

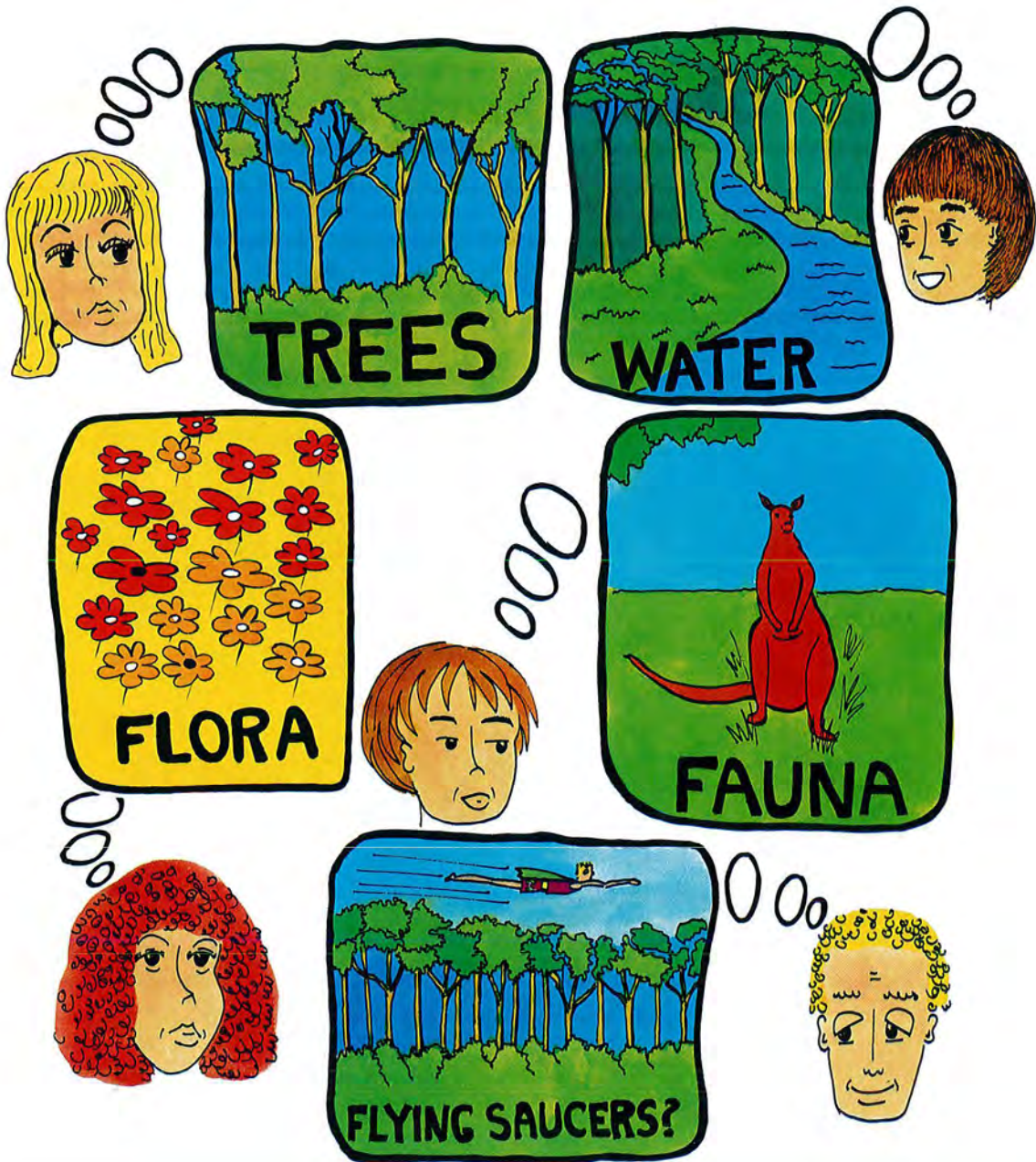


FOREST FOCUS '92

TUNING-IN TO TREES



Imagine yourself in the forest . . .





**Mr P J McNamara —  
Acting Conservator of Forests**

Mr Patrick John McNamara was born in Newark, Nottinghamshire, on 10 November 1926.

He was educated in England and graduated with an Honours Degree in Forestry in 1950 at Oxford University where he attended Brasenose College in 1943/4 and 1947-50.

Between 1944 and 1947 he served with the Royal Marines.

In 1950 he worked with the British Forestry Commission (North East England Conservancy) and he joined the Forests Department of W.A. in 1953.

Mr McNamara's early service with the Department included a short period on research and duties as Working Plans Officer at both Manjimup and Perth. In 1959 he became Divisional Forest Officer at Pemberton and moved again to Manjimup in

1961. In 1964 he became Working Plans Officer at Head Office.

Following promotion to Superintendent, Northern Region in 1967 he subsequently became Chief of Division, Operations, 1969; Assistant Conservator, Operations, 1973; Deputy Conservator, 1976.

On 22 March 1983 Mr McNamara assumed his responsibilities as Acting Conservator.

His main professional interests are forest planning and management.

Mr McNamara is an occasional lecturer in forest management at the Australian National University and is also a Fellow of the Australian Institute of Management.

His spare time activities include farming, woodwork and community affairs.



**The Honourable Brian Thomas Burke, M.L.A.**

**Premier and Cabinet**

**Treasurer, Minister Co-ordinating Economic and Social Development, and Minister for Forests, Tourism and Women's Interests.**

Western Australia's twenty-third Premier, the Honourable Brian Thomas Burke, M.L.A., was sworn into office on 25 February 1983 — his thirty-sixth birthday.

Mr Burke's interest in politics developed at an early age. He joined the Western Australian Branch of the Labor Party when he was sixteen and subsequently occupied various senior positions including those of Trustee, member of the State Executive, member of the Administrative Committee and member of the Electoral Committee.

Brian Burke was born and educated in Perth. He matriculated in 1964, and later studied Law and Economics part-time at the University of Western Australia.

In 1969, he joined commercial radio station 6PM Perth as a journalist and then embarked on a career in television journalism with the commercial station TVW Channel 7.

Mr Burke extended his interest in politics when he decided to contest a by-election for the seat of Balcatta in the Legislative Assembly of the Western Australian Parliament on 28 July 1973. He won the by-election by only thirty votes, but retained the seat easily in subsequent State Elections in 1974, 1977, 1980 and 1983.

Mr Tonkin's Labor Government was defeated in the 1974 election and, in 1976, Mr Burke was appointed a Shadow Minister. In this role he was Opposition spokesman at various times for Housing, Water Resources, Consumer Affairs and matters relating to the office of Chief Secretary.

On 18 September 1981 he was elected Leader of the State Parliamentary Labor Party, succeeding the Hon. Ron Davies, M.L.A., and at the State Elections on 19 February 1983 led the Australian Labor Party to Government in Western Australia.

An accomplished speaker and a skilled debater, the Premier is a dedicated Parliamentarian and has represented the Western Australian Parliament at meetings of the British Commonwealth Parliamentary Association.

He and his wife, the former Susanne May Nevill, whom he married in 1965, have three sons and two daughters. They live in the Perth suburb of Balga in the Premier's electorate.

Mr Burke is actively associated with many of the State's ethnic groups and organizations.



**The Honourable Hywel David Evans, B.A., M.L.A.**

**Minister for Agriculture, and Fisheries and Wildlife and Minister assisting the Minister for Forests.**

The Hon. David Evans was born in South Wales on 20 December 1924 and migrated to Western Australia with his parents when he was two years of age.

After service with the Royal Australian Airforce during World War II, Mr Evans entered Claremont Teachers' College, graduating in 1946. He gained his Arts Degree from the University of Western Australia after part-time study while employed as a teacher.

He was Deputy Headmaster of Pemberton Junior High School 1958-63, and Senior Master at Manjimup Senior High School 1963-67.

From 1956 to 1962 he was President of the Pemberton Branch of the Australian Labor Party and was a member of the State Executive of the A.L.P. from 1967-71, and convenor of the Labor Party's Rural and Agriculture Committee 1968-71.

Mr Evans was elected to the seat of Warren in the Legislative Assembly at the 1968 election and has held the seat continuously since then.

Following the election of the Tonkin Labor Government in 1971 Mr Evans was elected to Cabinet and was allocated the Lands, Agriculture and Immigration portfolios.

In the October 1971 re-allocation of portfolios, he was given the additional Ministry of Forests.

Mr Evans was Deputy Leader of the State Parliamentary Labor Party in 1979-80 and 1981-82, and was Opposition spokesman on Agriculture from 1974-1983.

Following the 19 February 1983 State Election Mr Evans was again elected to Cabinet, with the Ministerial portfolios of Agriculture, and Fisheries and Wildlife, and Minister assisting the Minister for Forests.

Mr Evans was married in 1951 and lives with his wife in Manjimup. They have one adult son and two adult daughters.



# TUNING-IN TO TREES

*Handsome, witty, debonair,  
brave and strong – that's  
JARRAHMAN, W.A.'s own  
Superhero of the forests.*

Published for Mr B.J. Beggs,  
Conservator of Forests, Forests  
Department, 50 Hayman Road, Como.

As part of the Year of the Tree  
celebrations and the ongoing Greening  
of Australia project, this issue of Forest  
Focus has been written in co-operation  
with the Education Department of  
Western Australia for use in schools  
throughout the State.

Information in this publication may be  
reprinted with acknowledgement,  
except in the case of commercial  
promotion material, when permission  
must be obtained.

Page preparation and offset plates by  
Gibbney's Graphics 1980.

Printed in Western Australia by the  
Government Printing Office at ISSN  
0049 – 7320.

Editor: M.R.L. Lewis, M.A. (Hons.)  
(Cant.)  
Assistant editor: H.K. Bradbury, B.A.  
(Murd.)

Text by Helen Bradbury  
Design by Patricia Ryder  
Photographs by Cliff Winfield, except  
where cited.  
Illustrations by Patricia Ryder and  
Cefn Ridout  
Map by Forests Department Mapping  
Branch.

Imagine walking into a forest. Look around you. How do you know it's a forest? Note the things that you sense, and describe them to another student — different colours, looming branches, the scent of Eucalyptus, the feel of rough bark, animal tracks. What different types of plants are there? What season is it? If you're lucky, the water in the creek may be fresh enough to drink.

Now listen, really listen to what you are hearing in this forest. Perhaps there is a river nearby, and there are always birds. These are obvious sounds that you'd expect to hear, but what else is there? Are there echoes? Are there city sounds?

Jot down all the man-made things that you may come across in your forest, like barbecue tables, electric light wires, litter, signs. Do they blend in with the forest setting, or do they stand out and look out of place? What evidence is there of humans having been in this forest?

Perhaps you could take a photograph of that spider's web, or scramble to the top of the rocks, or maybe you'd like to sit down in a shady spot, munch on a sandwich and relax. As

you're sitting, you can take a look at what you're wearing. Jeans protect your legs from the prickly bushes, sandals or boots make it easy to get around in the bush. Hats provide shade for your head. Maybe you'll be carrying nets to catch tadpoles or butterflies, or a pencil and pad to make quick sketches. You may even be carrying a tent or a sleeping bag to stay overnight.

The forest is different from our usual home environment of town or city. It's also completely different from a farm, a coastal environment or a desert. It's a total world of its own, and as you will discover, it is complex. There is a lot happening in a forest that affects you as you're walking in it, but you'll see that the forest affects you even when you're at home watching T.V. People affect forests too. We usually change them, sometimes for the worse. Think about yourself as you read about forests or walk under the trees and tune-in to this special environment. There's a balance that has to be kept here. You can be part of it.

# WHAT IS A FOREST?

The first thing to learn is that a forest is not just trees. A forest is a large area of land covered with a community of trees and other plants. A forest is part of the total land environment. It is mainly trees, but many other living and non-living things that depend on each other are also found there. Forests are vital to the earth, its atmosphere and its life. They control the climate near the ground and regulate water resources, they keep the soil intact and re-cycle its nutrients, and they influence the composition of the atmosphere. Forests not only influence climate, soil and water — they are also influenced by them. Forests provide us with timber, fuel and many other products such as medicines and paper. But despite the value of forests, they can be easily abused and destroyed. Careful management and tending is needed to maintain the trees, their environment and their produce.

I'M REALLY GOING TO HAVE TO LEARN TO FLY SOON IF I'M GOING TO KEEP UP THIS SUPER-HERO IMAGE!

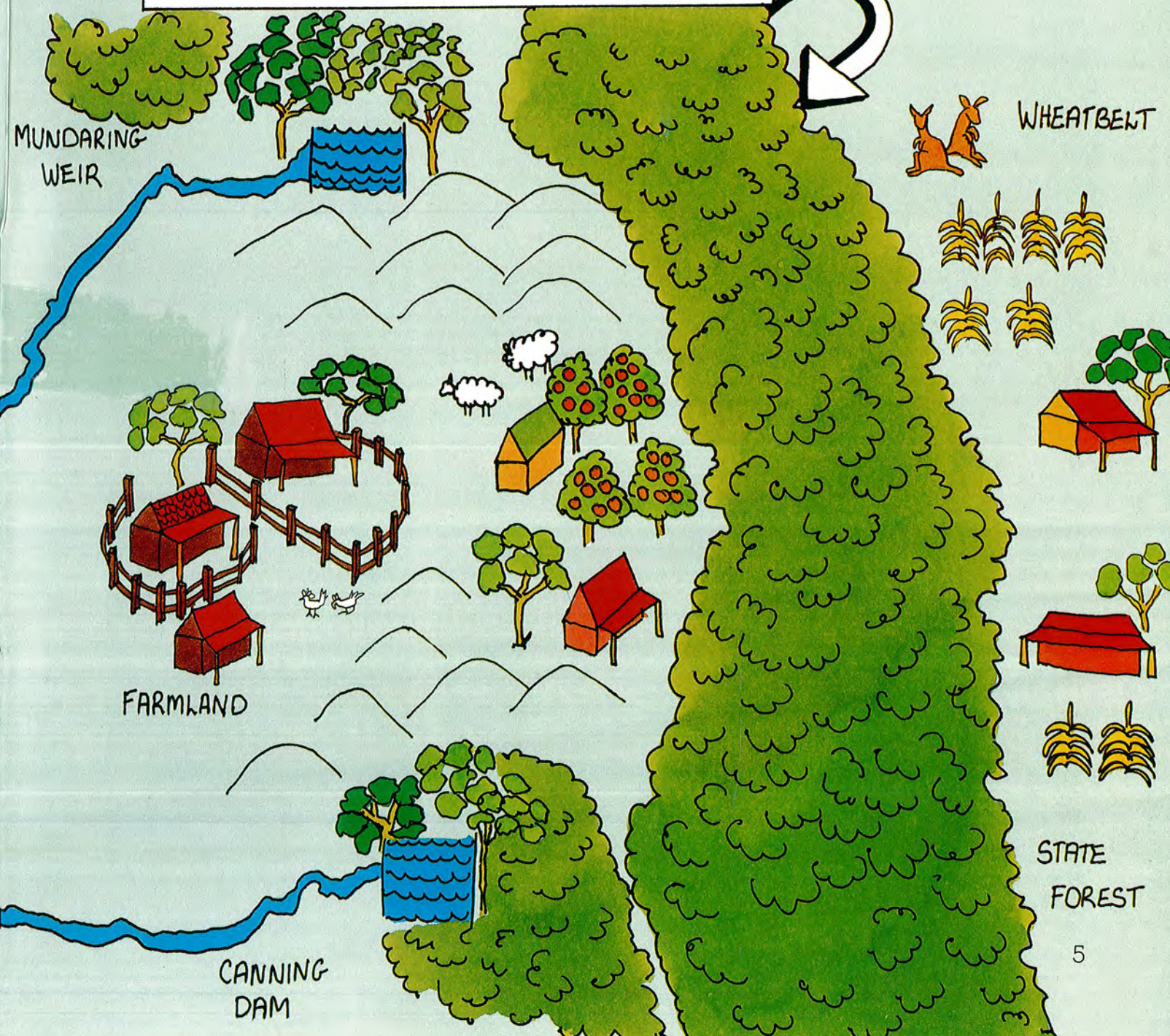
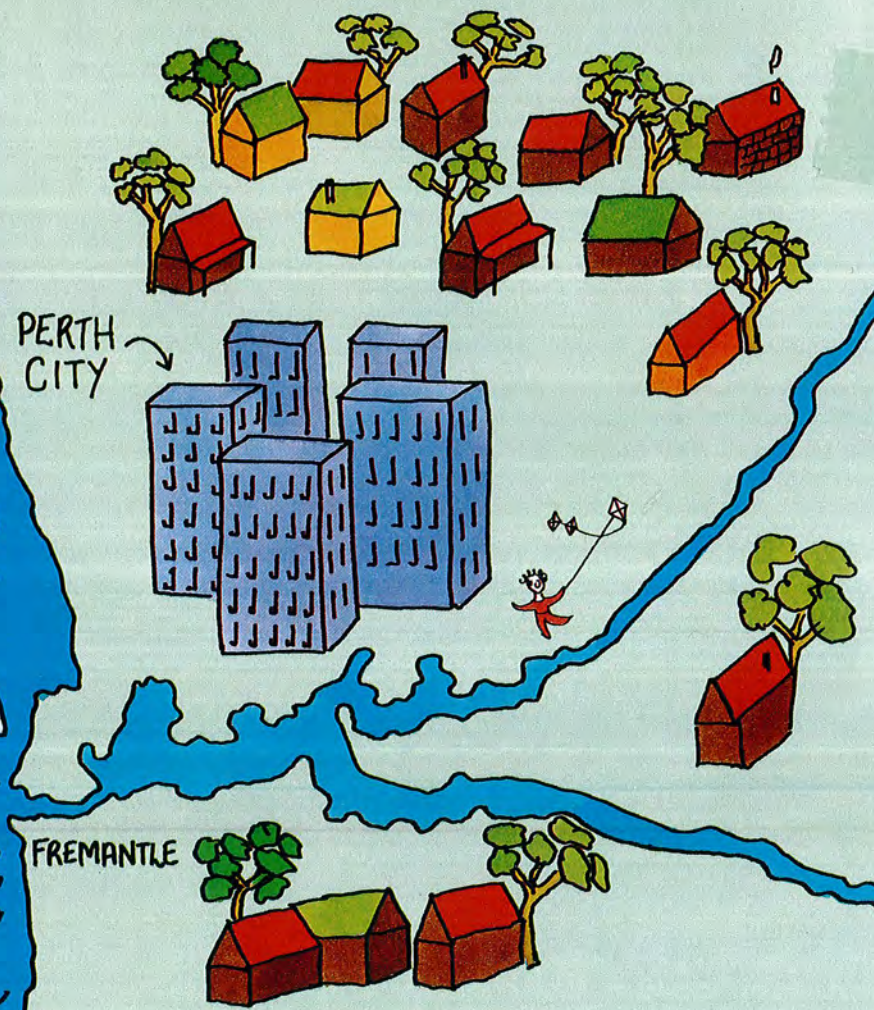
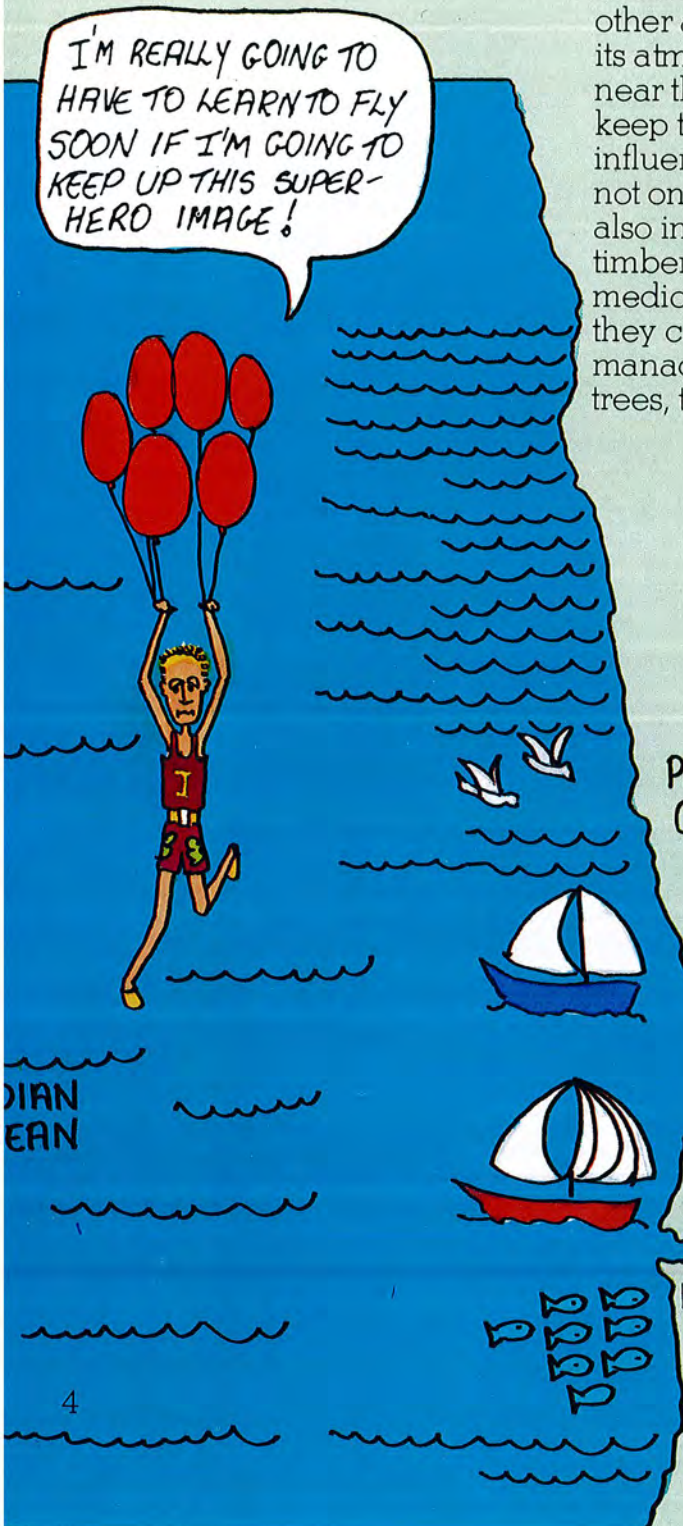
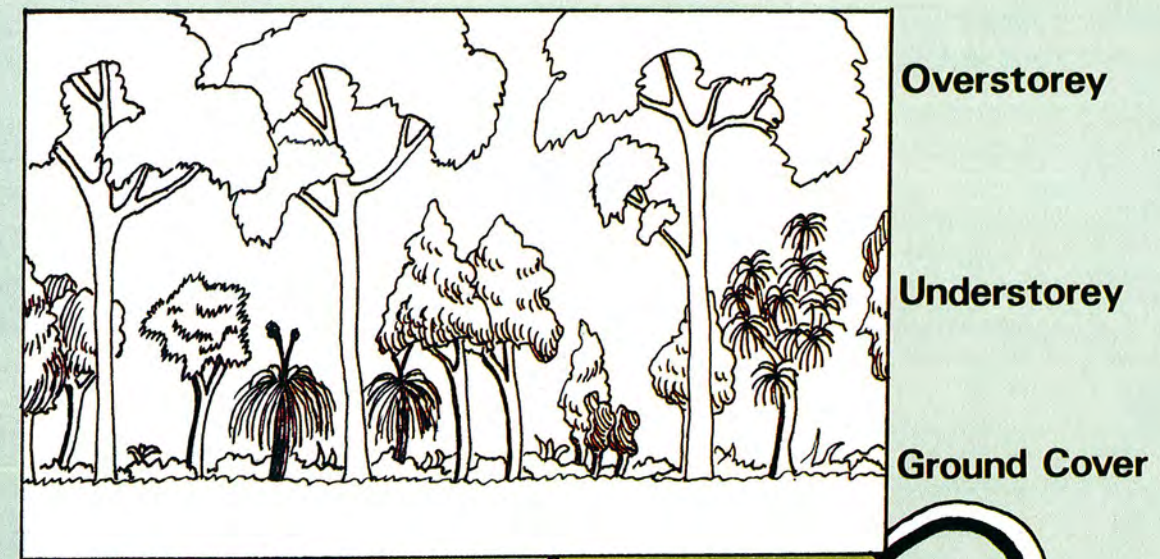


Fig. 1 LEVELS IN A FOREST



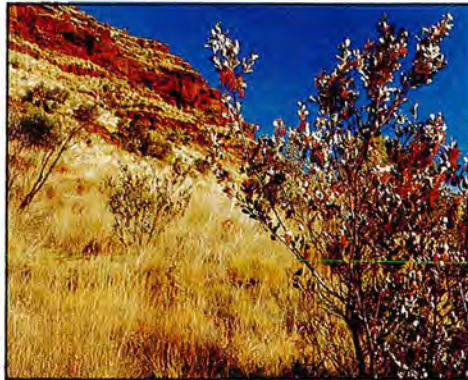
Overstorey  
Understorey  
Ground Cover

# Western Australia

About one third, or 33% of the Earth's land surface is forest, but in Western Australia less than 1% of the total land surface is State forest. This amounts to two million hectares. There are about one million people in Western Australia, which means that the proportion of forest to people is two hectares of forest for every person. So you can see that, compared with the total land surface of Western Australia the size of the forest is small, but compared with the population here, the size of the forest is large. In some other countries, for example Japan, the situation is just the opposite. The Japanese have more than half their land surface forested, but they also have an extremely high population.



*Tuart (Eucalyptus gomphocephala)*



*There are no forests in the Pilbara, but many beautiful plants do grow here.*



*Salmon gum (Eucalyptus salmonophloia)*



*Tingle (Eucalyptus jacksonii)*

G. Peard



*Wandoo (Eucalyptus wandoo)*



*Pine (Pinus pinaster)*

H. Bradbury

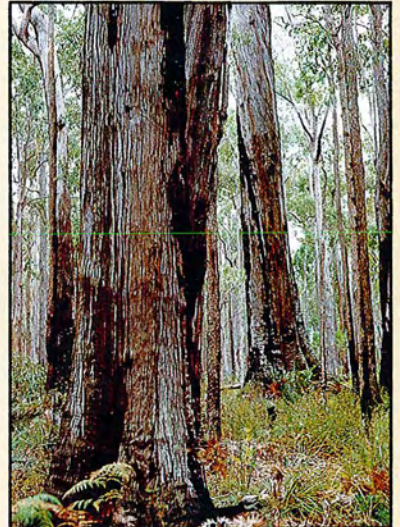
# FORESTS IN THE SOUTH-WEST OF WESTERN AUSTRALIA

FIG. 2

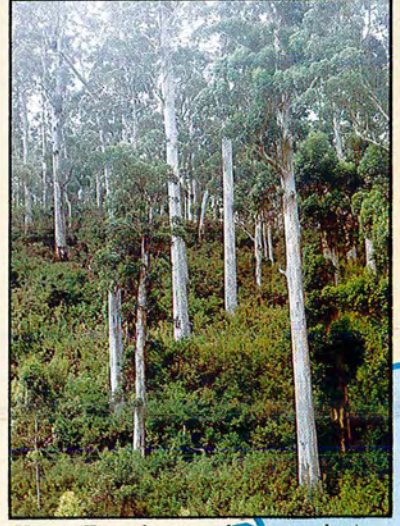
LEGEND

JARRAH		WANDOO	
KARRI		TINGLE	
TUART		PINE	

SCALE  
0 10 20 30 40 50km



Jarrah (*Eucalyptus marginata*)



Karri (*Eucalyptus diversicolor*)



*The Development of a Eucalypt Flower*



*bud*



*bud cap*



*flower|stamens*



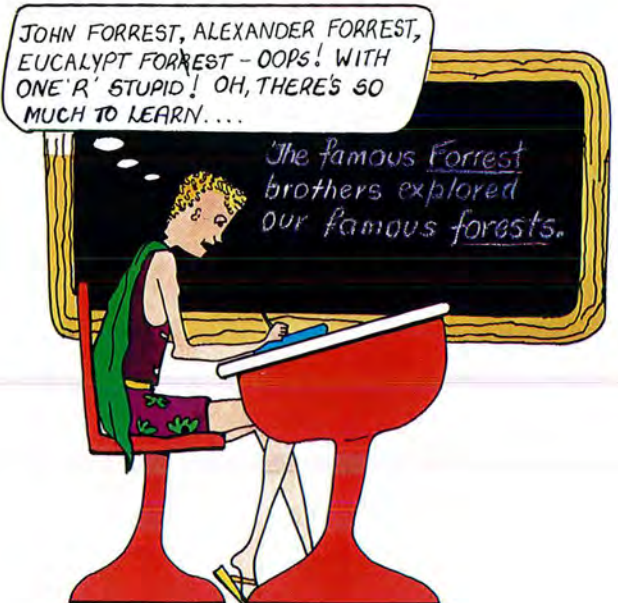
*The stamens fall off and leave a hard nut or fruit that contains the seed.*

# Eucalypts

Forests around the world, and even within Australia differ widely. Our forests in Western Australia are mainly made up of trees from a group called *Eucalyptus*. We call the trees **Eucalypts**. Eucalypts come from a family of woody plants that have leathery leaves, and that grow in a climate with relatively cold and wet winters, and hot and dry summers. This is the type of climate found in the south-west of the State. If you crush the leaf of a Eucalypt you will smell the strong Eucalyptus oil.

"Eucalyptus" comes from two Greek words meaning "well-covered" — a name applied to the little cap that protects the unopened flower. The petals in the flower are replaced by a "bud cap" that protects the miniature stamens (those fine stalks in the flower that hold the pollen).

Eucalypts are typically Australian, and apart from a few isolated species in New Guinea, Timor and other nearby islands, they are found growing naturally only in Australia. Six major Eucalypt forest types grow in Western Australia and no where else. They are found in different areas of the State according to climate, rainfall and soil. Refer to the forest distribution map, Figure 2.



# Major Forest Types in Western Australia

## Jarrah, (*Eucalyptus marginata*)

Jarrah is the main forest tree species in Western Australia. It grows throughout the south-west in areas where rainfall is higher than 600mm per annum. Jarrah is a tall tree with grey, stringy bark and creamy coloured flowers. It grows to a maximum height of more than 50 metres. Jarrah is unique to Western Australia and has very specific characteristics that enable it to grow on harsh, gravelly soils, in strongly seasonal conditions prone to frequent fires.

The long, straight trunk makes the jarrah tree highly suitable for the production of timber. Its timber is world famous for its hardness, durability and colour. Jarrah poles support our power lines, jarrah sleepers support our rail lines and much of our furniture is made of jarrah. Early settlers to Western Australia called jarrah "Swan River Mahogany" because of its resemblance to another fine timber, mahogany. However its many fine qualities were formally recognized in the 1860s when it became known by its aboriginal name "jarrah".

*The timber industry was one of the first industries in Western Australia. Jarrah trees were felled using axe and saw, and the logs were hauled to the timber mill with horse or bullock teams pulling a cart called a whim.*

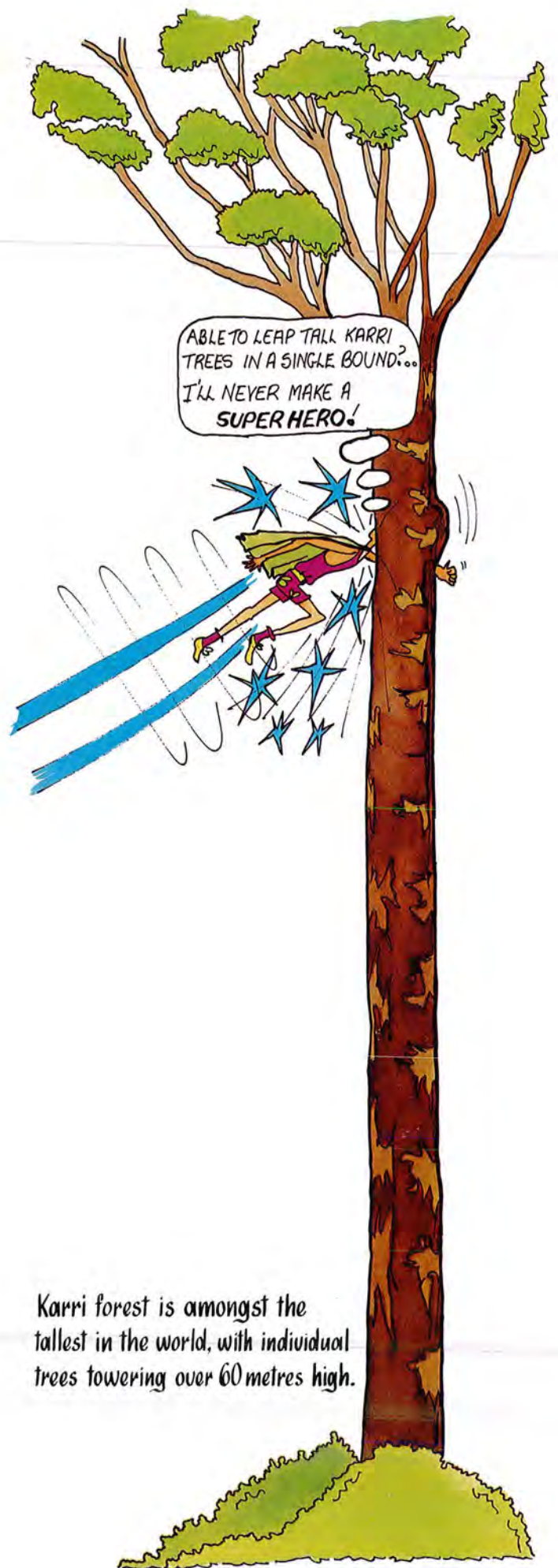


Jarrah's botanical name is *Eucalyptus marginata*, "marginata" referring to the distinctive vein or margin on the edge of the leaf. Although all Eucalypts have this margin, on jarrah it is very pronounced. Jarrah grows slowly, reaching its greatest size after about 500 years. The best jarrah forest is found in the Darling Range between Mundaring and Collie, and around the Blackwood River near Bridgetown. The undergrowth of the jarrah forest is made up of banksias, blackboys, wattles, sheoaks, zamia palms and many other shrubs and plants. Your school library should have more information on the jarrah forest. (See Forest Focus Nos. 7, 11, 14, 21, 22 and 26).

## Karri, (*Eucalyptus diversicolor*)

"Karri" is the aboriginal name for the State's tallest tree. It is also one of the tallest trees in the world. The botanical name for this tree is *Eucalyptus diversicolor*. "Diversicolor" refers to the difference in the shade of green between the upper and lower surfaces of the leaf. On days when the wind is strong enough to overturn leaves from their natural hanging positions, the paler undersurface contrasts strongly with the deeper green of the upper surface of the leaf. Karri forests are some of the most magnificent forests in the world, with individual trees towering 60 to 80 metres high. The tallest karri (measured in 1939) reached 90 metres high and was 7.3m around its trunk — truly a masterpiece of natural beauty and engineering.

The trunk is mottled in colour. As karri sheds its bark at the end of each summer irregular coloured patches are left on the trunk giving this mottled effect. The karri's flowers are light yellow in colour, and like all other Eucalypts, are protected by a bud cap when forming. The karri forest grows in the south-west of the State in areas close to the coast that are influenced by southerly breezes and receive some summer rainfall. The main belt of the karri forest lies south of an imaginary line drawn from Yallingup in the north-west, through Manjimup to the Frankland River then to Denmark and Torbay in the south-east near Albany. It grows mainly on loamy soils. Undergrowth in the karri forest is different from that of the jarrah forest, and within the karri belt, varies widely. It is usually very dense and includes karri wattle, karri sheoak, netic, sword grass, karri hazel, tree hovea and several creepers. We value the karri forest for its timber, as a water-catchment, as a popular recreation area, an area for conservation, and an area for scientific study. (See Forest Focus Nos. 1, 17, 24 and 27).



Karri forest is amongst the tallest in the world, with individual trees towering over 60 metres high.

## Marri, (*Eucalyptus calophylla*)

Marri, a large and shapely tree, is the most widely distributed Eucalypt in the south-west, growing with jarrah or karri. The early settlers knew the tree as Red Gum, no doubt because of the red coloured gum that can be easily observed coming out of the trunk. However, marri is the preferred native name, as there are several other Eucalypts known as Red Gum. The botanical name *Eucalyptus calophylla* means "beautiful leaf". It is a very good honey tree and provides excellent shade on farms. Marri is also milled for chips that are made into paper products. Children know marri for its fruit, called "honkey nuts". Marri is a tall tree, growing as tall as 60 metres. (See Forest Focus No. 12).

Marri trees are best known for their fruit known as "Honkey Nuts".



## The Tingles (*Eucalyptus jacksonii*, *guilfoylei* and *brevistylis*)

The three tingle species — red tingle (*E. jacksonii*), yellow tingle (*E. guilfoylei*) and Rate's tingle (*E. brevistylis*) are three tall species of tree that grow with karri and on their own in the extreme south-west of the State. On the south coast, in the vicinity of Walpole, is a small pocket of country which has the coolest and moistest climate of the whole State, and which supports the tingle forest. The Valley of the Giants is part of this pocket and is a favourite picnicking area.

## Tuart, (*Eucalyptus gomphocephala*)

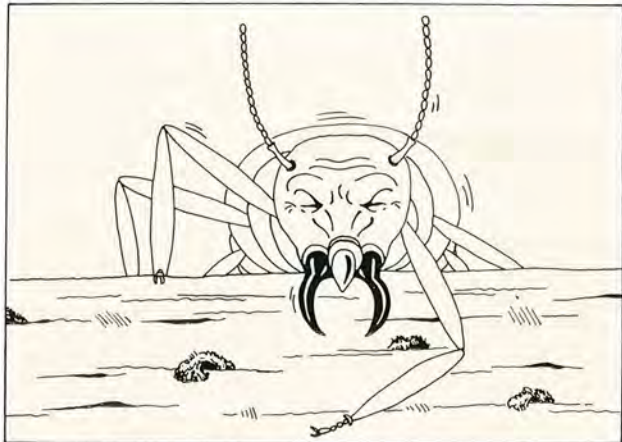
Tuart, or *Eucalyptus gomphocephala* is a tall tree that grows near the coast northwards from Busselton up to the Hill River, north of Moora. The tuart forest is a very open forest and is much easier to walk through than the karri, tingle or jarrah forests. The undergrowth of the tuart forest near Busselton consists mainly of smaller trees, like peppermints, and a ground cover of grasses. Cattle are grazed on the grasses in some parts of these forests to lower the chance of bushfires which could sweep through the forest in summer when the undergrowth is very dry.

Tuart was early recognized as a very strong timber and was widely used for such things as railway carriage frames. The fine tuart forests near Busselton are being specially managed to protect their value as an area for scientific study and recreation.

## Wandoo, (*Eucalyptus wandoo*)

Wandoo, called *Eucalyptus wandoo* is the other major tree species of the south-west, occurring mainly to the east of the Darling Range. It was once found widely throughout the wheatbelt, but is now restricted to the eastern margin of the State forest. Wandoo is a very strong timber and has been used widely in the building industry. It grows, not as a dense forest, but as an open woodland, in low rainfall areas of between 400 and 800mm per annum.

Wandoo has mottled bark, usually quite smooth, and is also known as White Gum because of its pale colour. (See Forest Focus No. 3). The wandoo forest is specially prized for protection of water catchments, for honey production and recreation.



**Wandoo timber is very hard and durable, and is prized because it resists termite attack.**

*The wheatbelt was once forested with wandoo and other types of trees, but has been cleared of its trees in order to plant crops. The clearing however, has caused rivers and streams in the wheatbelt to become salty. In some areas the clearing of forest has caused the destruction of the soil by wind erosion. Trees need to be replanted in the wheatbelt to prevent further damage.*



## Inland Eucalypts

The last major woodland type is composed of many species of Eucalypts growing together. This type is found in the Goldfields and other semi-arid areas of Western Australia. The Eucalypts in these areas are very slow growing because of the small amount of rainfall, and produce very beautiful flowers. Salmon gum and gimlet are two of the main species in this dry woodland area. Other species, such as sandalwood are not Eucalypts, but are found growing with the inland Eucalypts. The timber from salmon gum is used in the construction of the shafts for gold and nickel mines. (See Forest Focus No. 15).

## The Kimberley Region

The Kimberley vegetation is not yet as well known as that of the south-west part of the State. Only recently has survey work been commenced to assess the range of trees growing in the extreme north of the State. Many of the trees in the Kimberley are not Eucalypts, but are more like trees of Asia.



*The boab tree (above) is just one of the trees in the Kimberley.*

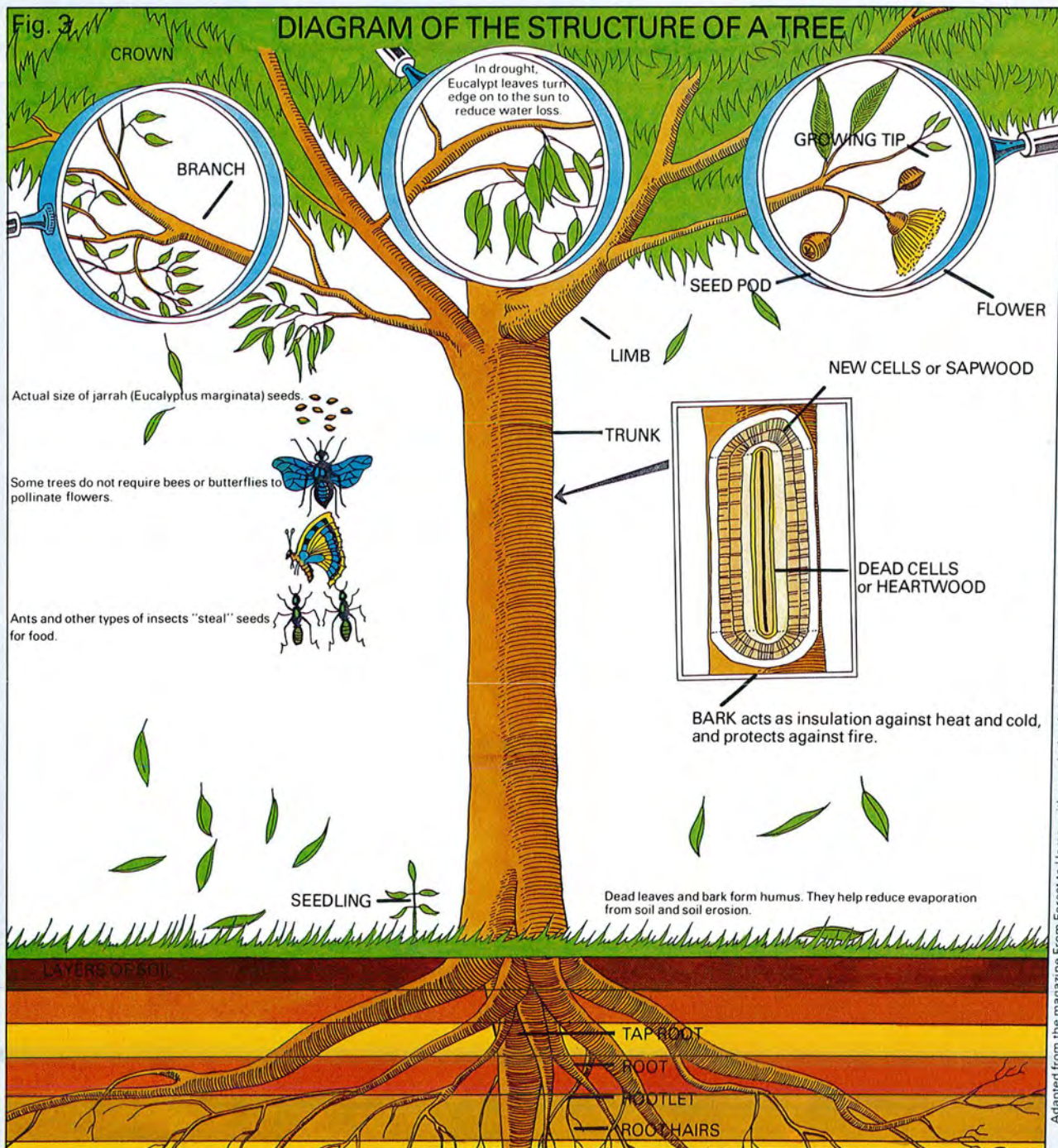
## Pine Forests

Some trees from other parts of the world are planted in large numbers in Western Australia for the purpose of supplying wood to the community. Two main species of pine, *Pinus pinaster* and *Pinus radiata* are planted in the Donnybrook Sunkland, the Blackwood Valley and along the coastal plain near Harvey and Perth. The wood from pine trees is known as softwood and is very much lighter in colour and weight than the wood of the Eucalypt trees. In Western Australia we use pine for the manufacture of crates and cases, as well as for furniture. Larger sizes of pine timber can be used for house and roof frames. (See Forest Focus Nos. 5, 9, 16, 20, 28).



*Even Superheroes have to work during the summer holidays!*

# HOW A TREE LIVES AND GROWS



Adapted from the magazine From Forest to Home, with permission from Hardboards Australia Ltd.

A tree may be defined as a woody, upright plant having three main sections: the roots, the trunk (stem or bole) and the crown (branches and leaves). The crown is generally supported by a single stem so that the plant, when mature, is taller than 2m. This definition separates the tree from all other members of the plant kingdom.

## Sections of a Tree

### The Root System

The roots are the underground part of a tree. They have two main functions: to support the trunk and crown and more important, to absorb from the soil the water and minerals required for growth.

Root types vary from species to species and from tree to tree. Some trees send a tap root deep down into the soil. Other trees spread their roots outwards, shallowly through the soil.

The nutrients in the ground water, when absorbed, are carried up, via the trunk, to the crown to be converted into the food materials necessary to sustain life and growth.

Water absorption is carried out by young fine rootlets and root hairs. They are the only part of the root system that does this. Their small absorbing ends have a short life and, once they have completed their work, break up and are replaced by the new rootlets formed at the growing tips. A layer of protective bark develops around the older non-absorbing roots, and they serve the dual role of anchoring the trees in the soil and as a pipeline to pass the water and minerals (sap) taken up by the tips back to the trunk.

Most root systems are extensively branched to allow the rootlets to spread through the soil in the search for water and minerals.

### The Trunk

The trunk of the tree carries out a twofold role in the life of the tree. It serves as a support to thrust the crown up and out into the light, and allows the water and nutrients picked up by the roots to be passed up into the crown. The trunk also transports the plant foods produced in the crown down to the roots.

All tree trunks are woody and capable of radial growth, that is, they grow outwards as well as up. Bark completely encases the trunk, protecting the vital conducting and growing tissues from damage.





A tree grows by the formation of new cells rather than by the extension of existing cells. A tree grows in height by adding new cells upwards on top of the existing tip. A nail placed at the base of a tree will not move upwards as the tree grows, as is often believed; it will remain at the same distance from the ground throughout the life of the tree.

The size of a tree's trunk or bole depends to a large extent on the particular type of tree, but it is also an indication of the quality of the site where the tree grows. Karri has a bole length often exceeding 30m, while the woodland wandoo is normally found with a bole of approximately 8m.

### Wood

The body of a tree is made up of small cells composed of **cellulose**, the building material of plants. These cells are usually relatively short-lived and are rapidly replaced by new, younger cells used for growth. In the **heartwood** of the tree trunk, the majority of the cells have completed their living function and serve purely as mechanical support for the living parts. The new cells in the trunk form the **sapwood** just under the bark. Wood is made up of both heartwood and sapwood. The heartwood is usually a darker colour than the sapwood, and is the most durable part of a piece of timber.

### Growth Rings

Each year the tree adds a layer of wood around the outside of the layer formed in the previous year. If growth is interrupted annually by cold weather or dry seasons, the character of the cells at the end of each year's growth and the beginning of the next is sufficiently different to define sharply the annual layers or growth rings. The age of a tree may be determined by counting the number of annual growth rings. Growth rings can be seen more clearly in some trees than others.

### The Tree Crown

The leaves of the crown form the "factory area" of the tree and the processes of food production (photosynthesis), transpiration and respiration are all functions of the leaves. Seeds for reproducing are also formed in the crown.

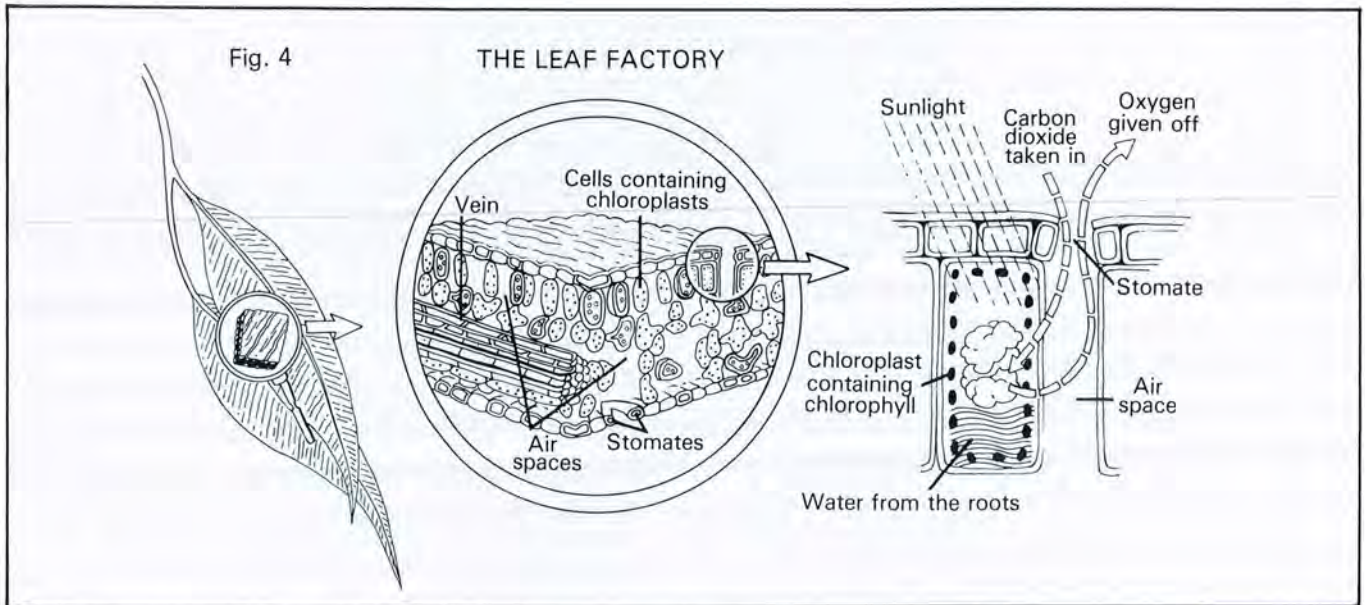


## Plants are Chemists

Plants are the sustenance of all life on earth, for they alone are able to produce from simple, naturally occurring substances, the complex organic foods necessary for the life of organic cells. This depends entirely on the action of sunlight on the green colouring matter (chlorophyll) of the leaves. It is called **photosynthesis**. Green plants use sunlight to convert carbon dioxide and water into useful food. Animals cannot make their own food so they must either eat plants or other animals to get their requirements for life.

The basic materials needed for food production come from two sources: the air and the soil. In all, nine elements — carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, calcium, magnesium and sulphur — are required by all plants in fairly large quantities. Other elements are called trace elements and are required in much smaller amounts. Of all these elements, carbon and oxygen in the form of carbon dioxide are taken from the atmosphere and all others are derived from the soil, in the form of mineral solutions in water.

A fertile soil will supply all of the major trace elements while an infertile soil lacks one or more of them. The fertility of the soil can be seen in the health and vigour of the tree.



*The leaves in the crown of the tree carry out the processes of photosynthesis, transpiration and respiration. The leaves are like factories because it is here that all the raw materials are made into food products for the tree to live on.*

Like all living things trees and other plants breathe. This is called **respiration** and is the opposite to photosynthesis. Respiration uses food and oxygen to produce energy for growth. Respiration is a continual process whereas photosynthesis only occurs in the presence of sunlight.

## Transpiration

Another important function necessary to the life of the tree occurs through the leaves of the crown. It is known as **transpiration**, or the release of excess water from the tree into the atmosphere.

Less than 1% of the water taken up by the roots and transported up to the leaves as sap is used by the plant cells. The bulk of the water is used to carry the mineral nutrients, which are dissolved in it, from the soil to the leaves. Once the nutrients have been removed from the sap, the water is of no further use and must be removed from the plant to allow room for more sap to be moved up from the roots. This excess water is released into the atmosphere through special breathing pores, called **stomates**, in the leaves. The water passing through the stomates is in the form of a gas or vapour.

## Reproduction

Nature makes sure that a species continues to survive. All trees, when they come to maturity, bear flowers. Within the flowers pollination occurs and in time they develop into fruit with seeds that fall to the ground, germinate and grow to form new trees.

Jarrah flowers, for example, are pollinated during the summer months. Twelve months after pollination, the fruit contains mature seeds. In the hot months of the summer the ripe fruit opens while still attached to the tree and the seeds drop to the forest floor. During their travel from the height of the crown to the floor, air currents may spread or carry the light seeds some distance from the parent tree.

On the forest floor the seed germinates when conditions of temperature, light and moisture are favourable for the growth of the young seedling. Of the thousands upon thousands of seeds that germinate on every hectare of forest soil, only a few survive competition from weeds and neighbouring trees, and the long dry summer to eventually become mature trees.

Besides reproduction by means of seed, many trees, like jarrah, are able to regenerate by shoots (coppice) which arise from the stump after the parent tree has been felled, or by suckers from the roots.

# WHAT TREES PROVIDE

The whole forest and its inhabitants form an **ecosystem**. An ecosystem can be defined as living and non-living things interacting with each other to produce cycles of raw materials. The raw materials are mainly nitrogen, carbon, water and oxygen. These things make up the food for all living things within the forest. The raw materials are exchanged between air, plants, soil and animals in **balanced cycles**.

## Living Things in the Forest

In the forest ecosystem there are communities of living things. The dominant community is of course, the trees. But there are many other plant communities in the undergrowth (for example, shrubs and flowers) and on the forest floor (for example, mosses and creepers).

There are many communities of animals, birds and insects living in the forest. The forest provides a **habitat** for these living things. The raw materials in the forest are passed through the living communities in a **food chain**. So we see that larger animals feed on smaller animals, birds feed on insects and small animals and insects feed on plants. When the living things in a forest die they decay and are broken down to become part of the soil which in turn provides nutrients to the trees and other plants. All members of the forest community produce wastes (gases and chemicals) which are returned to the environment to be used by other members of the community.

All communities in a forest depend on each other. Trees cannot grow satisfactorily unless certain soil and climatic factors are present. They cannot continue to reproduce and thrive unless animals, insects and birds are available to aid the process and maintain soil fertility. Within the forest ecosystem trees in their turn provide many things.

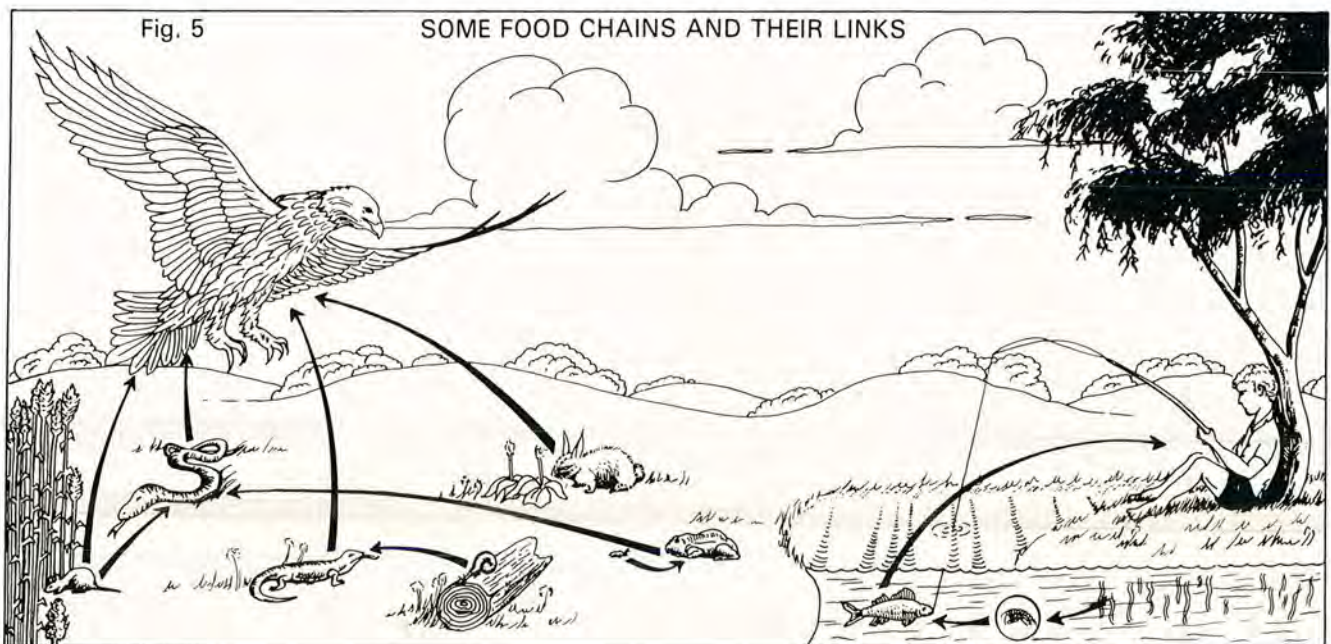


Fig. 6

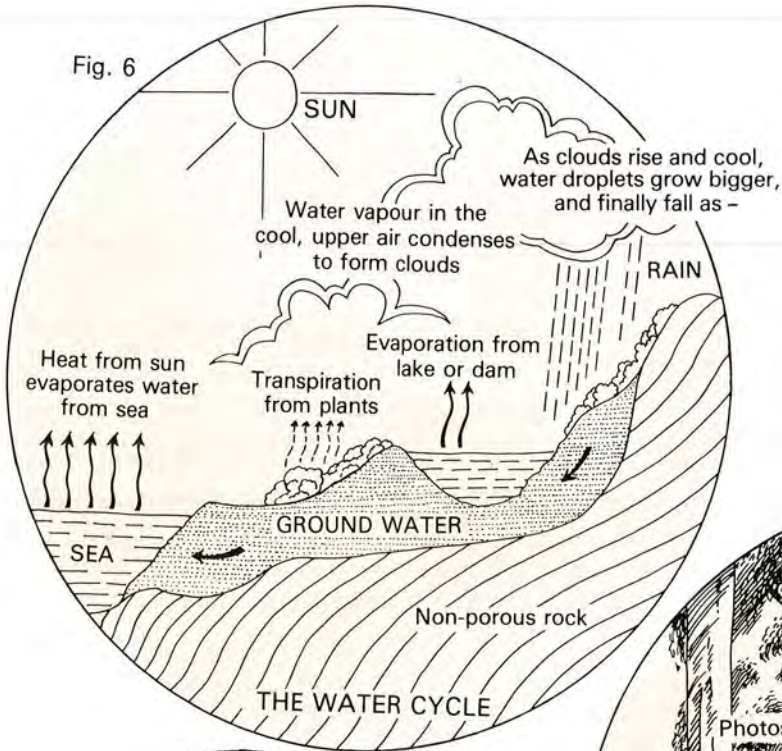


Fig. 7

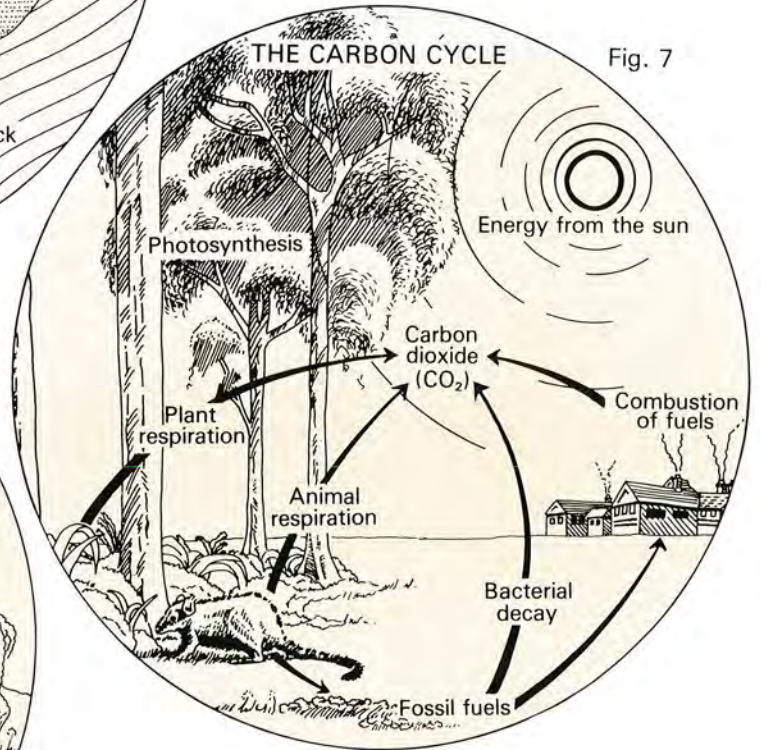
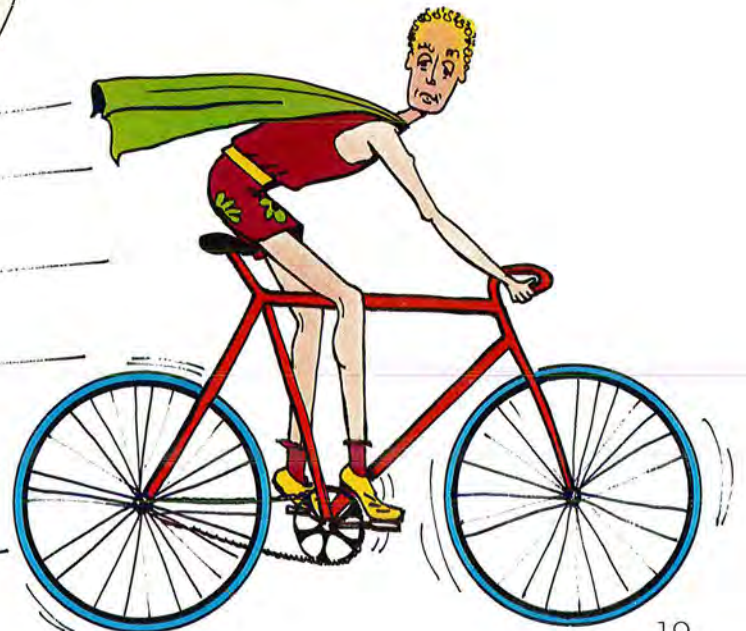
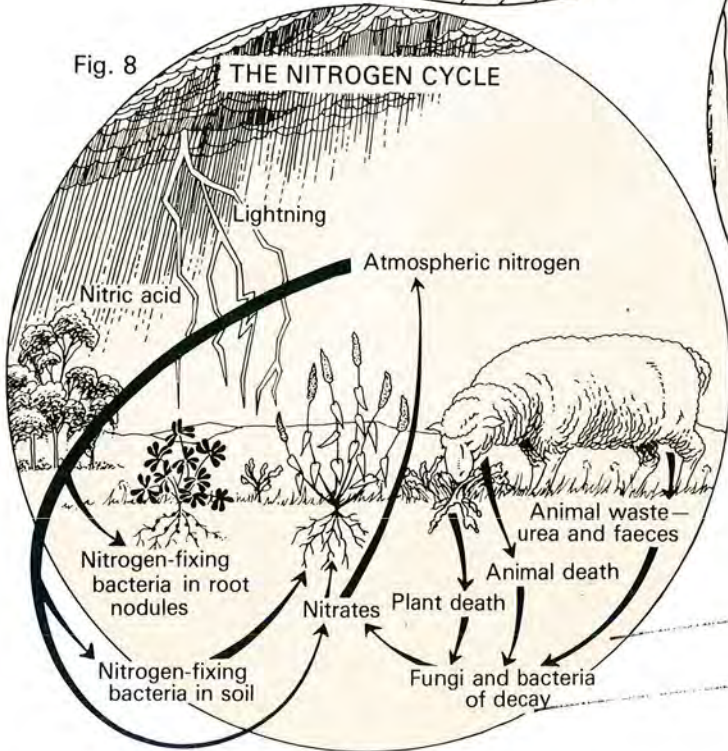


Fig. 8

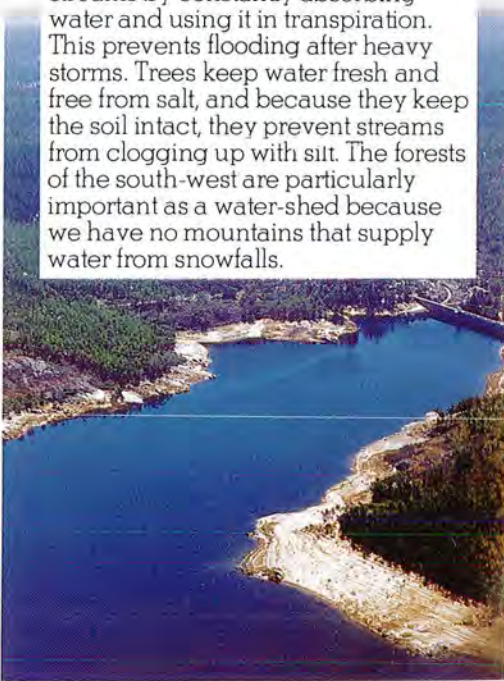


The forest ecosystem is composed of many living and non-living things depending on each other.



### Water —

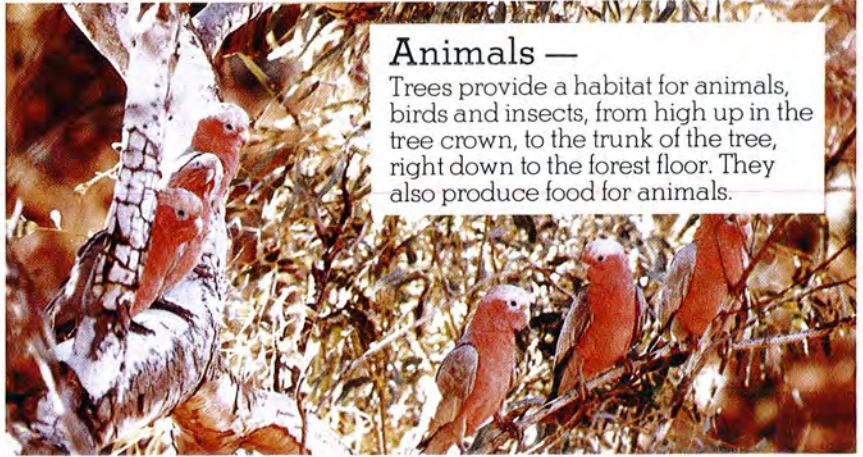
Trees along with other vegetation in a forest regulate the flow of water in streams by constantly absorbing water and using it in transpiration. This prevents flooding after heavy storms. Trees keep water fresh and free from salt, and because they keep the soil intact, they prevent streams from clogging up with silt. The forests of the south-west are particularly important as a water-shed because we have no mountains that supply water from snowfalls.





### Air —

Trees and all green plants filter the air for the entire earth. They use up the carbon dioxide and circulate the oxygen. There is a constant cycle of gases going on in the atmosphere and all green plants, including trees, keep the cycle going. Animals in the forest and humans on the earth breathe the air filtered by the trees and other plants.



### Animals —

Trees provide a habitat for animals, birds and insects, from high up in the tree crown, to the trunk of the tree, right down to the forest floor. They also produce food for animals.



### Climate —

Forests regulate the climate near the ground protecting the land from excessive heat and drying out, and from excessive cold. The temperature in a forest is more constant than in a cleared area. Forests are shelters for many living things.

In summary, we can say that a forest is a **balanced** but **dynamic** ecosystem. Dynamic means moving, and there is a lot of action in a forest that we don't see. We don't see the trees or other plants grow and decay, we don't see the nutrient cycles, yet these things are continually happening in all parts of the ecosystem. There are millions of intricate food chains in which

the raw materials are transferred from organism to organism, between the atmosphere and the soil. At any one time we may study a forest and record a given amount of oxygen or nitrogen, or a certain number of trees or possums. The numbers, generally speaking, remain constant, but small changes occur all the time. The forest is **balanced, dynamic and complex**.

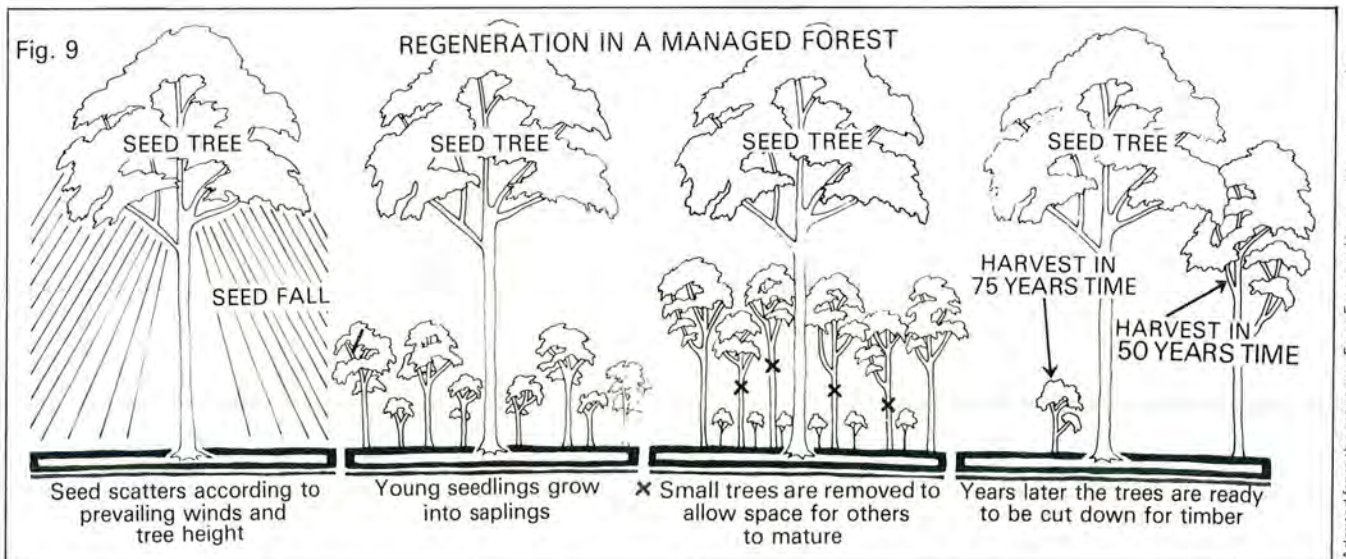
# PEOPLE USE FORESTS

Not only do forests form an important part of our environment, but they are used by people for many products and activities. Forests need to be carefully managed to provide a variety of products and values for all time.

## Wood

In our daily lives we are surrounded by material produced from trees. From newspapers and books to the cardboard carton, through the long range of rayons, plastics and chemicals to the more obvious chipboard, plywood and sawn timber for furniture and construction. The basic raw material in each case is wood. Once a tree is felled the wood that can be used is known as timber.

Timber is used very widely because it is versatile and easy to use as a construction material. We also value timber for its beauty in wall panelling or furniture. It is easier to produce timber than it is to produce other construction materials such as concrete, steel and aluminium. Most importantly the production of timber produces very little pollution, and requires a lot less energy than concrete, steel or aluminium. (Refer to Fig. 10).





People use forests in many ways. Here people at work use timber from our forests to make furniture and repair a fishing boat.

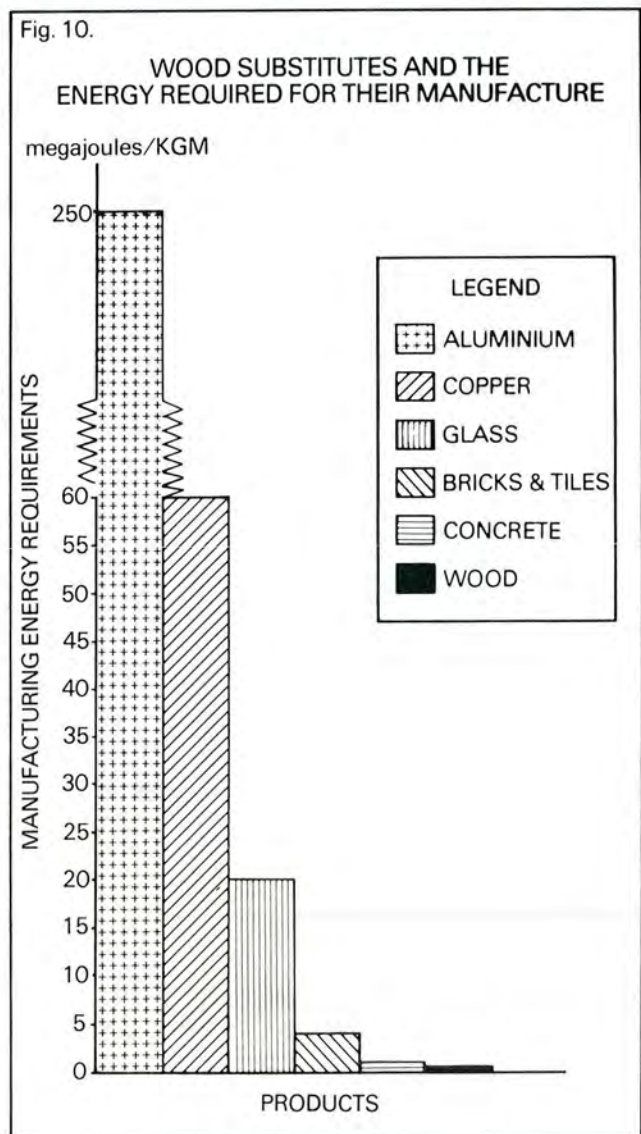


The outstanding characteristic of wood is that it is **renewable**. We can re-plant trees once they have been cut down, to enable a continuing supply of wood products. This is called **regeneration** of the forest. We can also plant areas of land that don't normally have forests on them, with trees. This is called **afforestation**. An example of afforestation in Western Australia is the pine forests planted along the Blackwood River. These pine forests have been planted to provide us with timber on land that was cleared for farming.

### Other Products

Apart from timber, forest products are important to several industries in the form of such resources as rubber, turpentine, tannin, cork, honey, edible fruits and seeds, medicinal oils, charcoal and carbon. In Western Australia, honey collection, charcoal, wood chemicals, fuel supply, tool handles and tannin extraction are examples of industries that have depended on the forest.

*It takes less energy to make timber products than it does to make concrete or metal products that do the same thing as timber.*







*Some towns in the south-west depend on the timber industry for their livelihood. Here is an aerial view of a timber mill at Dwellingup, where the logs are sawn up into planks and beams for use in construction or furniture building.*

## Employment

From the time that a seed germinates in the forest or the seedling is planted, to the time that the tree is fully grown, thousands of people are employed working in or with the forests. People are employed by industries such as sawmills, to cut the trees for timber supply. Beekeepers work in the forest, collecting honey made from tree blossoms.

The jobs of managing, tending and protecting the forests are done by foresters. Foresters are men and women who study the forest, who guide the timber industries and who make areas in the forest into picnic spots for everyone to use on weekends or holidays. Foresters fight bush fires, and try to prevent the spread of forest disease, such as jarrah dieback. An important part of the forester's job is to grow and plant trees.

*The forest is an exciting place to visit. You can go canoeing, bushwalking or picnicking in State forest.*



There are many towns in the south-west whose main industry is timber. Some of these are Jarrahdale and Dwellingup in the jarrah forest of the Darling Range, Nannup and Kirup near the pine forests along the Blackwood River, and Manjimup, Pemberton and Walpole further south in the jarrah and karri forests.

## Recreation

We have all been for picnics in the forest, near rivers, dams or rocky outcrops. Managing a forest for recreational purposes is a very important part of forestry as growing numbers of people are seeking the beauty of the forest environment. Australians use forests as places for relaxation, walking, canoeing, picnicking and studying the bird-life, animals or wild flowers.

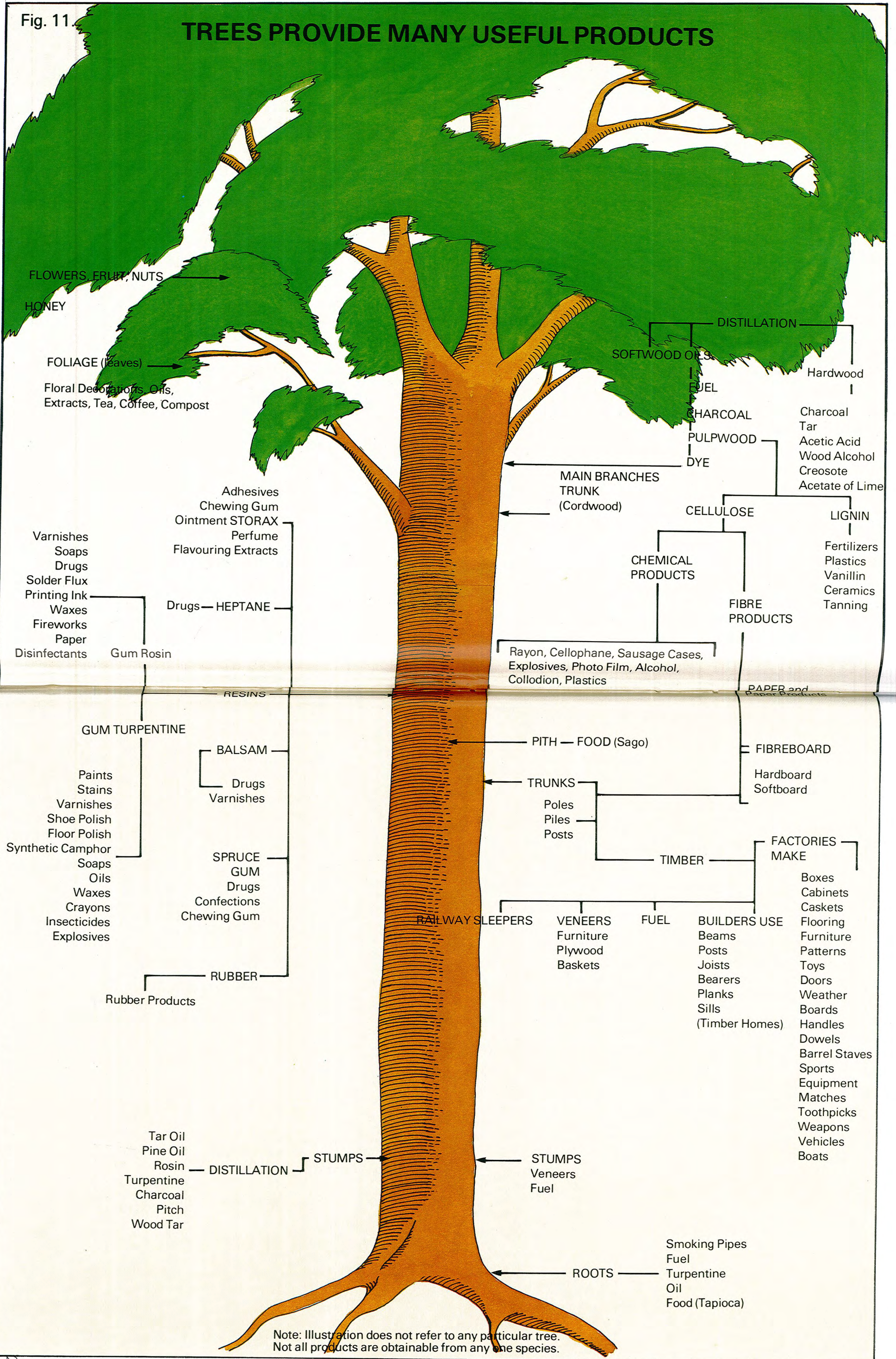
## Forest Fauna

Forests provide a habitat for many birds, animals, insects and aquatic life. In order that we disturb communities of animals and birds as little as possible when felling trees for timber, we leave tracts of forest uncut as refuges and corridors for fauna. Some areas of forest support unique populations of fauna, such as the numbat, the woylie, the native cat, the fire-tailed finch and others. It is important that Western Australians value the fauna and flora as well as the timber in the forests. (See Forest Focus Nos. 23, 24, 25, 26 and 27).



Fig. 11

# TREES PROVIDE MANY USEFUL PRODUCTS



Note: Illustration does not refer to any particular tree. Not all products are obtainable from any one species.

# FORESTS — LET'S KEEP THEM



So, the forests of Western Australia provide us with many things, some that we see and some that we don't see. There is the unseen ebb and flow of nutrients, oxygen and water in the forest ecosystem. There are also complex interactions between plants and animals within the forest. Then there are the benefits that we can easily see that are provided by forests, such as timber supply, employment and recreation. It's easy to appreciate that the forests of Western Australia are a valuable **resource**.

As our population expands there is more and more pressure being put on the forests to provide the things we want. As well as

use for timber production and recreation, there is pressure to use forest land for other purposes, such as for farming, for mining and for public utilities like roads, reservoirs and powerlines.

Of course we need roads, reservoirs and powerlines, but we should place them in forests only if there is no alternative, and we should use land efficiently. For example, we could use one access way through forest for both a pipeline and a powerline instead of having two access ways.

We also need some minerals found in State forest, but the mining should be carefully planned to minimize forest disturbance.



G Peard

The construction of powerlines (below) and roads (above) in State forest are examples of the stress placed on the forest by human society. Note the dead trees near the road. They have died from jarrah dieback disease, which is spread on vehicles travelling through the forest.



To make the Collie river fresh again, areas of land around the river that were cleared of trees have been re-planted.



Wherever possible the mining operation should be directed to poorer quality forest areas or areas of forest affected by disease. After mining is completed the mine operator should always reforest the area that has been disturbed — and this already happens with some mining operations in Western Australia.

We should avoid any further use of forest land for farming. In many areas, the permanent clearing of the trees from the land can cause rivers to become salty. The water is then less useful or even completely useless for plants and animals.

It is important that we protect the forests we have from harm, and **use them wisely**. With proper care and management, our forests can be there forever, but for this to happen we must all understand and appreciate the life of the living, ever-changing forest, and value the great benefits it can provide.

This does not just apply to us here in Western Australia. Forests are part of a global resource. Forests and other natural resources such as fisheries are under increasing pressure everywhere because of growing populations all over the world. Because of this pressure, a **World Conservation Strategy** has been developed to guide countries in the management of their natural resources. For forests, the World Conservation Strategy recommends:

*managing the forests so that they give the greatest long-term benefits to people now, and at the same time caring for the forests so that they will be able to meet the needs of future generations of people.*

Forest conservation includes setting aside from harvest some parts of the forests, **wise use** of other parts for production of wood, water and other products and the restoration of disturbed areas of forest.

Here in Western Australia we are trying to do just this. We are planting trees to take the place of those we fell and we protect and manage different areas of forest to produce other forest values for the years to come.



*"Let's replenish what we take away,  
And plant a tree for W.A."*

### SOME KEY WORDS

FOREST —	a large area of land covered with a community of trees and other vegetation.
COMMUNITY —	plants and animals which live in an area and depend on each other for survival.
ENVIRONMENT —	the total surroundings (living and non-living) that affect an organism. There are two main environments — water environment and land environment.
ECOSYSTEM —	an area of living and non-living things interacting with each other to produce cycles of raw materials.
CYCLES —	the continual movement of raw materials within an ecosystem, from plants to animals, to soil, water and air.
FOOD CHAIN —	that part of the cycle of raw materials that includes living things.
HABITAT —	all the things that make up the place where an organism lives.
RESOURCE —	a reserve of a product from which we can draw when need be.
RENEWABLE —	a resource that can be restored to its original size or capacity.
REGENERATION —	the process of forest renewal, by planting or by natural reproduction.
REFORESTATION —	the regeneration of a previously forested area with forest trees.
AFFORESTATION —	the planting of forest trees, on areas of land on which forests do not normally grow.

## List of Figures in Forest Focus No. 29.

Figure	Page	
1	5	Levels in a Forest
2	7	Forests in the South-west of Western Australia
3	14	The Structure of a Tree
4	17	The Leaf Factory
5	18	Some Food Chains
6	19	The Water Cycle
7	19	The Carbon Cycle
8	19	The Nitrogen Cycle
9	22	Regeneration in a Managed Forest
10	23	Wood Substitutes and the Energy Required for their Manufacture
11	26, 27	Trees Provide Many Useful Products

### FURTHER FOREST FACTS

Information about the forests may be obtained from your school or local library, or from the Forests Department, or the Department for Conservation and the Environment.

#### Forest Focus

- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>No. 1 — Focus on the Karri Forest<br/>Karri Botanical Notes<br/>The Growing Importance of Pine</p> <p>No. 2 — Focus on Forest Conservation<br/>Invitation to the Rainbow Trail and Nearby Karri Forest<br/>Eucalypts — A Simplified Key to 17 W.A. Species</p> <p>No. 3 — Focus on Controlled Burning for Forest Conservation<br/>Wandoo Botanical Notes<br/>Hauling Past and Present</p> <p>No. 4 — Focus on Loss of Productive Forest<br/>Jarrah Root Rot<br/>Trees for Country Areas</p> <p>No. 5 — Focus on \$30 Million Integrated Forest Products Complex<br/>Summary of Main Plantation Development Operations for Blackwood Valley<br/>Forest Recreation</p> <p>No. 6 — Focus on the Jarrah Forest<br/>Bushfire Survival<br/>Trees of the Arid Zone — Goldfields<br/>Sand Mallee</p> <p>No. 7 — Early History of Jarrahdale<br/>Birds of the Jarrah Forest<br/>Flight Line One<br/>Prescribed Burning in W.A. Forests</p> <p>No. 8 — Focus on Shifting Sands<br/>Dryandra An Ecological Oasis</p> <p>No. 9 — Natural Rounds — Here to Stay —<br/>The Push-Button Age<br/>Timber Industry and the National Economy</p> <p>No. 10 — Focus on a New Concept in Forestry —<br/>Fauna Priority Areas<br/>Some Ecological Aspects of Jarrah Dieback</p> <p>No. 11 — Focus on Land Use Conflicts in the Northern Jarrah Forest</p> <p>No. 12 — Focus on the Marri Woodchip Project</p> <p>No. 13 — Fire in the South-West Forest Ecosystems<br/>Bibbulmun Bushwalking Track</p> <p>No. 14 — Focus on Jarrah Dieback — A Threat to W.A.'s Unique Jarrah Forests</p> | <p>No. 15 — Focus on Inland Eucalypts — A Valuable Biological Resource<br/>Recreation Characteristics of Western Australian Forests</p> <p>No. 16 — Focus on Sunklands Multiple Use Land Management</p> <p>No. 17 — Focus on Forest Policy<br/>Karri Life Cycle</p> <p>No. 18 — Focus on Southern Recreation and Conservation Management</p> <p>No. 19 — Managing Jarrah Forest Catchments</p> <p>No. 20 — Agro-forestry Trials in the South-West</p> <p>No. 21 — Dieback Hygiene ... first steps<br/>An Ecological Approach to the Control of Jarrah Dieback</p> <p>No. 22 — Focus on Northern Jarrah Forest Conservation and Recreation Areas</p> <p>No. 23 — A Sad Day for Native Fauna<br/>Tree Lookouts — A Unique Chapter in Western Australian History<br/>The Remarkable Whim</p> <p>No. 24 — Aircraft of the Forests<br/>Clear Felling and Native Fauna in South-West Forests<br/>Re-Cycled Towns</p> <p>No. 25 — Bush Pasture in the South-West<br/>Fire Management for Forest Fauna<br/>Summer Canoeing</p> <p>No. 26 — On Rational Grounds — a precis of a study on the W.A. Murray River<br/>Playing Possum</p> <p>No. 27 — Towards the Greening of Australia<br/>From Germinants to Giants — The Manjimup Nursery<br/>Trees for Badgingarra<br/>New Light on the Numbat<br/>Sites for Sore Eyes</p> <p>No. 28 — Pilbara Gardens<br/>Pioneers: A Profile<br/>Timber for the Future — Pine<br/>Notable Trees of Perth.</p> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Note: Forest Focus Nos. 1-21 are out of print but are still available in your school library.

## Arbor Day . . . day of trees



W. Edgecombe.

*Tuning-in to trees on Arbor Day. School students from all over Western Australia release balloons containing seeds of thousands of trees.*



## FOREST FOCUS 29 - TUNING-IN TO TREES

### NOTES FOR TEACHERS

Forest Focus 29 has been designed for use in Western Australian schools. It contains an introduction, five chapters, and keys to terminology, figures and further reading.

Forest Focus 29 encourages students to "tune-in" to trees and forests at a personal level. It attempts to reinforce the concept of the individual interacting with the whole. Hence, individual trees are connected with whole forests in W. A. and the world, particular botanical facts are connected with broader ideas of resource management, the impact of a single person on a forest is connected with the impact that whole societies can have on a resource.

Please use Forest Focus in the classroom as a non-consumable resource book. Accompanying is a model set of worksheets, one worksheet for each chapter. The worksheets are intended as suggestions for lessons, and have been made in conjunction with officers of the Education Department and the Forests Department of W. A. There is no copyright on the worksheets and you are welcome to photocopy them for distribution to students. The answers to the questions at the beginning of the worksheets can be found directly in the text or the diagrams. The questions become more difficult towards the ends of the sheets. Research questions encourage students to use other resource material. Personal experience of trees and forests is encouraged whenever possible.

---

## FOREST FOCUS 29 WORKSHEET

### CHAPTER ONE: WHAT IS A FOREST?

- 1 What is a forest? What do you think a community is?
- 2 How many hectares of forest are there in W. A.? What percentage of the land mass of W. A. is this? How do these figures compare with a country like Japan?
- 3 Referring to the map on page 7, where do you find karri forest?
- 4 What major types of trees do you find growing in the Donnybrook Sunkland?
- 5 Look at the series of photographs on page 8. What is the fruit of a Eucalypt called?
- 6 Before agriculture took over, what was the major type of forest found in the wheatbelt?
- 7 What type of trees grow in the Valley of the Giants?
- 8 Refer to Fig. 1, page 5. What are the levels in a forest? List some of the ways they help each other survive. What types of animals would live in each of the three levels?
- 9 Why do you think that the trees in the Kimberley have more in common with the trees of Asia than they have with those in the rest of Australia?
- 10 How has European settlement influenced or changed the Tuart forests of the south-west?



RESEARCH QUESTIONS:

1

How are jarrah trees adapted to growing in harsh, gravelly soils?

2

List some of the ways that Eucalypts are adapted to their environment.

3

Pine trees are not native to W. A. Why then, do we grow them?

---

## FOREST FOCUS 29 WORKSHEET

### CHAPTER TWO: HOW A TREE LIVES AND GROWS

- 1 List the parts of a tree and the functions they perform.
- 2 How can you tell the age of a tree?
- 3 What three important processes are carried on in the leaves of trees and other green plants?
- 4 What are the "raw materials" that are used by plants in photosynthesis?
- 5 What is the difference between a fertile soil and an infertile soil?
- 6 Why could ringbarking kill a tree?
- 7 Growth rings in a tree are not evenly spaced. Why do you think this is so?

### RESEARCH QUESTIONS:

- 1 Trace the movement of water through a tree from the point where it enters to the point where it leaves. How can water climb to the height that it does in our tallest trees?
  - 2 Carbon dioxide only makes up about 1% of the Earth's atmosphere. If we removed all the forests in the world, what effect do you think this would have on the amount of carbon dioxide in the atmosphere? Why?
-

## FOREST FOCUS 29 WORKSHEET

### CHAPTER THREE; WHAT TREES PROVIDE

1

What is an ecosystem?

2

What is a habitat? What type of animals have a habitat in the forest?

3

Study the food web, Figure 5, page 18, and the cycles in Figures 6, 7 and 8 on page 19. Use these to answer the following questions.

- a. How are animals dependent upon green plants for food?
- b. What do trees take in from the soil?
- c. How does each of these things eventually get back to the soil?
- d. What do trees take from the air we breathe?
- e. What do trees add to the air we breathe?

4

What is meant when we say that the forest is dynamic? Give an example.

5

Look at the diagram of the water cycle (Fig. 6). Imagine the water cycle in your area. What effect do you and other people have on the water cycle in your area?

6

Imagine that your backyard is two hectares of dense forest. This is the only forest in your neighbourhood. Under what circumstances would you sell it? What things would you expect to gain by selling it, and what things would you lose?

7

Arbor Day is the "day of trees" and it is often celebrated by the planting of trees. How could this custom affect the environment you live in?

---

## FOREST FOCUS 29 WORKSHEET

### CHAPTER FOUR: PEOPLE USE FORESTS

1

List all the things in your classroom that are made or derived from wood.

2

People have been using forests to supply timber for thousands of years. In that time many materials have been developed that can be substituted for wood, yet wood still plays an important role in our society. Why? (Refer to Fig. 10).

3

What jobs are related to forests?

4

Why are trees called a renewable resource?

5

Study page 23 and the list of keywords at the back of Forest Focus. There are three ways to renew a forest. What are they?

6

When we reforest an area is the ecosystem automatically renewed? Explain.

7

What would happen if there were no longer a demand for timber?

8

What is a managed forest?

9

Forest regeneration occurs naturally all the time. How does natural regeneration differ from regeneration in a managed forest?



RESEARCH QUESTIONS:

1

Find out where the major timber towns are located in W. A. How does their location compare with the map of major forest types on page 7? How is the timber produced in these towns used?

2

Choose an animal that lives in the forest. How do different groups of people (loggers, tourists, foresters) affect its living conditions?

---

---

3

4

5

6

7

8

9



## FOREST FOCUS 29 WORKSHEET

### CHAPTER FIVE: FORESTS - LET'S KEEP THEM

1

What is the World Conservation Strategy?

2

Look at the illustration on page 28 keeping in mind the World Conservation Strategy. How would you care for a forest in order to be a "superhero"?

3

The jarrah forests of the Darling Range are used for many things, for example, wood supply, honey production, mineral supply. List as many uses of the forest as you can. Are they compatible with each other and with the conservation of the jarrah forest? Why?

4

Some rivers in W. A. have become too salty to drink. Where are these rivers and why are they salty? How could this problem be corrected?

5

You have to put a telephone line through a forest. How could this be done with minimal damage to the vegetation?

### RESEARCH QUESTIONS:

1

The picture at the top of page 29 shows the effect that dieback disease has on the jarrah forest. Find out what the disease is and how it spreads. How is human presence in the jarrah forest increasing the spread of dieback? What measures are being taken to prevent it from spreading further?

2

How are forests used in developed countries, such as the U.S.A., Germany and Japan? How are they used in developing countries such as Malaysia or the countries of Africa and South America? Why do you think that the World Conservation Strategy was proposed?

---

---