3.

FOREST FOCUS

NUMBER 13 APRIL 1974

FIRE IN THE SOUTH-WEST FOREST ECOSYSTEMS

▲ *These massive banksia fruits* (Banksia attenuata) *protect the seeds during fires.*

FOREST FOCUS

Number 13, April 1974

PRODUCTION
PROTECTION RECREATION
CONSERVATION

Published for Mr. B. J. Beggs, Conservator of Forests, Forests Department of Western Australia, 54 Barrack Street, Perth.

Articles in this publication may be freely reprinted—preferably with acknowledgement, except in the case of commercial promotion material, when permission *must* be obtained.

Photographic processing by Brian Stevenson.

Maps by Forest Department Drafting Branch.

Text (10 on 12pt. Times) by Monofoto Typesetters.

Offset plates by Art Photo Engravers Pty. Ltd.

Printed in Western Australia by the Government Printing Office.

AT ISSN 0049-7320

Compiled and photographed by
Dale Watkins
(unless otherwise credited).

Front cover

Fire in typical dry sclerophyll forest.

Back cover

Fire of various intensities helps to provide a diversity of habitats. The open karri forest in this photograph encourages, among other species, kangaroos and emus.

FOCUS on The role of fire in the South-West forest ecosystems

by P. CHRISTENSEN

It is a measure of the incredible tenacity of established ideas and values that we Australians of European descent still doggedly cling to the belief that fire in nature creates only havoc and destruction. Fire we say is only good when it is used to heat our homes, or light our cigarettes. For two centuries we have fought and battled with fire on this continent, steadfastly refusing to accept the simple truth, well known to the indigenous inhabitants, that fire is a part of the environment. There can be no compromise on this point, fire is not a factor that the environment has to "put up with", it is an essential part of many Australian ecosystems. The maintenance of the *present* forest ecosystems in the South-West depends on fire.

In the heathlands and dry and wet sclerophyll forests of the South-West, fire is so much a part of the environment that were it possible to exclude it for an indefinite period, which it is not, we would see a complete change in the present plant and animal communities. Many species would disappear altogether, causing the present ecosystems to change for ever.

Fire dependence

Native plants and animals of this region have evolved with fire and not only have they adapted to it but in some instances they have come to depend on it for their continued survival. The eucalypts, for example, produce epicormic shoots to replace their scorched crowns after hot fires. The small seedlings of some species have lignotubers, or thick carrot-like roots enabling them to take advantage of fire conditions by sprouting strong, vigorous shoots following hot fires. Other species, like karri (*Eucalyptus diversicolor*) shed their seed from hard protective fruits, which open after fires, on to the ashbed where they germinate and flourish.

Most species of understorey vegetation are able to regenerate from underground rootstocks, bulbs, tubers or corms. Others such as the legumes have special hard seed which protects the endosperm from the heat of flames. Indeed these seeds require heat treatment in order to germinate at all.

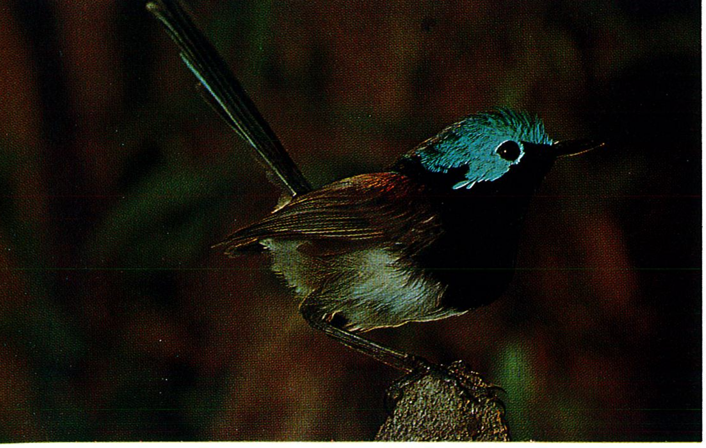
Hard protective fruits have been developed by many of the proteaceae. A good example of this is displayed by a species of banksia whose large, hard fruits protect the seed during a fire and do not release it until after they have been wet by the first autumn rains.

Very few species appear to have no specific adaptations to fire. These species grow under conditions where they experience only infrequent fires.

▲ *Yellow robin* (above—P. Kimber) *and scarlet robin* (Alwyn Y. Pepper, E.F.I.A.P.) *are recorded in true karri forest only after* ▼ *severe fires.*

▲ *Burnt karri crowns regenerating by means of epicormic shoots.*

▼ *Karri understorey unburnt for 15 years; wildflower diversity is poor.*



▲ *Red-winged wren* (above) *and splended wren* (below) *prefer*
▼ *dense low understorey.* (Alwyn Y. Pepper, E.F.I.A.P.)

▲ *Silky blue orchid flowering six months after a regeneration burn.*

This composite picture shows a few of the wide range of flowers in karri forest
▼ *about three years after a burn.* (Brian Stevenson and Dale Watkins)

An example of this is *Acacia cyclops*, a plant which is often found near the edge of coastal sand dunes or recently fixed dunes. This species, unlike most of the acacias in the forest, does not have hard seed. Its seed has to be able to germinate on wet sand after the autumn rains. The hard seed of other acacias is unable to do this without the heat treatment provided during a fire.

Fire aids greater species composition

Whole communities are adapted to fire conditions. The understorey scrub of the wet sclerophyll forest if not burnt for a long period becomes poorer in species composition. Many species of plants favour the early stages of succession immediately following fires. They germinate, grow, reproduce and die, leaving only their seed in the soil to perpetuate the species. Many of the leguminous plants come into this category and certain species are commonly referred to as "fire weeds" because of their fantastic proliferation immediately following fires.

The present south coastal communities are dependent on periodic fires for their continued survival. Following deposition of the coastal sand dunes there is a succession from small plants, grasses and sedges through larger shrubs and bushes to a peppermint (*Agonis flexuosa*) forest which is ultimately replaced by dry sclerophyll eucalypt forest. If it were possible to exclude fire the succession would undoubtedly progress towards the sclerophyll forest climax and this forest would extend much closer to the coast. However, periodic burning ensures the setback of the succession so that a wide coastal belt of heath and peppermint forest persists.

In recent times the ecology of this area has been disrupted by cattle grazing which has encouraged the introduction of grasses and herbs allowing more frequent burning, which in turn has destroyed much of the scrub, creating an open, very low vegetation.

Fauna

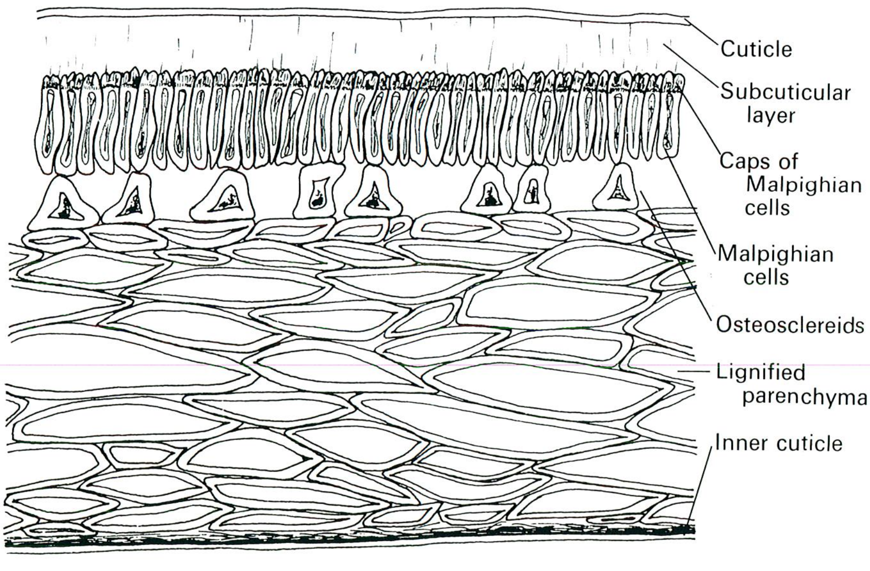
The forest fauna follows a succession dependent on the seral stages of the plant succession. Experimental work has shown that immediately following fire in the karri forest, conditions become favourable for the introduced house mouse which proliferates and spreads to colonise the area with incredible rapidity. After 12 to 18 months, when ground cover is almost complete, the southern bush rat (*Rattus fuscipes*) begins to re-establish itself and a little later small marsupials such as the mardo (*Antichinus flavipes*) and common dunnart (*Sminthopsis murina*) return to the area. The bird community undergoes similar successional changes, the very early seral stages with open undergrowth favouring birds such as robins and the shrike thrush, while later stages are preferred by species of wren.

The tammar (*Macropus eugenii*) lives in thickets of *Melaleuca* sp. or *Gastrolobium bilobum* (heart-leaved poison) in the eastern fringes of the dry sclerophyll forest. It prefers these thickets to be open underneath, but not too open. Periodic fires keep them this way. If they were allowed to grow protected from fire the habitat would eventually degenerate and become unsuitable for the tammar.

The wildflowers which the honey possum (*Tarsipes spencerae*) and many of the insect and nectar eating birds frequent depend on periodic burning to maintain the vigour of the community. The bronzewing pigeon feeds largely on acacia seeds which, as was mentioned earlier, are dependent on periodic fires.

These examples illustrate the important role of fire in the South-West forest communities. Without fire the forest ecosystems as we know it at present would change completely, some species would die and disappear for ever. The well-known case of leadbeaters possum in Victoria is perhaps a good example to illustrate this. The species was thought to be extinct until the "disastrous" fires

Seed coats of many legumes are very thick and impermeable to water. This is ▼ a section drawing of a highly magnified acacia seed coat.



in 1939 when it again became common in the resulting mountain ash regrowth stands. Had this fire not occurred it is possible that the species would have become extinct.

Major natural factor

Fire is the major natural factor responsible for maintaining plant and animal diversity within the forest ecosystem in Western Australia. Fires occur naturally during all seasons except winter, and they vary in intensity from very hot to very cool fires. The frequency of fire in any area also varies causing further diversity in the system.

For a long time foresters have recognised the need for protective burning. More recently the necessity of fire in the forest ecosystem has been generally accepted. Prescribed burning is carried out to reduce the fuel build-up, thereby preventing dangerous wildfires which may destroy or damage timber and are a danger to life and property. In practice it is possible to meet natural conditions only half-way due to the changed circumstances now that human habitations and pursuits are so inextricably woven into the fabric of the forest areas. Therefore, under present conditions it is only possible to burn during a fairly restricted season and most burns are mild so as to protect life, property and timber resources.

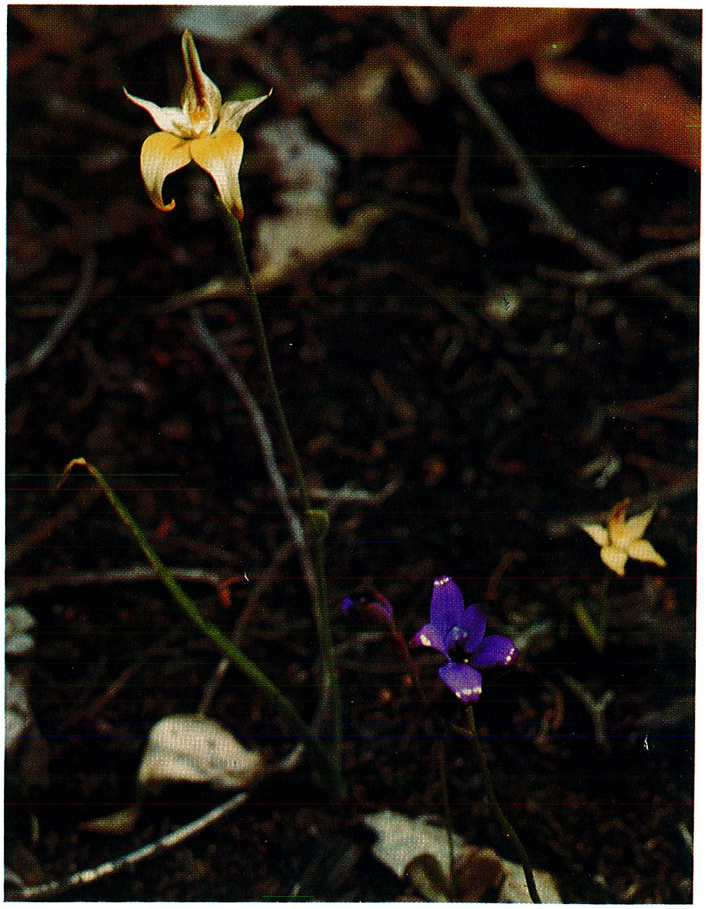
Variety of habitat

Even under these conditions the variation achieved is large. No burn is identical to any other, and within the prescribed burn areas themselves 20 to 40 per cent remains untouched by fire due to excess fuel moisture content, insufficient leaf litter and other causes. It is common for certain sectors, especially along creeks and gullies to remain unburnt for 15 to 20 years at a time. As our knowledge of fire behaviour and the fire ecology of the forest increases, it

▲ *The southern bush rat, an early coloniser of dense vegetation resulting from a fire.* (D. H. Perry)

The tammar prefers thickets with a particular structure—fires ensure the perpetuation of suitable habitats. (B. Stevenson) ▼

▲ *Infra-red aerial photograph showing the mozaic effect achieved with prescribed burning in dry sclerophyll forest.*



▲ *Cowslip and purple enamel orchids six months after a regeneration burn. Orchids start flowering the first winter after a fire and usually flower best in the first three years from the fire.*

seems likely that it will be possible to approach even closer to the natural conditions existing prior to European settlement.

The frequency and intensity of burns, in certain safe areas at least, can be varied so as to maintain the maximum possible habitat diversity.

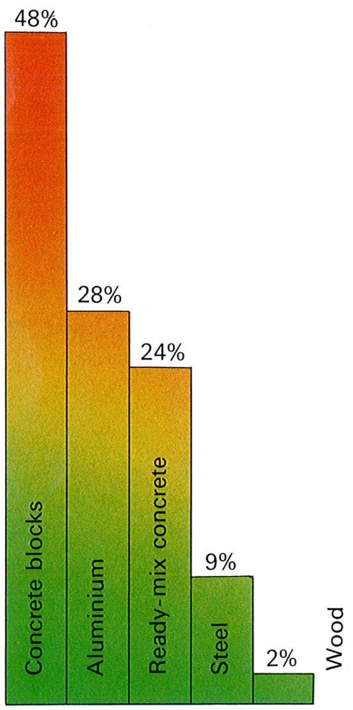
Fire is a natural environmental tool which if used correctly and with adequate knowledge and restraint will ensure the future conservation of our fauna and flora. The necessary knowledge can be obtained by studying the basic ecology of the plants and animals in our forests. But first we must rid ourselves of those inbred fears and misunderstandings about fire which we have inherited from European ancestors living in a climate completely alien to our own.

Typical tammar habitat maintained by periodic fires. ▶

Now for a few good words about wood . . .

Reprinted from *Forest Industries*

Wood is the building material that produces the least harmful impact on the environment, according to an Oregan University study. Reporting in the *Journal of Forestry*, Business Administration Professor C. W. Dane graded five common building products on the basis of their *hidden costs to society*.



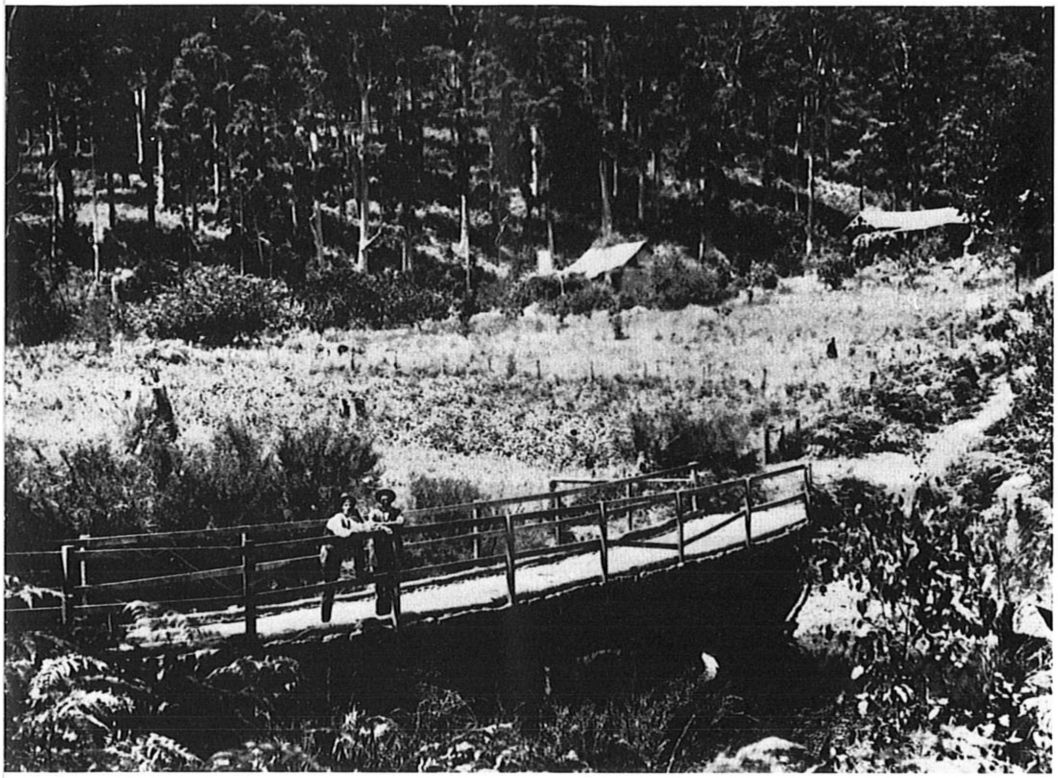
Hidden social costs as a percentage of price.

The worst marks went to concrete blocks, which would experience a price increase of 48 per cent if manufacturers were required to bear the costs of their effect on the environment, Professor Dane said.

Comparing the social costs as a per centage of price, aluminium would cost an additional 28 per cent; ready-mix concrete an additional 24 per cent; and steel, which requires 10 tons of non-renewable raw materials for each ton produced, rated 9 per cent.

Wood creates the least impact on the environment primarily because it is renewable. Professor Dane estimates timber's hidden cost to society as 2 per cent.

▲ *Two examples of timber used for structural purposes. Above, termite-proofed pine framing and roof timbers of a semi A-frame home at Australind, built by F. and L. M. Burke. Below, the huge new Bunnings building at Welshpool, supported by 705 by 127 mm glue laminated jarrah arches and spanning 19·5 m. The building is 110·95 m long with 8·53 m maximum internal height.*



▲ *The original-style One-tree bridge some time between 1904 and 1933.*

The redecked bridge—note the more sophisticated bridge timbers and also the more delapidated smaller house in the background. Tourists from two cars are admiring the scenery. ▼

ANNIVERSARY OF A LANDMARK

A 70-year-old historic landmark, link with the past and long-standing karri forest tourist attraction, is still drawing tourists from near and far.

This winter is also the tenth anniversary of that particularly wet and stormy winter of 1964 which spelt doom to that veteran of many years' service—One-tree bridge.

The well-known bridge had its beginning in 1904 when Hubert and Walter Giblett, assisted by Jack Scott, felled a 4·9 m girth karri tree which was standing on the east bank of the Donnelly River. Their purpose was to fell the tree over the river and to construct a bridge so that graphite could be transported from a mine, lying 2·5 km to the south-west, to the Bridgetown railhead.

Up to that time the graphite had been transported over a natural rocky crossing about ·5 km upstream. This was a hazardous undertaking and almost impossible in winter owing to the high flow of water.

Jarrah decking

The tree spanned the 23 m wide river and a superstructure hand hewn from nearby jarrah trees was built on top to form a narrow bridge. Crosspieces, or bolsters 225 by 150 mm were set and spiked into the log at 1·8 m intervals. Jarrah slabs were laid across each end of the bolsters and jarrah decking was laid across each longitudinal slab or bearer.

One-tree bridge, as it was to become known, was duly completed and the first load of graphite (said to be three tonnes) was taken over the bridge by Andrew Muir, of Fernhill, driving a 12-bullock team at the official opening.

Trial shipment of graphite

The graphite had been discovered by a geologist named Walker, in 1889. The first consignment of 66 tonnes was despatched to England in 1906, however, the quality was only fair and although the mine was worked intermittently over the next few years, it was finally abandoned in 1927.

Indications are that during its short life it had a checkered but most unproductive career. It changed hands in 1908 and 1911, and in 1916 a London syndicate tried to float a company to mine the graphite, but the W.A. Government intervened. The lease was forfeited in 1921 and was taken up by Mrs. Elizabeth Taylor, who changed the name to the Lindsay Gordon Lease, after the poet Adam Lindsay Gordon who lived nearby during the late 1860s. She abandoned it in 1927, and though there have been various tentative inquiries since, including one from a Japanese concern and another from an oil syndicate, the mine has remained unproductive. The main shaft has collapsed, although numerous open pits can still be seen between the scrub regrowth.

Decking altered

During a bushfire in 1933, the top of a burning blackbutt tree standing on the west bank of the Donnelly River, fell on to the bridge. The fire burnt the decking, which was later replaced with sawn jarrah and the bridge was slightly changed by laying the decking along the bridge's length —as it remains today. Although declared dangerous in 1943, there was no suitable alternative river crossing for local farmers like the Henwoods and Fouracres, and it

▲ *The log bridge as it stands today. in the middle of a picnic area.*

was in use until January, 1948, when the second bridge further downstream was opened to traffic.

An indication of the old log bridge's resilience was provided by Mr. Wes Forrest, a Forests Department employee on loan to the Main Roads Department. Mr. Forrest had driven a light bulldozer over the old log bridge about four times a day for two weeks during construction of the second bridge. This second bridge had a life of about nine years, when a third (and current) bridge was built in a position between the two older ones. The second bridge was later removed.

In the winter of 1964, a particularly wet and stormy season, the old log bridge broke under the pressure of water and fell into the river. With the weight of its butt end holding steady on the east bank, the crown end of the log swung diagonally across the river.

There is little doubt that the unprepared and uneven foundation under the western end, lack of central support in felling across the river, and heavy usage like the bulldozer, would have hastened its demise.

Reconstructed on west bank

In autumn, 1971, the Forests Department arranged the resurrection of the cld One-tree bridge. The log was hauled out of the river and placed on the west bank, where the superstructure was faithfully rebuilt by men from the Department's Glenoran settlement. The rebuilt section—now surrounded by a picnic area—is only 17 m long, because a 6 m section broke off and was swept downstream some years ago.

After 70 years, the log is still very sound inside, and it is a reminder of the pioneering spirit of the early settlers.

BIBBULMUN Bushwalking Track

Adapted from information supplied by
ROSS GOBBY

▲ *Front cover photograph of the proposed Bibbulmun track guide book. The book will contain a complete set of 30 maps covering the entire 500 km Kalamunda to Northcliffe section of the track when it is completed, plus a sheet index map, two additional simple sketch maps in the introductory section, and descriptive notes for the respective stages along the track.*

The price for the 96-page guide book will be $1.

The Bibbulmun track is a marked bushwalking track from Kalamunda to Albany, through the forest along the Darling Scarp and the beautiful and sometimes rugged south coast.

The approximately 500 km first part of the track, from Kalamunda to Northcliffe had limited use last summer and autumn, although modifications to the route were still to be made before it could be published and officially opened. The modifications were necessary to provide greater protection against the spread of the fungal disease *Phytophthora cinnamomi.* Selection and marking of the section from Northcliffe to Albany is in progress and will be opened at a later stage.

The route has been selected to pass through a variety of countryside and takes in some of the best scenery in the South-West. For much of its length the track follows seldom used forest tracks, but the route passes through bush for short distances. As better routes are discovered, some sections may be further modified.

Additional circuit routes similar to the ones near Collie and Pemberton may also be added at a later date.

The Bibbulmun track is named after aboriginal inhabitants of the area through which it passes. Jesse

This sheet map from the guide book shows the route and the area covered by individual maps in the book. ▶

INDEX TO 1 : 100 000 MAP SHEETS
SCALE
0 10 20 30 40 50 Kilometres
MIDLAND
PERTH
KALAMUNDA
Helena
Mundaring Weir
River
BARTONS MILL
River
KELMSCOTT
Mt. Dale
Canning
ARMADALE
River
Canning Reservoir
Mt. Randall
River
Serpentine
Serpentine Dam
Mt. Solus
MANDURAH
NORTH DANDALUP
North
Dandalup
River
South
Dandalup
Peel Inlet
PINJARRA
River
South Dandalup Dam
INDIAN
DWELLINGUP
BODDINGTON
Murray
River
Mt. William
OCEAN
HARVEY
Stirling Dam
MORNINGTON TOWER
WORSLEY
Collie
River
BUNBURY
COLLIE
Wellington Dam
WELLINGTON MILL
DONNYBROOK
NOGGERUP
KIRUP
GRIMWADE
BALINGUP
BOYUP BROOK
River
BRIDGETOWN
NANNUP
Blackwood
WHEATLEY
River
GLENORAN
MANJIMUP
Donnelly
River
PEMBERTON
Warren
Lake Muir
SOUTHERN
NORTHCLIFFE
OCEAN
River
Shannon
River
Deep
Frankland
River
Kent
River
Denmark
River
WALPOLE

Hammond, in his book *Winjan's People*, refers to the aboriginal group which occupied the area to the south-west of the dotted line shown in Hammond's map (page 15). The map is taken from the Bibbulmun track guide book, which contains additional general information of interest to users of the track, 32 maps prepared by the Forests Department Drafting Branch, and descriptions of the various sections along the track from Kalamunda to Northcliffe.

The Bibbulmun track traverses an area of fascinating geological and biological interest and many points of interest are noted in the description accompanying each map page in the guide book.

Geology

From Kalamunda to just north of Manjimup the track follows inland of the western edge of the ancient Western Australian plateau. This large plateau, which makes up most of the southern half of the State, has been lifted to a height of 300 to 500 m by geological forces acting over millions of years, and now forms the Darling Scarp along the western edge. The plateau surface is a gently undulating plain—levelled by millions of years of erosion before being uplifted. Rivers and streams running over the scarp have cut steep-sided valleys. With the exception of a few large rivers such as the Murray and Blackwood, these valleys do not extend far inland.

The ridges, which are part of the ancient plateau surface, are brown ironstone, or laterite, which yields bauxite ore, and is also the growing medium for forest trees in the region. The laterite was formed over millions of years by chemical breakdown of underlying granite in climatic conditions in which the iron and aluminium minerals were retained. Its depth varies, but is rarely greater than 6 m. Below the laterite is a zone of decomposing granite clays above undecomposed granite.

The shallow valleys of the old surface are broad and flat with sandy soils. Near the scarp young fertile soils, derived from the underlying granite and basic rocks, have formed on the valley floors and slopes. Because of this, steep valleys have frequently been cleared for agriculture.

Throughout the area there are numerous outcrops of granite and basic rocks—some of the more resistant of which remain as hills such as Mts. Dale and Solus.

Vegetation

The south-western corner of the State has developed as a forested island for a long time, separated from the rest of the continent by the surrounding deserts. Slow genetic changes have taken place and unique species and complex plant communities have evolved that are adapted to the unusual soil types, harsh climate and ever-present factor of fire.

Along the scarp the track passes through the famous jarrah (*Eucalyptus marginata*) forest. Jarrah is usually associated with marri (*E. calophylla*) and is particularly well adapted to growing on the laterite ridges, although it is also found on sands and the fertile valley soils. A number of common understorey species are found in this forest: bull banksia (*Banksia grandis*), sheoak (*Casuarina fraseriana*), blackboy (*Xanthorrhoea preisii*), and zamia palm (*Macrozamia reidlei*) to name a few. Countless species of wildflowers abound in the spring, while a few provide almost year-round flowers.

Along the water courses and creek flats are W.A. blackbutt (*E. patens*), flooded gum (*E. rudis*), white-barked bullich (*E. megacarpa*) and paperbarks (*Melaleuca*). In the more easterly country the white-barked wandoo (*E. wandoo*) will be encountered.

This plant community has developed in association with frequent fires. Many species, for example the banksias, grevilleas and hakeas, have woody "nuts" which normally require fire to open and release seed. Both jarrah and karri germinate best in the ashbed left on the forest floor after a fire. Jarrah (and some other species) grows a carrot-like root known as a lignotuber before it develops as a vigorous sapling. This adaptation ensures that the plant develops an extensive root system which is virtually indestructible by fire and which can supply the water necessary when the tree begins to grow vigorously. The seed of most wildflower species will germinate only after a fire and as most of these plants are relatively short-lived, fire is essential to a continuous wildflower display.

Although remarkably resistant to the effects of fire and summer drought, most of the plants in this community are highly susceptible to the effects of a disease known as "jarrah dieback", which causes the decline and death not only of jarrah, but several hundred other plant species. The disease is due to a tiny soil-borne fungus called *Phytophthora cinnamomi* which attacks fine feeder roots of susceptible species. The disease spreads by the transport of spores in infected soil. Apart from restricting the movement of mud or soil-covered vehicles from infected to healthy forest to prevent widespread distribution of spores, no means of economically controlling the disease is yet known.

The Bibbulmun track passes many disease affected sites which have been planted with pines or resistant eucalypts. Areas affected by jarrah dieback can be detected by the presence of dead or dying jarrah trees, dying banksias and zamia palms and in severely affected areas, by the open nature of the forest.

From Manjimup southwards where the summers are milder, the track enters the majestic, white-barked karri (*E. diversicolor*) forest in the valleys of the main rivers and streams. On these moist, better quality sites there is often a luxuriant tangle of undergrowth, commonly of the soft-leaved hazel (*Trimalium*), netic (*Bossiaea*) and *Acacia urophylla*. Trailing vines, such as clematis, are common and there are many fascinating orchids, mosses, ferns and fungi on the forest floor.

Forests are not static, but grow from youth to maturity like all living things, and must regenerate. In some areas the forest is young and the trees compete vigorously as they grow to become forest giants. In the mature forest the massive, slower growing trees suppress the young growth until they eventually make way, through fire or logging, for another generation.

By understanding the ecology of the forests we can manage them wisely and work in harmony with nature to promote a healthy plant community and at the same time provide a permanent supply of raw material for our future needs.

Animals and birds

Although the south-west region of the State has the richest fauna population, it also is the most densely settled area and as a result the natural habitat of many animal and bird species has been destroyed by clearing for agriculture. The preservation of fauna habitats is more important in conservation than simply protecting individuals from killing. Fortunately, State Forests, through which the Bibbulmun track passes, constitute the largest area of undeveloped land in the South-West and has an unusually rich animal and bird population. One-third of the mammals known to occur in the State are found in these forests, which occupy only 0·72 per cent of the State's area.

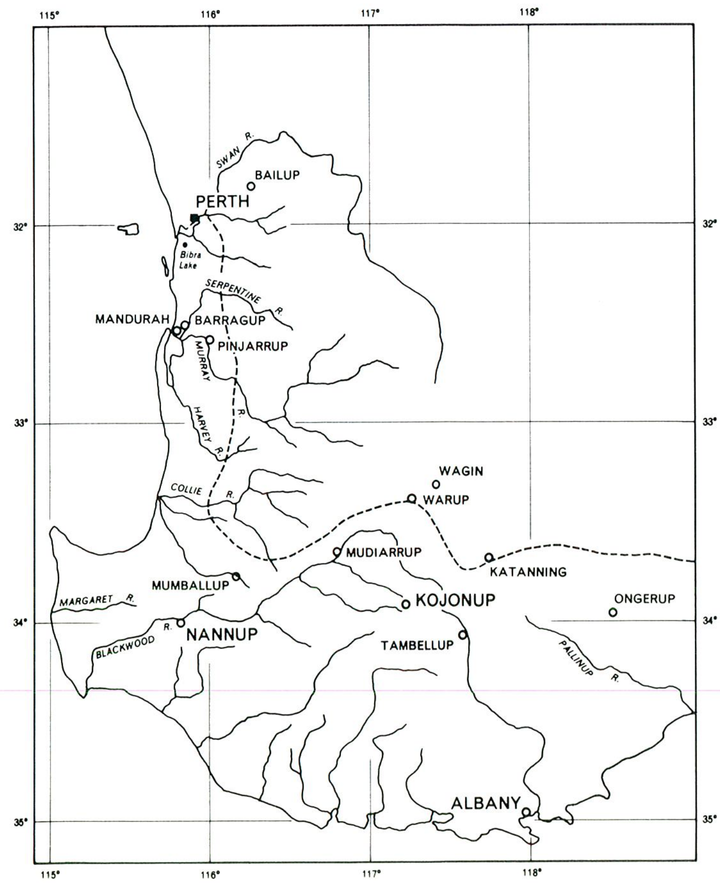
Most of the native animals are shy and nocturnal, and so are rarely seen, making the forest seem deceptively deserted. The best way to see them is with a powerful spotlight at night, when they are active, to pick up the light of their eyes and then use binoculars to observe them closely. Kangaroos, wallabies and many other animals are particularly active at sundown and rest in dense scrub during the heat of the day.

The wandoo forest is particularly rich in fauna, especially possums, numbats and tammars. Swamps in the jarrah forest are the habitat of quokkas, mardos and other small marsupials. In the karri forest the southern bush rat, the small mouse-like common dunnart, and where perennial water occurs, the water rat may be found. Throughout the whole forest area kangaroos and wallabies are extremely common and the occasional emu may also be seen.

Most larger native animals are herbivores, but the smaller marsupials are frequently carnivores and live on large quantities of grubs and insects. They are generally frugal users of water—obtaining much of their requirements from the vegetation and resting during the heat of the day. Many have fascinating habits. The pigmy possum, which lives on insects and nectar, and often hides in blackboys, under bark or in tree holes, can lower its body temperature and go into a sort of hibernation to conserve its resources when times are hard.

The jarrah and karri forests also have rich bird populations—there are over 80 different species in the Dwellingup area alone. Each species has its habitat requirements. Quails and warblers, for example, require dense undergrowth, while parrots and cockatoos require holes in trees.

To those interested in nature study and the freedom of the outdoors, the Bibbulmun bushwalking track, with its variety of stages, will provide both challenge and relaxation.



◀ *A sketch map by Jesse Hammond, showing the area of habitation of the Bibbulmun tribe south-west of the broken line.*