range in Moondyne Nature Reserve. There are several species of smaller snakes including the black-headed whip snake (*Denisonia gouldii*) but these are seldom seen. (*ALL* REPTILES INCLUDING POISONOUS SNAKES ARE PROTECTED ON NATURE RESERVES.)



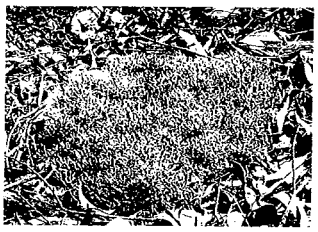
Amphibolurus minor minimus *is a bearded dragon lizard commonly seen running at considerable speed across granite rocks. The banding on the tail is sometimes very obvious. Bearded dragons feed on insects though they have been seen eating flowers and soft herbage.*

(e) Conical Hill



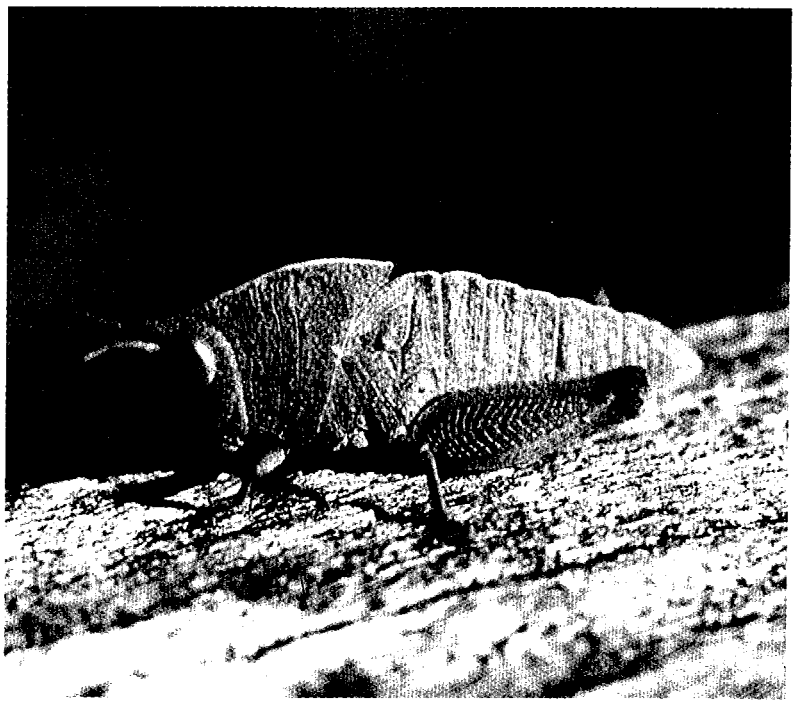
"Conical hill"—laterite boulders can be seen scattered over the ground surface. The grass tree in the foreground has been killed by fire and is now the home of small marsupials.

"Conical hill" is 900 metres from the north-western corner of the Reserve. It has a remnant of resistant duricrust on its summit overlying the pallid zone clay which forms its steep slopes. The slope of the hill is determined by the duricrust. This is another good site to see the effect of soil type on the vegetation: the duricrust with jarrah trees and the slopes with powderbark wandoo. Two particularly interesting plants can be seen on the laterite which are not evident elsewhere on the Reserve: *Astroloma compactum*, a prostrate plant with bright yellow-green leaves and *Gastrolobium ilicifolium*, a coarse shrub that can grow to one metre high. At the base of the hill, among the wandoo, occurs the tall triggerplant *Stylidium carnosum* which has a basal rosette of leaves.



Astroloma compactum *is easily recognised by its bright green leaves and compact appearance.*

Many insects are well adapted to living among fallen eucalypt leaves. One grasshopper, for example, looks just like a dry leaf and is difficult to detect among leaf litter. Leafminers are prevalent on eucalypts and can do quite a lot of damage. The tunnels made by the larvae can be seen on most of the trees on the Reserve.



Many grasshoppers look like fallen leaves and merge in with the litter. Quite a few species are found on the Reserve.

Gastrolobium ilicifolium *grows in profusion on "Conical hill". Although a poison plant, many small honeyeaters are often seen feeding from the flowers.*

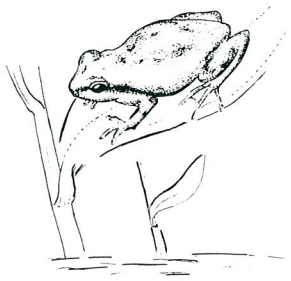
(f) Ephemeral Creek Flats

Many of the upper parts of the creek valleys on Moondyne Nature Reserve are broad and gently sloping. Here water accumulates after winter rain and many small ephemeral plants flourish. Examples of ephemeral creek flats can be found 150 metres from the north entrance of the Reserve, about 200 metres into the bush to the west of the track. Another ephemeral creek flat occurs about 1.2 kilometres from the south-east corner of the Reserve.

One of the ephemeral creek flats on the Reserve. There is, as yet, little in flower.

Photo: Bernie Dell

Many interesting ephemeral plants are found on these flats including two species of bladderwort (*Polypompholyx* spp.), *Pritzelia pygmaea, Triglochin procera, Microtis unifolia* and *Centrolepis aristata* which grow in shallow slowly moving water. During the winter and early spring these areas are extensively grazed by kangaroos. They would have been favoured places for pasturing stock and several have been used for this purpose in the past. Introduced species are common including the aquatic *Crassula natans* with its long threadlike stems, small scattered leaves and tiny white flowers which just break the surface of the water. During



Frog waiting for a passing insect.

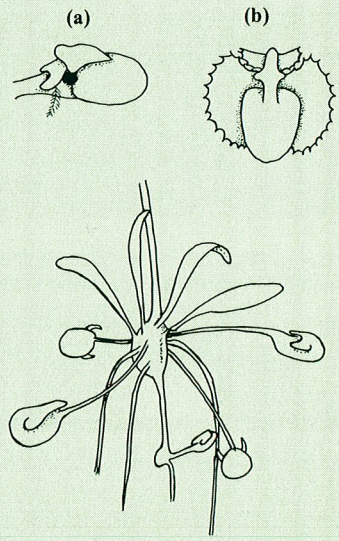
the late spring and early summer the creek flats dry out and the plants die or enter a senescent phase, only to appear again after the next winters rain.

Burrowing frogs such as *Heleiporus eyrei* and *H. albopunctatus* are common in this area and can be heard during winter and spring.

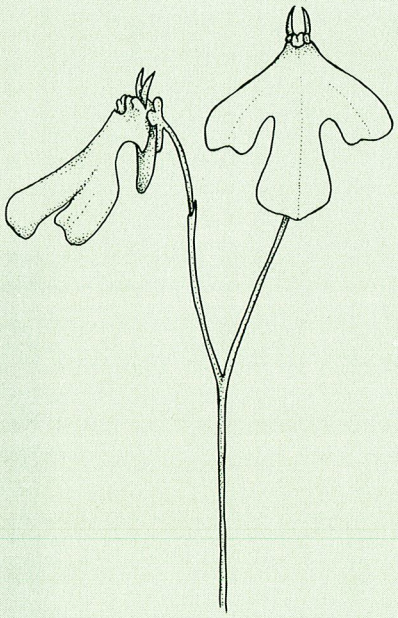
BLADDERWORTS

Bladderworts are found in ditches, pools and very wet bogs. They are usually totally submerged and only the flowers rise above the water. Beneath the flowering stem and submerged in the swamp are little bladders in which insects can often be found. Each bladder is oval with a mouth-like opening at one end. The opening is closed by a delicate valve-like "door". At the sides of the mouth are hairs and there are a few straight bristles on the valve itself. In the normal way the bladder is completely closed by the "door". In order to trap an insect, liquid, which fills the bladder, is pumped out and the sides of the bladder are drawn in. The valve door is now in a condition of very delicate balance and if even a very minute insect comes in contact with the bristles on the valve it will buckle in and allow a sudden inrush of water to relieve the tension. The inrush carries with it the insect. The valve then slips back into its original position and the insect is trapped.

Enzymes released by cells in the walls of the bladder break down the insect into chemicals the plant can digest. Once this has been completed the trap is ready to catch further prey.



The underground structures of the bladderwort Polypompholyx *sp. Each plant produces many bladders: (a) sideview; (b) top view.*



Polypompholyx *sp.*

The largest bird seen on the Reserve is often found feeding on these creek flats. Emus (*Dromaius novaehollandiae*) are well known for spreading seeds, and evidence of passing emus can be seen throughout the Reserve as their droppings are very characteristic and often have grasses and seedlings growing on the rich source of nutrients. Other evidence of emus is seen on the Reserve boundary where their feathers often adorn the barbed wire fence.

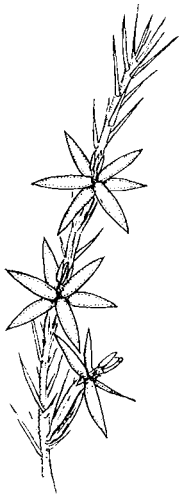
Grass sprouting from emu droppings. Emus bring "weeds" into the Reserve when they feed outside in farmland.

Zamia seeds being dispersed by emus. The droppings provide a rich source of nutrients for young plants.

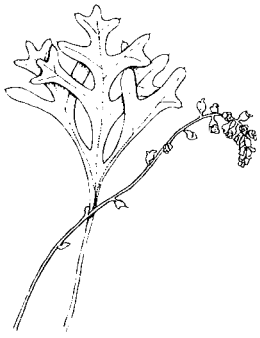
(g) Sandplain

One of the few sandplain areas on the Reserve. Several species of Hovea *and* Lechenaultia *can be seen in the foreground, blackboys and marri behind.*

Near the north-eastern corner of the Reserve there is an area of white sand overlying clays and laterite loams. This pocket of sand supports a jarrah/marri woodland and understorey which is more typical of the coastal Bassendean dune system of the Swan Coastal Plain than it is of the Darling Range. Common understorey species are: *Jacksonia floribunda, Allocasuarina humilis* (scrub sheoak), *Calectasia cyanea* (blue tinsel lily), *Conostylis aurea* and *C. candicans*. The yellow flowered *Calytrix angulata* is evident in November. A common shrub, which is always an indicator of deep sand, is the blueboy, *Stirlingia latifolia.*



Calytrix *sp.*

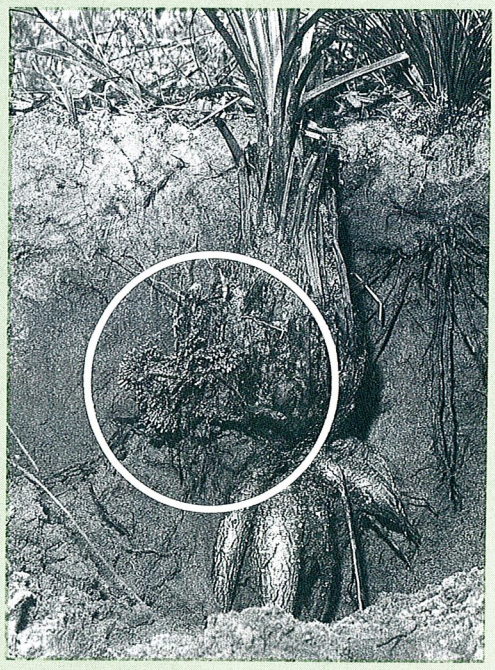


Synaphea petiolaris *is found throughout the Reserve.*

Magnificent specimens of zamia palms *Macrozamia riedlei* are dotted throughout the sandplain area. They have trunks which are more than one metre high and are reminiscent of the very tall cycads which occur along the Brand highway near the Hill river. Like *Acacia* species and other legumes, zamia palms are important in the forest ecosytem as they are able to fix atmospheric nitrogen.

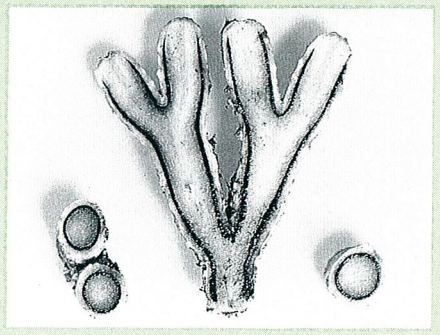
ZAMIA PALMS

Gaseous nitrogen "fixed" by zamia palms is an important source of nitrogen in the ecology of a forest. Coralloid roots branch out from under swollen stem bases beneath the soil. Spaces in the cells contain masses of bacteria whose activity produces nitrogen for growth of the host. When the coralloid roots die and decay or the zamia palm dies, nitrogen becomes available to other plants.



Close-up of coralloid root.

Photos: Bill van Aken



The zamia palm, *Macrozamia riedlei*, is not a true palm. It is a cycad, a member of a small group of plants distantly related to the conifers. The zamia palm occurs widely in the jarrah forest and is common throughout the south-west.

Male plants develop from three to seven cones, usually during April or May. The cones grow up to 30 centimetres long and are made up of lots of scales which have pollen sacs underneath. The female plant only develops one or two cones and these are quite large, weighing up to 14 kilograms. The zamia palm can be sexed by the shape of the cone scales. The female plant also has many seedlings around its base. Pollen is shed between September and November, but actual fertilization will take place some months later. The seeds are only released when the female cone rots away and this will probably occur the following autumn. When they are first shed the seeds are bright red. They will lie dormant for at least a year and then germinate after winter rains. Animals such as water rats feed on these seeds. Emus will pick them up also. For the first few years growth of the seedling is very slow and only a few leaves are produced at any one time.

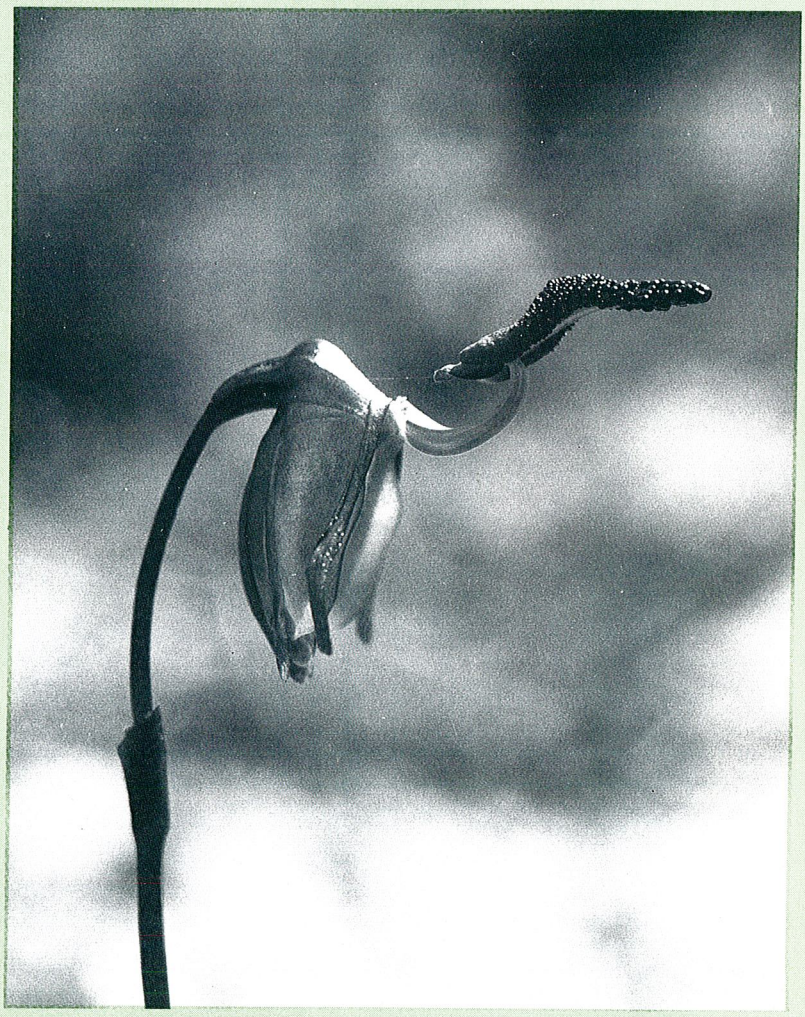
The leaves of the zamia palm are toxic to livestock and the seeds are poisonous if eaten by man, though after careful preparation Aboriginals used to eat them; but this is not advised.

Male cone of Macrozamia riedlei.

Large specimen of a zamia seen on the Reserve.

The sandplain is not very large but contains a rich variety of plants. Others of special interest include the red and green kangaroo paw, *Anigozanthos bicolor*, and many species of orchid which do not occur elsewhere on Moondyne. These include the hammer orchid (*Drakaea gracilis*) and flying duck orchid (*Caleana nigrita*).

THE FLYING DUCK ORCHID (*Caleana nigrita*)



The flying duck orchid is often found growing with the hammer orchid. This orchid has a sensitive labellum and it is thought it is able to snap shut when an insect lands on it and so trap the insect in the pouch. The insect, crawling around in the pouch looking for an escape, transfers the pollinia to the stigma. It will be let out eventually when the labellum curls up again setting the trap for another insect.

HAMMER ORCHIDS (*Drakaea* spp.)

Orchids are the most famous specialists in fertilization. Charles Darwin in his book "The Fertilization of Orchids" revealed some of the many intricate and ingenious devices these plants use to ensure cross pollination takes place.

Many species of orchid are found on the Reserve and they have adopted various interesting ways of ensuring they are pollinated. This guide only deals with one of these methods in detail—that of the hammer orchids, *Drakaea* spp.

A recently discovered species of hammer orchid occurs on the sandplain and it has been named *Drakaea gracilis* because it has a graceful curved neck at the base of the labellum.

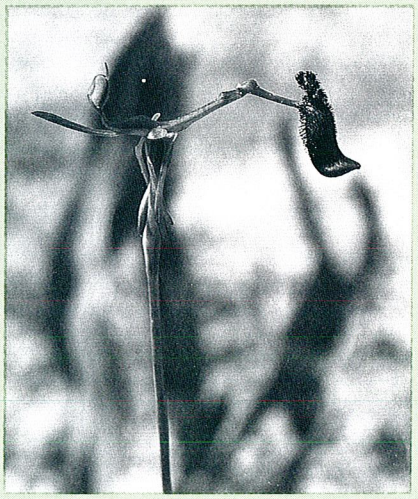
Hammer orchids are difficult to see because they are small and insignificant and blend in with the other vegetation. However, it is well worth taking the time to find these delicate orchids because close up they have a most complex beauty thought to be part of an unusual pollination mechanism.

The orchid was given the name "hammer" from the shape of the labellum and the way it is hinged to swing up and over towards the column. Recent observations suggest that the labellum is shaped to look like a female *Thynnid* wasp. It has also been suggested that the orchid produces chemicals similar to the insect pheromones which are used as sex attractants. A male *Thynnid* wasp, looking for a mate, will be attracted to the orchid "look-alike" and try to mate with it. Once it has grasped the labellum, thinking it to be a female, it tries to fly off and begin a mating flight. The result is that the "hammer" swings up and over and crashes the frustrated insect against the column of the orchid. As it hits the column pollen is transferred onto the insect. The whole process will take place again when the male wasp tries to mate with yet another hammer orchid. This "pseudo copulation" has been recorded in other species of orchid throughout the world, for example, the fly orchid (*Ophrys insectifera*) in Britain.

The hammer orchid is helped in its method of pollination by the fact that the male *Thynnid* emerges before the female so there are a lot of male wasps flying around with no females to mate with. The female wasp spends most of her life on the ground as she cannot fly. When she's ready for mating she climbs up a thin stem and hangs there waiting for a male. She looks just like the labellum of a hammer orchid. After mating she drops to the ground and searches out another insect into which she lays her eggs. *Thynnid* wasps are parasitic.

"Pseudo copulation" in Australian orchids is not very well documented but it is thought to occur in quite a few different species.

Photograph showing how the hammer is hinged over and able to hit the column.



Drakaea *sp. waiting for a male wasp.*

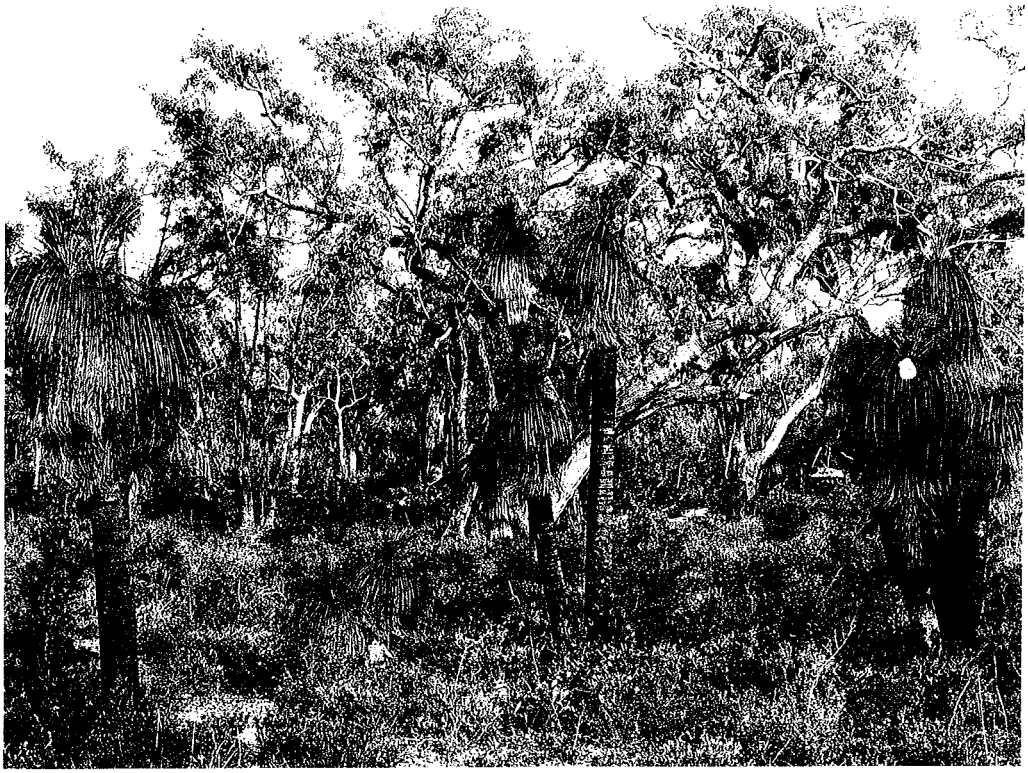
(h) Kingia Flat

Approximately three kilometres from the northern boundary along Plunkett road is a fine stand of "black gin" *(Kingia australis),* a "grass tree" with characteristic drum-stick inflorescences and wide silky-hairy leaf bases. *Kingia australis* only occurs in Western Australia.

Some of these grass trees are over six metres high and are probably 300-400 years old.

Example of a large grass tree found in the Reserve. Kingia australis *is named after both Philip King, commander of survey expeditions along Australian coasts between 1818 and 1822, and Philip King, Governor of New South Wales from 1800 to 1807.*

The drumstick inflorescences of Kingia australis.

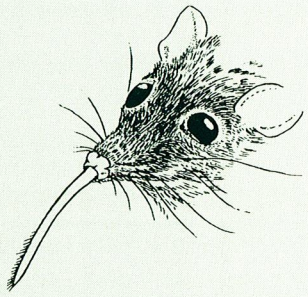


A fine stand of interesting grass trees showing the silky leaves.

Grass trees are a favourite haunt of small marsupials. Honey possums (*Tarsipes rostratus*) and western pygmy possums (*Cercartetus concinnus*) often hide in the old dead trunks during the hours of daylight. Both of these small marsupials have been recorded on the Reserve.

THE HONEY POSSUM (*Tarsipes rostratus*)

The honey possum is about the size of a mouse and a highly specialised nectar and pollen feeder. It has a long tube-like mouth and a tongue which is brushed at its tip like that of a honey eating bird. Like these, too, it probably supplements its diet with small insects which it obtains in blossoms.

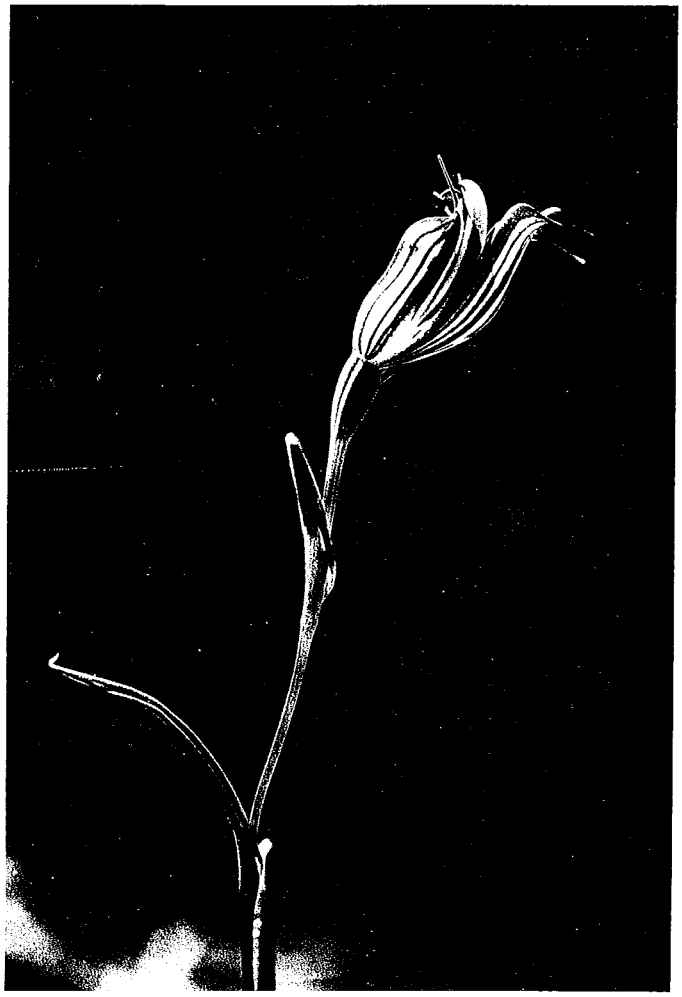


In September the purple enamel orchid (*Elythranthera brunonis*) flowers in abundance in the sandy loam among the kingia trees. Other orchids include species of *Caladenia* such as *Caladenia flava* (cowslip orchid) which like so many of its kind has a fascinating pollination mechanism.

THE COWSLIP ORCHID (*Caladenia flava*)

There are at least five species of *Caladenia* on the Reserve. The name *Caladenia* refers to the rows of beautiful, gland-like hairs or calli on the labellum. The rows of calli act as a kind of landing platform and direct insects into the flower.

Cowslip orchids are visited by native bees and the calli appear to keep out visitors too small to pollinate the orchid. Larger bees, on the other hand, are able to climb over the calli and push their way into the flower to get at the nectar and on the way out they pick up the pollinia.



*A greenhood orchid (*Pterostylis *sp.) photographed on the Reserve. This orchid is often called the jug orchid because of its shape. Insects, usually gnats, are trapped within the "jug" and the only escape is past the pollinia which ensures the orchids are cross pollinated when the insect visits another orchid.*

Blackboys and grass trees alike are fequently heavily grazed.

Adjacent to this area, still in the jarrah/marri woodlands, are patches of *Glischrocaryon aureum* which form carpets of yellow in October/November after the shrubby wattles have finished flowering. Drummond's acacia (*Acacia drummondii*), which has bipinnate leaves and elongated heads of bright yellow flowers, is common throughout the Reserve but is more prolific on clay loams. It is possible that the tall form seen here has been introduced from further south in the wandoo and jarrah woodlands.

A common tree of the Swan Coastal Plain is the Christmas tree (*Nuytsia floribunda*), and a few of these interesting semi-parasitic trees can be found on the Reserve.

THE CHRISTMAS TREE (*Nuytsia floribunda*)

The Christmas tree flowers profusely during November and December and is a spectacular sight on the Swan Coastal Plain. The tree is a member of the mistletoe family, Loranthaceae, and like all mistletoes it is a semi-parasite. This means it obtains some nourishment from other plants. In the case of the Christmas tree a wide variety of host plants are used. The tree uses modified roots to clasp the roots or underground stems of the host. Even telephone cables with polyethylene covers have been attacked by the clasping roots.

Biologically our Christmas tree is an oddity and is the giant of all mistletoes because the other 500 or so species of the family are all shrubs. Some are ground-dwelling while others live in the branches of host trees or shrubs.

The trunk of the Christmas tree is very different from most other tree trunks. Instead of a simple central cylinder of wood surrounded by bark, it has layers of wood and inner bark forming concentric cylinders. The wood is extremely brittle and breaks readily in strong winds. The trees may also be severely pruned by fire; however, they appear to be adapted to periodic burning.

The vivid tangerine flowers are a magnificent sight in the bush, made more spectacular as the Christmas tree comes into bloom after most of our spring flowers have finished, and the bush has reverted to its sombre summer colours.

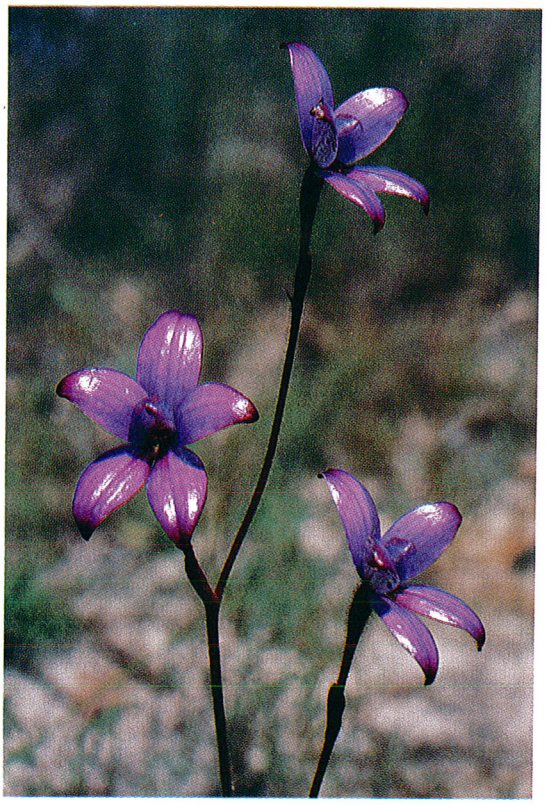
A mass of tiny flowers make up the vivid tangerine bloom of the Christmas tree.

Jarrah bark.

Blue fairy orchids.

Marri fruits.

Burrowing whip snake.



Purple enamel orhid.

(i) Powderbark Wandoo Woodland

In the south-east corner of the Reserve, adjacent to the national park, the powderbark wandoo woodland is nearly devoid of understorey vegetation and there are sweeping views of the Avon river. It is simple to identify a powderbark wandoo as the bark is covered with a fine powder that can be rubbed off very easily.

In early spring the rabbit orchid *Caladenia menziesii* is common in groups in moist places.

Looking across the river, wedge-tailed eagles (*Aquila audax*) can often be seen coursing over the water on the hunt for small prey. These birds are common over the fields adjacent to the Reserve as well.

A powderbark wandoo damaged by fire.

Powder rubs off the bark easily.

Eagle's nest on the edge of the Reserve.

*Rabbit orchid (*Caladenia menziesii*) named after Archibald Menzies, a surgeon attached to Vancouver's voyage of 1790-95.*

The Avon valley—the railway line can just be seen as a cleared area to the left of the photograph.

(j) Jam and Everlastings

In the south-eastern corner of the Reserve there is an area of jam acacia, a type of vegetation more characteristic of the Wheatbelt than the Darling Range. Jam acacia (*Acacia acuminata*) has a sap which smells rather like raspberry jam and is very strong in freshly broken stems—hence its name. Nearby are river red-gums (*E. camaldulensis*). This is one of the most southern recurrences of this widespread species. Elsewhere in the south-west *E. rudis* (flooded gum) occupies the same habitat.

Hollows in these trees provide homes for a number of marsupials, including brush-tailed possums (*Trichosurus vulpecula*), which come out of their hiding places at night to feed.

*Jam acacias (*Acacia acuminata*) by the side of a creek. Acacias are legumes and able to "fix" atmospheric nitrogen by means of bacteria in root nodules. The only obvious flowers are everlastings.*

Although this area has probably been extensively grazed by sheep and other animals in the past, it is one of the best places on the Reserve to see everlastings. Dominant

WATTLES

The name "wattle" which is used for acacias goes back to Anglo-Saxon times: it was used for flexible saplings planted or interwoven, and the word is still used in some English dialects. When the early settlers of this country made a framework of split saplings in building their dwellings, they were "wattling" and the saplings used were "wattles". In time, the term became transferred to the plants that were most commonly used.

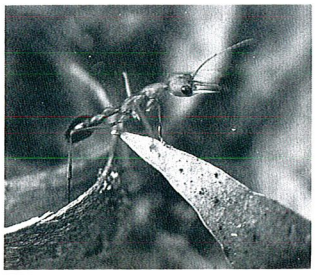
The origin of the name "*Acacia*" is disputed, but it probably comes from the Greek "*akazo*" (I sharpen), referring to the sharp spines of some *Acacia* species. Most wattles, like the jam tree, do not have true leaves, the leaf-like structure being formed from the petiole—the stalk of a leaf. In young seedlings the divided leaves may be seen as well as the modified petiole. A few species, such as Drummond's acacia, have true leaves.

species are: *Helichrysum bracteatum* (yellow), *H. lindleyi* (pink), *H. leucopsidium* (white), *Helipterum cotula* (white), *H. manglesii* (pink), *Podolepis lessonii* (yellow), *Waitzia aurea* (yellow) and *W. citrina* (yellow form).

Everlastings just opening in the early morning light.

The area also contains a large number of exotics. Because of the number of introduced grasses and herbs, this is a good area to watch the western grey kangaroo (*Macropus fuliginosus*) and the brush wallaby (*Macropus irma*) both of which are common on the Reserve.

Bull ants are aggressive and should be left alone.



This open grassy area is also a good place to see well defined ant tracks made as meat ants (*Iridomyrmex* sp.) trek from one nest to another. Bull ants (*Myrmecia* sp.) tend to stay closer to their nest which is very distinctive. Bull ants are also very aggressive and should not be disturbed.

*River red-gums (*Eucalyptus camaldulensis*)—some botanists believe this small colony could be a hybrid between* E. camaldulensis *and the flooded gum,* E. rudis.

(k) Jarrah Woodland

Like so many other areas of the Darling Range, the jarrah woodland near the south-west corner of the Reserve has an understorey containing a dense tall shrub layer of *Dryandra sessilis* and *D. carduacea*. The understorey trees *Persoona elliptica* and the bull banksia (*Banksia grandis*) can be seen here also. The bull banksia is the only *Banksia* which grows on laterite in the woodland. The large saw-toothed leaves of this tree and the very long yellow flower spike make this one of the most distinctive species of the genus. *Persoona elliptica* is a snottygobble or native plum and a member of the Family, Proteaceae. It has small plum-like tart fruit.

THE JARRAH LEAFMINER

The squiggly lines and blotches found on many leaves in the Reserve, especially those of eucalypts, are made by leafminers. Leafminers are larvae of flies or moths and for their protection they live inside a leaf. Jarrah leafminers cause quite a lot of damage to our forests.

The jarrah leafminer is a small native moth (*Perthida glyphopa*). The larvae of these moths feed within the leaves of jarrah in a large area of forest in the south-west of Western Australia. Since the early 1950's yearly outbreaks in the inland forest have caused permanent damage to tree crowns which has stunted tree growth. High infestation results in trees looking as though they have been scorched by fire.

The female moths prefer to lay their eggs in forests with open tree canopies—those disturbed by thinning or part clearing are attacked quite badly. Female moths also prefer to lay their eggs on new leaves. The number of eggs laid each year varies considerably. There will be fewer eggs in years following a drought when tree growth is suppressed.

The larvae survive the summer in soil and emerge in February after a short pupation. While localised fire will kill many of the larvae this does not mean the number of leaves attacked the following year will decrease as moths tend to move about the forest.

Most, but not all, jarrah trees are affected by the leafminer moth. Some have leaves that moths tend to avoid. A female moth is able to tell if a leaf is suitable for egg-laying when she lands as she has very sensitive feet which are used to test the surface of the leaf. She examines the leaf further by cutting a hole in it with her ovipositor. If the internal structure of the leaf is not suitable she will fly off and test another tree.

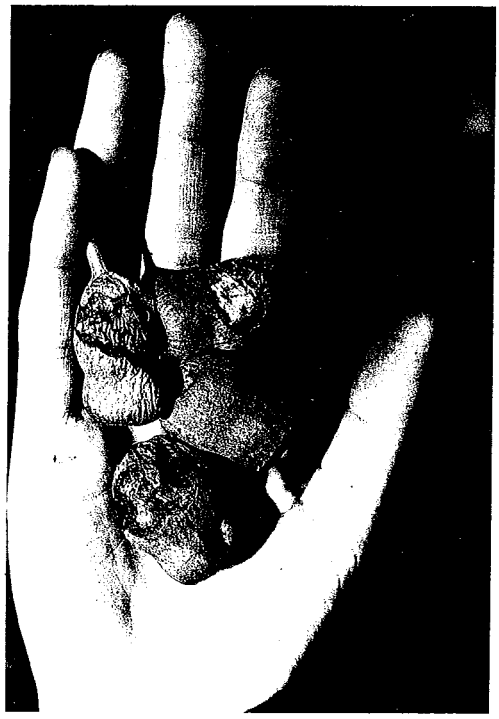
A few jarrah trees are able to resist larval feeding. After hatching the larvae start to feed on the internal cells of the leaf; but in some trees the larvae do not grow very well and eventually die.

Jarrah leaf with evidence of leafminer activity.

(l) Jarrah/Marri Woodland

Examples of this type of woodland can be found throughout the Reserve. The marri is a dense tree with large pendulous leaves and heavy branches almost touching the ground. It well deserves its botanical name "*calophylla*" meaning beautiful leaf. The creamy masses of its flowers are borne in February/March and attract birds, insects and small marsupials. Red and pink-flowered variants occur sporadically through the woodland although none has been recorded on the Reserve. Trees usually flower every three to four years but individual ones will sometimes flower each year. Most will carry buds, ripening fruits and maturing fruits at the same time. The mature fruits are about two centimetres in diameter and up to three centimetres from stem to cup edge. As the fruits ripen, white-tailed black cockatoos (*Calyptorhynchus funereus baudinii*) arrive seeking the seeds, tearing at the fruits with their powerful beaks. The brilliant green Port Lincoln parrots (*Barnardius zonarius*) also share the harvest, usually eating the fallen seeds.

Large gum-nuts—characteristic of marri.



Marri fruit eaten by parrots and cockatoos.

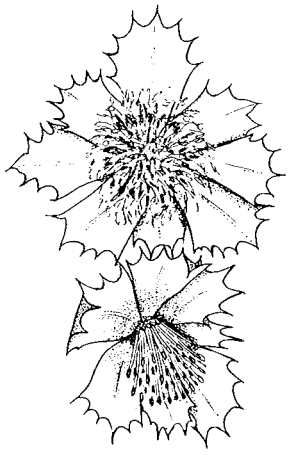
When the tough bark of the marri is damaged by fire or borers, veins of "gum" start to flow down the trunk. In the eucalypts this substance is not a true gum but a "kino"—a dark red resinous material containing tannin and polyphenols. Kino was used in medicines as well as tanning. However, the word "gum" has become well established when referring to the sticky substance oozing out of eucalypt trees, especially the marri, and has given this tree one of its popular names—red gum. Marri is an Aboriginal name but there is some doubt as to whether it refers to the kino or the bark. It is one of the very few bloodwoods to be found in the south-west.

Marri bark—the shiny areas are "kino".

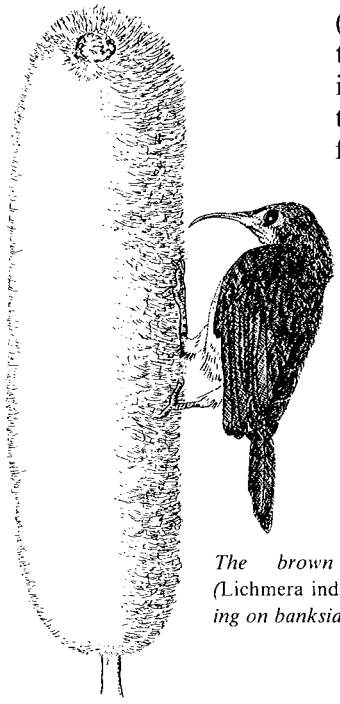
Jarrah/marri woodland supports a variety of reptiles. Those recorded include three species of skink, two species of gecko, the black goanna (*Varanus tristis*), Gould's goanna (*Varanus gouldii*) and the mulga snake (*Pseudechis australis*).

Mammals frequenting this woodland include pygmy possums (*Cercartetus concinna*) and honey possums (*Tarsipes rostratus*) which feed on the banksias and dryandras when in flower.

The jarrah/marri woodland has a varied bird population and honeyeaters are common, moving from one flowering tree to another. The trees, together with the flowering shrubs, provide a food supply for most of the year. Many of the honeyeaters, including the New Holland (*Phylidonyris novaehollandiae*) and spinebill (*Acanthorhynchus superciliosus*) are nomadic, except when breeding. They move from place to place as the trees and shrubs flower. Spinebills are usually found on *Adenanthos barbigerus* which has a very long flowering time. Other birds that occur here and on the rest of the Reserve include the striking western yellow robin (*Pachycephala pectoralis*) and the richly coloured rufus tree creeper (*Climacteris rufa*) which are largely insectivorous and tend to stay in their favourite haunts throughout the year, delving under bark and litter for food.



Dryandra sessilis *is an excellent honey producer.*



The brown honeyeater (Lichmera indistincta) *feeding on banksia.*

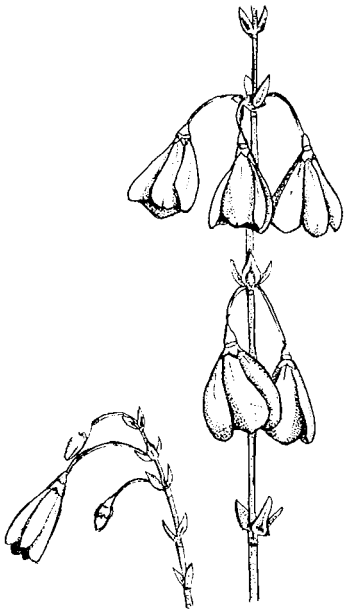
Bull banksia (Banksia grandis) *has leaves up to 40 centimetres long and the large flower spike provides a rich source of nectar.*

Open forest of jarrah and marri with a denser understorey of Dryandra sessilis *and* Banksia grandis.

Moondyne Nature Reserve contains a wealth of wildlife and this guide can only touch upon the animals and plants of the area and the landscape in which they live. The 12 areas of interest are merely an introduction to the diversity of riches it contains.

It is hoped the guide will inspire those interested in the conservation of our flora and fauna to explore the area for themselves in greater depth.

The Wildlife Authority's role in conservation of flora and fauna is to ensure that areas of national and regional importance are safeguarded; and to identify other areas of value to conservation so that their interest is not lost by default. The Wildlife Authority, through the Department of Fisheries and Wildlife, is also responsible for managing these reserves so that their values are retained as part of our national heritage.



A Tetratheca, *so called because the anther is made up of four cells. This herb, with its pink flowers, is common throughout the Reserve.*

RARE, UNCOMMON AND ENDEMIC PLANT SPECIES

No rare species as published in the *Government Gazette* (Nov. 14 1980) have been recorded for the Reserve. However, four species with very restricted distributions and considered rare by Marchant and Keighery (1979)* have been found. Details are provided below:

Conospermum densiflorum—undershrub growing in clumps to 45 cm with white flowers (bracts and buds blue), on sandy gravel under jarrah/marri. Recorded from Badgingarra to Walebing.

Hakea cristata—erect shrub to 2 m with spiny toothed leaves, characteristic fruit and white flowers, on clay loam under jarrah/marri. Recorded from Red Hill to Woorooloo.

Tetratheca nuda—spindly herb to 30 cm (recorded as *caespitose* by other workers), stems almost leafless with mauvy pink flowers, on gravelly loam under jarrah/marri. Common. Recorded generally in the Darling Range.

Thomasia glutinosa—hairy shrub to 40 cm with reddish mauve flowers and glandular inflorescences, on laterite under jarrah/marri. Recorded from Mt. Saddleback to Northam.

A further nine species occurring on the Reserve have restricted or partially restricted distributions (Marchant and Keighery, 1979)*. Details are provided below:

Acacia barbinervis—low shrub to 30 cm with yellow flowers, on upland laterite under jarrah/marri. Recorded from Woorooloo to Waroona.

Boronia ovata—slender shrub to 50 cm with pink flowers, on laterite at edge of breakaways under powderbark wandoo and on gravelly loam under jarrah/marri. Recorded from Mogumber to Perth.

Conostylis caricina—tufted perennial with yellow flowers. Recorded from Bullsbrook to Dwellingup.

Conostylis setosa—tufted perennial with white flowers purple at the base, on sand under jarrah/marri. Restricted to northern jarrah forest.

Dryandra praemorsa—shrub to 2 m with yellow flowers, on breakaways at western end of Reserve. Recorded from Clackline to Dwellingup, often associated with granite.

Hibbertia lasiopus—prostrate and erect perennial to 20 cm with golden yellow flowers, on gravelly loam under jarrah/marri. Recorded from Mogumber to Perth.

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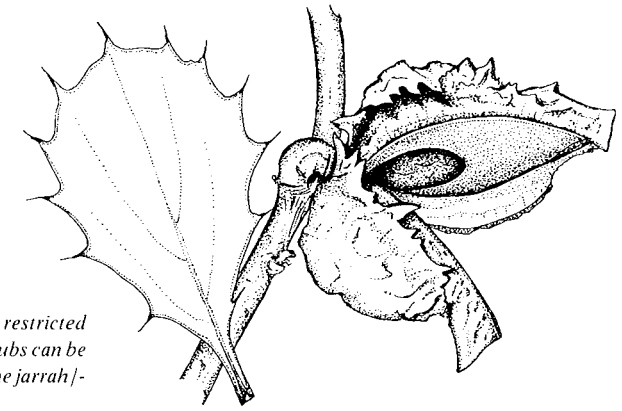
* Marchant, N. G. and Keighery, G. J. (1979). Poorly collected and presumably rare vascular plants of Western Australia. Kings Park Research notes—No. 5.

Hibbertia rhadinopoda—semi-prostrate perennial to 20 cm with yellow flowers, on loam overlying clay under powderbark wandoo. The taxonomic status of this specimen is uncertain. The species has been recorded from Harvey to Margaret river.

Lhotzkya brevifolia—shrub to 75 cm with purple flowers, on gravelly loam under jarrah/marri. Recorded from New Norcia to Toodyay.

Templetonia drummondii—slender straggly perennial to 20 cm with yellow and brown flowers, on gravelly loam under jarrah/marri. Recorded from Bindoon to Kalamunda.



Hakea cristata *has a very restricted distribution and a few shrubs can be found on the Reserve in the jarrah/-marri woodland.*

". . . . we need to put into effect, for its preservation, some principle other than the principles of exploitation or usefulness or even recreation. We simply need that wild country available to us, even if we never do more than drive up to its edge and look in. For it can be a means of reassuring ourselves of our sanity as creatures, a part of the geography of hope."

Wallace Stegner

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Back cover—Coral vine Kennedia coccinea.