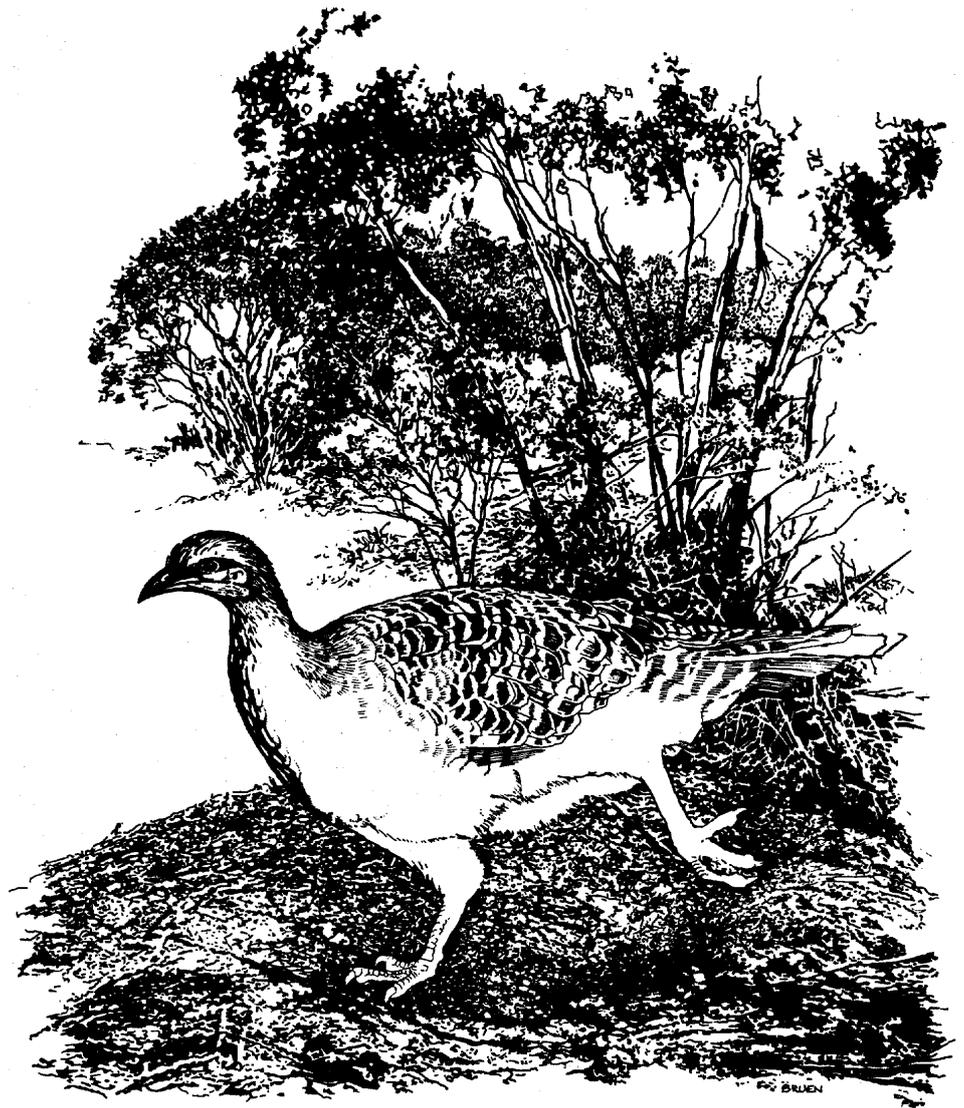


Australian National Botanic Gardens

# Mallee plants

Adapting to hot and dry conditions



Discover...



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# *The Mallee*

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# Planning the Excursion

This resource is intended to support a teacher guided visit to the Gardens or to develop post visit activities for your classroom. The concepts can be adapted to all levels, and the activities tailored to the time available in the Gardens.

## *About the Questions*

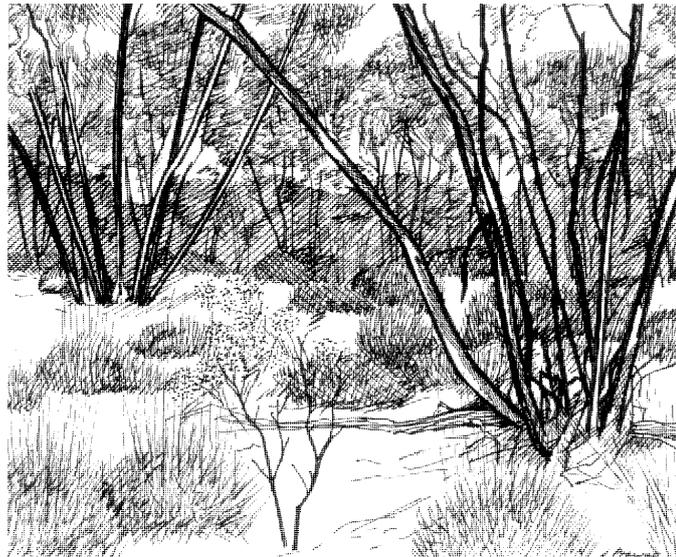
Questions are;

- open-ended so that students are encouraged to observe and think
- intended as mind joggers for teachers to develop their own questions based on the outcomes they want
- for use onsite and in post-visit activities
- written for adult and may need to be modified for your students

## **Purpose**

Plants of the Mallee Shrublands activities focus on investigating some adaptations of plants to the semi-arid Mallee environment with its distinctive soils and climatic conditions.

*Typical mallee growth –  
multistems from  
lignotubers*



# Mallee

Mallee is an Aboriginal name for a group of eucalypts which grow to a height of 2 - 9 metres and have many stems arising from a swollen woody base known as a lignotuber. They have an umbrella-like leaf canopy and the trees shade 30-70% of the ground.

Several layers of vegetation grow in association with Mallee eucalypts, from large shrubs up to 3 m high to very small grasses and forbs, and ephemerals. There is a lot of bare ground and any leaf litter decomposes slowly in the dry conditions.

Mallee is also a name given to the type of vegetation community in which the Mallee eucalypts grow. Mallee areas are generally very flat, and without hills or tall trees it is very easy to become lost. Some areas of Mallee have expanses of vegetated sand dunes. This probably accounts for the fear of the Mallee felt by many early explorers and settlers.

The Mallee is a complex and sensitive environment. It contains a great diversity of organisms many of which are under threat. Since European settlement one third of all mammal species have disappeared from the Mallee of south-eastern Australia more than a dozen plant species are now considered threatened or rare as a result of clearing and grazing.

Mallee soil is generally sandy and in some areas contains a high proportion of lime. In other areas the soil is quite salty and/or very shallow. It is often covered by a 'crust' of lichens and algae.

The soils of the Mallee Shrubland section of the Australian National Botanic Gardens have been specially prepared to suit these plants by the addition of sand and the alteration of the soil pH (acidity). The site is very well drained. There is another Mallee vegetation site in the Gardens at Section 100. It is well worth visiting if time permits.

## Distribution

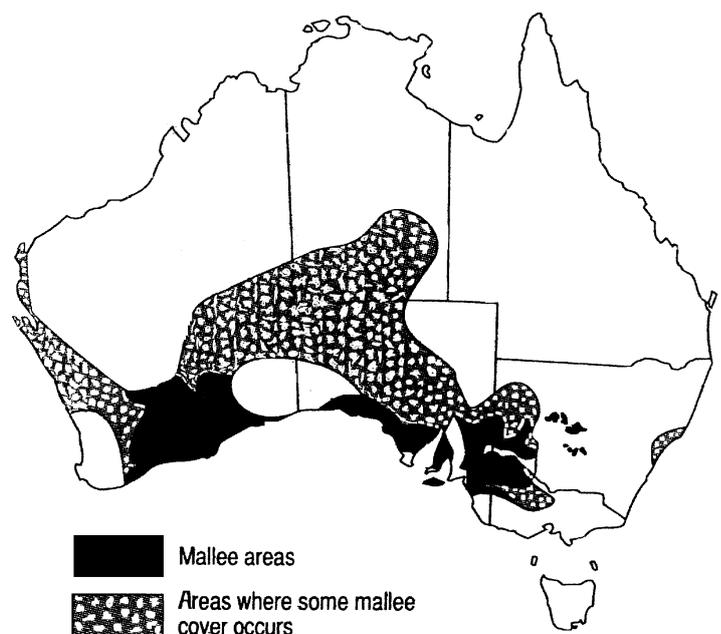
Mallee shrublands occur in southern Australia, as shown on the map.

## Climate

The Mallee Shrublands are dry (semi-arid) with a rainfall of 225-400 mm per year. Fires are common in Mallee areas.

Winter in these areas is short, cool and at times quite wet, whereas the summer is long, hot and dry.

The plants in cultivation at the Gardens must cope with colder, longer winters and shorter summers which can be quite wet.



*Distribution of Mallee Shrublands*

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## **Aboriginal People in the Victorian Mallee**

Groups of aboriginal people living in what is now the Swan Hill area near the Murray River moved into the 'Nowie' or Sunset Country (the Mallee) after rain. They moved from one water source to another. A large seasonal camp was established at the north-west point of Lake Tyrell and many family groups gathered there. The hearths remaining today are spread over at least a square kilometre. Other signs of occupation are found around Lake Tyrell and many of the smaller Mallee lakes. When the lakes dried, food became scarce and groups would move back to their more permanent river camps.

Aboriginal people knew how to obtain water from the trees of the Mallee. One way was to dig a trench around the base of a certain type of tree, locating the roots which ran out from just under the surface of the soil. They then removed the roots of the tree, cut them into pieces up to a metre long and stood them against the tree. The water draining from these pieces was collected.

Groups of aboriginal people living in the area are the Boora Boora, Wamba Wamba and the Watty Watty.

## **European settlement**

The first settlers had very little interest in the Mallee. Their sheep and cattle grazed on nearby grasslands. Some grazed the Mallee but it could only support one sheep to 12 hectares.

In the late 1800s large scale clearing of the Mallee began. Ploughing was extremely difficult as the ploughs were continually being broken by the solid rock-like "Mallee roots" known as lignotubers. Many farmers did not persist.

## **Stump-jump plough**

The stump-jump plough invented in 1876 changed the landscape. It jumped over the Mallee roots which remained in the ground which meant farmers could prepare large areas of Mallee for crop growing. The plough was invented by Mr R. Smith of the Yorke Peninsula in South Australia.

It wasn't long before the farmers had another problem - the amazing ability of Mallee eucalypts to regenerate from their rootstocks. New stems grew as quickly as the wheat and no matter how frequently they were cut off they were replaced.

Digging out individual roots was far too expensive in time and labour. Some farmers attempted to grow special long-strawed varieties of wheat. The ears of wheat would grow above the Mallee shoots; they could then be harvested and the thick stubble which was produced could be burned after the harvest. It was hoped this burning would destroy the Mallee stems (shoots) along with the stubble. However, after burning, the Mallee root-stocks produced even more vigorous shoots.

During the First World War the struggle to clear and tame the Mallee country continued, particularly in South Australia and Victoria. By cutting and burning after every harvest the farmers managed to keep the Mallee shoots below the level of the growing wheat and more and more land was opened up for wheat farming.

Today at least 75% of the original Mallee vegetation in South Australia and about 60 – 65% in Victoria has been cleared and developed for farming.

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## Mallee roots for firewood

The dead Mallee roots were left in huge piles on the land which provided shelter for rabbits which fed on the wheat crops. To remove the rabbits' breeding places the farmers burnt the Mallee roots. The roots burned evenly and slowly with a very hot, clean flame; perfect for firewood. In the 1930s Great Depression farmers earned money selling Mallee roots to people in the cities for firewood. This continued until recent years.

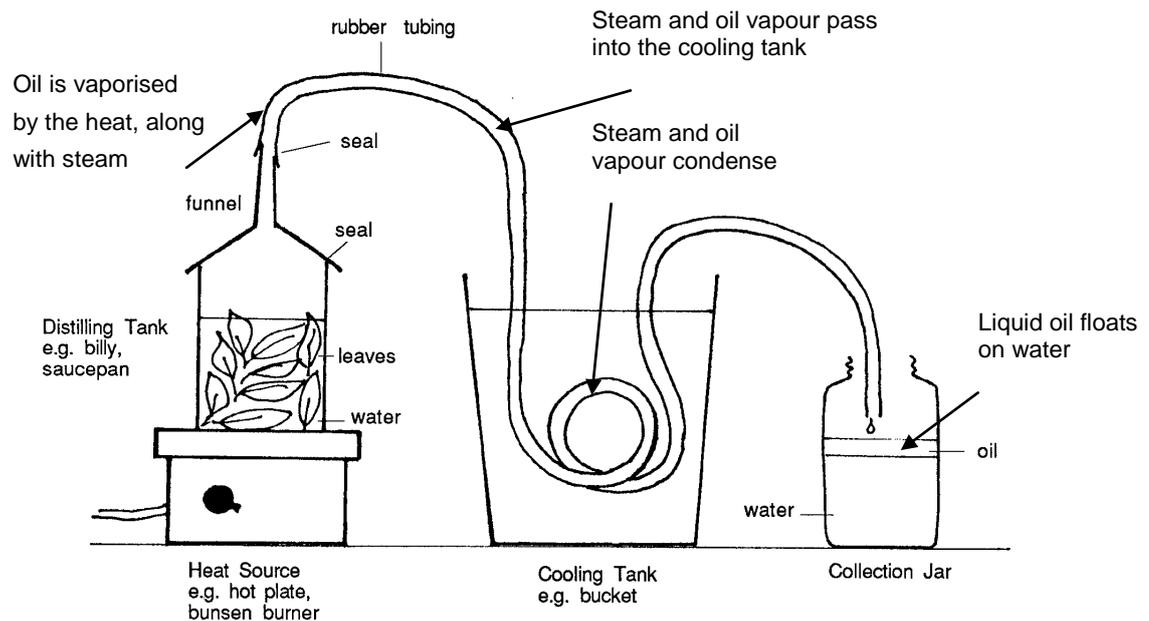
## Soil erosion

Problems which surfaced in the early 1930s included serious wind erosion caused by removal of the covering vegetation and overuse of the land for cropping. The 'crust' of lichen, fungi and cyanobacteria which covered much of the soil was disturbed, exposing the soil to the agents of erosion. The fertility of the soil was greatly reduced as large quantities of the surface layer were blown away by the wind.

## Oil from eucalypts

Most of us are familiar with the fragrance of *Eucalyptus* oil when we crush *Eucalyptus* leaves or walk in the bush on a hot day. We can even see the glands containing the oil as little dots when we hold a *Eucalyptus* leaf up to the light.

Extraction of oil from eucalypt leaves has gone on in Australia for many years. Trees used for this purpose include *Eucalyptus viridis* (Green Mallee) and *Eucalyptus polybractea* (Blue Mallee).



Extraction of *Eucalyptus* Oil

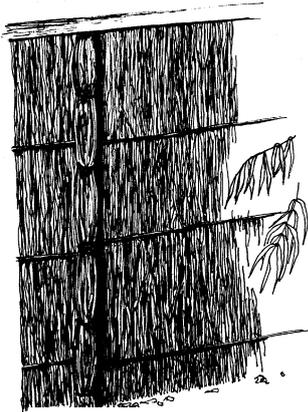
*Eucalyptus* oil is distilled by a simple process in which water is boiled to form steam which passes through the leaves, vaporising the oil in them. The mixture of oil and water is then cooled and collected. The oil settles on top of the water and can be collected when the water is siphoned off.

The advantage of using Mallee as the source of leaves is that there can be regular harvesting of regrowth from the lignotubers. The leaf crop is thus kept low and accessible. The leaves can even be harvested with mechanical equipment designed for other crops.

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## Broombush harvesting



Section of Broombush fence

Brush fencing has been a popular form of domestic fence throughout Southern Australia since the depression years of the 1930s. Commercial Broombush harvesting began in the Victorian Mallee in 1972, after South Australia placed restrictions on this activity. Broombush (*Melaleuca uncinata*) is used for luxury brush fencing.

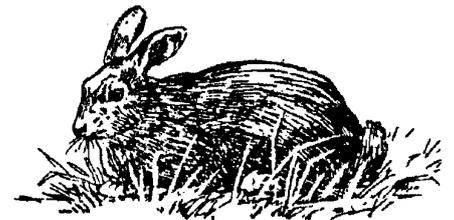
As the brush-cutters moved into sensitive heathlands, their vehicles caused irreparable damage. The tracks increase erosion and allow easy introduction of weeds and feral animals. The Malleefowl and Pygmy Possum became threatened. After public protest commercial harvesting was phased out in Mallee public lands in 1990.

## Grazing

The Mallee has been heavily grazed by sheep and cattle and those grasses, shrubs and trees most palatable to them have been greatly reduced and in some areas eliminated. At the same time the numbers of spiky and unpalatable shrubs have increased.

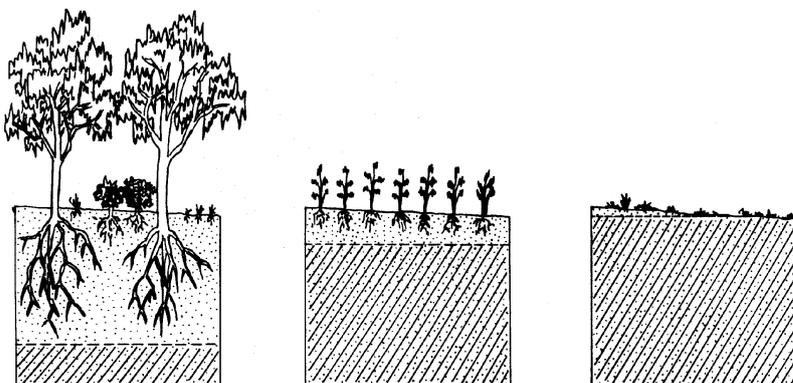
## Feral animals

Rabbits have had a devastating effect on the Mallee. They devour large quantities of saltbush and chew the bark of trees such as *Callitris* (Cypress pines). Foxes and feral cats kill many native animals such as small marsupials, native rodents and Malleefowl. The effects of feral animals can be very obvious. However, it is the subtle changes they cause which threatens many sensitive species.



## Salting of the soil

Soil salting is a serious problem in parts of the Mallee. The roots of plants constantly remove water from the soil as they transpire and grow. This means the groundwater level remains deep in the subsoil. When the trees are removed and replaced with crops, the crops remove water from the soil at a much slower rate. The groundwater level rises and this water brings with it salts from the soil. When the groundwater gets close enough to the surface to be evaporated the dissolved salts are left behind in the surface soil. As more and more water rises to the surface and evaporates, more and more salt accumulates at the surface.



----- = water table

Irrigation of crops increases the amount of water in the soil and speeds up the rise of groundwater and salt to the surface.

# Adaptations of Mallee Plants

Plants of the Mallee shrublands have special adaptations to help them withstand the dry conditions and high temperatures. Most of these adaptations are shown by their leaves because this is where most water is lost.

Besides physical characteristics which we can easily observe there are a number of physiological adaptations that are more complex to understand. Stomates, the pores in leaves, open to allow the exchange of oxygen and carbon dioxide with the atmosphere. As a consequence of opening leaves lose water by evaporation. Stomates close when the water loss from the leaf becomes too high e.g. eucalypts open their stomates in the early morning but generally close them by late morning on a dry day. Some succulent plants can actually absorb water from the atmosphere in the early mornings when dew forms.

Another physiological adaptation involves the ability to tolerate salty soil conditions. Some plants including *Rhagodia* species, *Enchylaena* species and many succulents absorb salty water through their root system and excrete it as deposits from the stomates in the leaves.

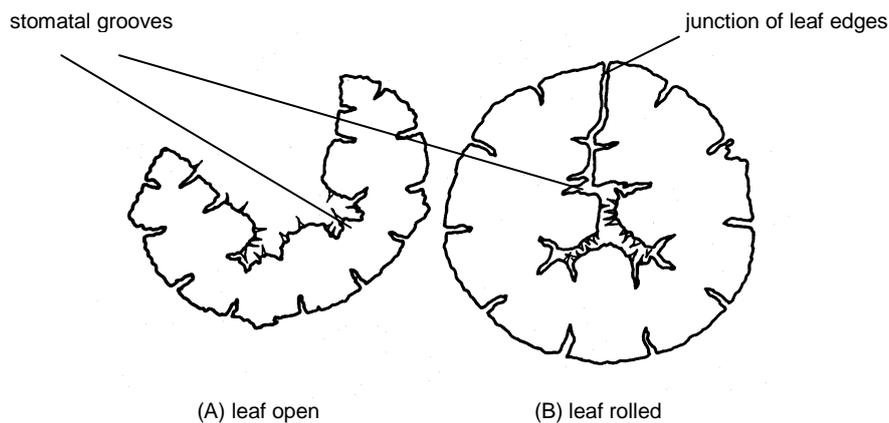
## 1. Xerophytes – strategies for surviving in dry climates

Mallee plants show many adaptations to **survive dry climates** such as;

### Reducing the surface area of their leaves to minimise water loss

- (a) **tiny leaves** e.g. *Callitris* species (Cypress Pines), *Phebalium* species
- (b) **long narrow leaves** that reduce exposure to the hot sun e.g. *Melaleuca* species, or **needle shaped leaves** e.g. *Hakea* species
- (c) **rolling their leaves** during the hottest part of the day e.g. grasses such as *Triodia* species (porcupine grasses), *Phebalium* species, *Dianella* species (flax lilies).

When the leaf is rolled fewer stomatal grooves are exposed to the drying atmosphere.



Section through a leaf of *Triodia* species

### Leaves which reflect heat and light

Some plants have shiny leaves, with waxy cuticles that reflect heat e.g. *Eucalyptus* species  
Light coloured leaves, especially if they are hairy, reflect significantly more radiant heat energy than do smooth leaves e.g. *Rhagodia* species, *Eremophila* (Emu Bush).

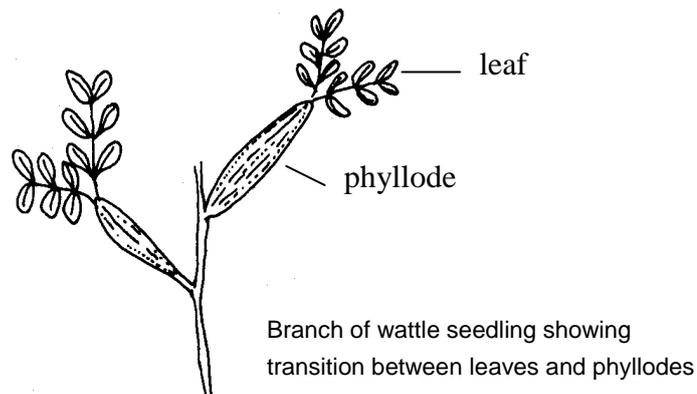
These fine, white hairs also decrease the air movement close to the surface of the plant, thus reducing water loss by evaporation. More stomates are located on the under surfaces of leaves and it is on this surface that most hairs are found e.g. *Phebalium* species, *Lasiopetalum* species, *Rhagodia* species

### Leaves which hang vertically and edge-on to the sun

This reduces the total surface area exposed to the sun e.g. *Lasiopetalum* species, *Eucalyptus* species

### Reduced numbers of leaves

In some plants e.g. many species of *Acacia*, flattened leaf stems called **phyllodes** have replaced leaves. In others e.g. *Bossiaea* a flattened stem or **cladode** takes on the function of the leaves and the leaves themselves are reduced to tiny spikes. The phyllodes and cladodes do not lose as much water by evaporation as leaves do because they have far fewer stomates.



### Very extensive and deep root systems

Many plants have a tap root to reach deep for soil water, and an extensive surface system to absorb water from any small falls of rain. This accounts for the “bare” spaces between eucalypts in Mallee areas. The surface roots out-compete other plants and reduce their chances of becoming established.

*Triodia* species are also examples of plants that have a very extensive and deep root system. They also grow in a manner that provides total shade for the soil underneath, and hence reduces its temperature, and reduces water loss after rain or heavy dew.

## 3. Sclerophylls

These plants have hard, leathery leaves which reduce wilting and thick waxy cuticles which reduce water loss e.g. *Eucalyptus* species

## 4. Succulents

These plants store water in fleshy stems or leaves e.g. *Enchylaena* species, *Carpobrotus* (Pigface), *Myoporum* species (Boobiolla) and *Einadia* species and *Atriplex* species (Saltbushes).

## 5. Ephemerals or Annuals

Ephemerals are plants which are highly opportunistic. They can complete their life cycles very quickly and set large quantities of seed which can resist heat and drought for long periods. The seeds germinate quickly when rain comes e.g. *Rhodanthe diffusa*

Annuals e.g. *Senecio* species, *Bracteantha* species (Paper Daisies) often occur where winter rains are more regular. They germinate, grow, flower, set seed for the following year and die off in summer.



*Bracteantha bracteata* (Paper Daisy)

## 6. Other adaptations

Some coastal Mallee plants, like coastal *Goodenia* species form low, dense bushes; the salt-laden winds blow over the tops. The leaves of these salt tolerators have a thick cuticle. The lower leaves are protected from the salty air.

Some plants produce hard, woody fruits that protect the seeds from drying out, e.g. eucalypt capsules, Cypress Pine cones.

Some plants are parasitic and do not have to depend on their own root systems for finding water, e.g. *Exocarpos* species, mistletoes, Quandongs.

## 7. Special Features of the Mallee Eucalypts



*Epicormic Shoot*

Mallee eucalypts are specially adapted to cope with fire as well as damage caused by other agents such as frost and attempted clearing.

They shoot vigorously from the **lignotuber**. This is a large underground woody rootstock which stores water and from which new branches can grow when the tree is damaged. They also shoot from dormant (epicormic) shoots which occur just below the bark of the lignotuber, trunks and branches. Growth from these dormant shoots accounts for the appearance of bright green bushy foliage along main branches of eucalypts shortly after a bushfire.

# Student Discussion Questions and Activities

The sign at the beginning of the Mallee Shrublands walk introduces the Mallee and shows the areas of Australia where it is found. **Mark these areas on the map of Australia.**

*(See map at beginning of these notes)*

1. The soil in this area of the Gardens is highly modified, with large amounts of sandy material brought in from the real mallee regions. The plantings have also been less dense than in other parts of the Gardens. **Suggest why these measures have been taken.**

*(Sandy Mallee soils are porous and do not hold water well; Mallee plants cannot tolerate heavy, water-logged soils. In the Mallee plants tend to be spread out, giving each one greater space to capture surface water with their widespread surface roots.)*
2. ***Phebalium*** species, like many Mallee shrubs, are well adapted to the hot, dry conditions of summer. The leaves are small, hairy underneath and curled over at the edges. **Suggest how each of these features might help it survive.**

*(Small – means small surface area, so reduced water loss and reduced heat gain from hot sun.)*

*(Hairs – reduce air movement near leaf surface so reducing water loss from evaporation.)*

*(Curled leaves – reduce air movement around under surface of leaf, reducing water loss; less area exposed to direct sun.)*
3. Annual plants are common in Mallee areas. Some plants, like ***Senecio*** species and ***Bracteantha*** species (Everlastings) are drought evaders. Find out the meanings of the words annual, ephemeral and drought-evader. **Suggest how these plants are well adapted to Mallee conditions.**

*(Ephemerals are opportunistic in that they germinate, flower and set seed in rapid succession when conditions are suitable ie there's enough moisture about. The seeds are usually dispersed by wind and remain dormant until the next period of wet. Hence the species survive. Annuals rely on more regular rains each year and often take longer to complete their life cycles.)*
4. Many plants, including some of the ***Goodenia*** species grow along the southern coastal Mallee areas of Australia and are subject to strong winds and sea spray. **Suggest how they cope with this situation.**

*(waxy cuticle so that salt doesn't penetrate, grow as low spreading bushes - wind goes over the top and the majority of leaves underneath are protected.)*
5. ***Enchylaena tomentosa*** (Ruby Saltbush) is one of the many different kinds of “saltbushes”. It persists throughout the year (perennial). **Suggest a feature that assists it to survive in the driest times.**

*(Succulent – holds a lot of water; hairy – reduced air movement near surface and so reduced water loss.)*
6. ***Triodia scariosa*** (Porcupine Grass) provides excellent habitat for many animals including reptiles. **Suggest why.**

*(Physical protection, cool shaded soil underneath and hence reduced drying out of the animals.)*

If you have a hand lens look closely at the shape of the leaves. **Suggest how the shape is useful in allowing this plant to survive in a dry environment?**

*(Rolling leaves reduces surface area for water loss. Sharp spines not attractive to herbivores.)*

7. ***Melaleuca uncinata*** (Broombush) gets its name from its branches which are used to make brush fencing, still popular in Adelaide and Melbourne. **Suggest how its leaves allow it to cope with the Mallee environment.**  
*(Long, narrow – reduced exposure to direct sun so don't heat up. They have a large surface area because of the length, and this helps to increase heat loss from the area not in direct sun.)*
8. ***Exocarpos*** species (native cherry) is semi-parasitic, attaching its roots to those of nearby plants. **How is this advantageous?**  
*(It doesn't have to find its own water and mineral nutrients.)*
9. ***Lasiopetalum behrii*** exhibits a set of adaptations that help it to survive. **Suggest some.**  
*(Drooping leaves and curved edges – reduces surface area exposed to the sun; reducing water loss. Leaf hairs on under surface – reduced air movement and therefore reduced water loss.)*
10. ***Callitris verrucosa*** (Scrub Cypress Pine) is an example of a conifer, a tree which bears cones. Conifers do not have flowers. The seeds are protected within the scales of the cone. **Suggest why the cone is so thick and woody.**  
*(protection for seed from drying out and being eaten.)*

Its leaves are very tiny and wrap themselves around the green stems. **Look closely at the leaves and suggest why mature pines tend to thrive in Mallee areas.**

*(decreased exposure of stomates to the air so less water loss)*

11. ***Eucalyptus nortonii*** (Large-leaved Box) can be a huge tree of the open woodlands and forest. The trees in the Mallee section have lignotubers and many stems growing from them. Notice other Mallee eucalypts nearby. Lignotubers enable the plants to regrow after fire, drought or other damage. **Suggest how this can happen.**  
*(The damage triggers special cells in the lignotuber to start producing new stems and leaves. The lignotuber holds a large store of food to provide the energy for this to occur.)*

Notice how the leaves hang vertically. **How might this help the tree withstand the harsh conditions of the Mallee?**

*(reduced surface area exposed to the sun's heat, leaf doesn't get so hot, reducing water loss.)*

12. ***Acacia havilandiorum*** (Needle Wattle) only has complete leaves when it is young. What you see here are really flattened leaf stalks called phyllodes. Phyllodes have far fewer stomates than do leaves. **How does this help the plant survive long periods of heat and drought?**  
*(less pores through which to lose water.)*

There might be some seed pods or seeds on the ground. The seeds of many wattles remain viable for many years and can survive fires which occur periodically in the Mallee. **How do they accomplish this?**

*(hard, thick testa (seed coat) which insulates embryo in the seed from heat and dehydration.)*

They often germinate after the first rains following a fire. **Explain how this happens and why it is advantageous to do so.**

*(Heat of the fire causes small cracks/weaknesses in the seed coat enabling water to penetrate. After a fire there is little or no competition from other plants for soil water, light or minerals from the ash bed.)*

13. ***Bossiaea walkeri*** (Cactus Bossia), unlike *Acacia havelandiorum*, does have true leaves but they are reduced to tiny scales. These flattened stems are called cladodes. **What is the adaptive value of having such tiny leaves?**

*(very few stomates, so very little water loss.)*

14. ***Melaleuca lanceolata*** is widespread in the Mallee. It tolerates salty soil conditions, indicating that there are probably many more adaptations that we cannot easily observe. Many of these are physiological and relate to the chemistry of life within the plant. Many Mallee species, including melaleucas and eucalypts produce enormous amounts of very fine seed within hard woody fruits. **Suggest how these factors might be useful for a Mallee plant.**

*(many seeds – ensures some will survive (from ants, birds, other foragers);  
very small seeds – means they can be widely dispersed by wind and some will find a suitable microhabitat;*

*woody fruits – protection from fire, foragers and drying out.)*

15. ***Rhagodia spinescens*** (a Saltbush) has distinctive grey leaves. **How is this useful for living in hot conditions?**

*(reflects heat and decreases evaporative loss)*

In the Mallee these leaves often have salt encrusted on the under-surface, yet there might not be a salt lake nearby. **Explain.**

*(tolerates salty ground water and excretes it through stomates in leaves)*

Note the under-surface of these leaves is quite hairy. **How is this an advantage?**

*(reflects heat, reduces air movement around stomates and reduces water loss)*



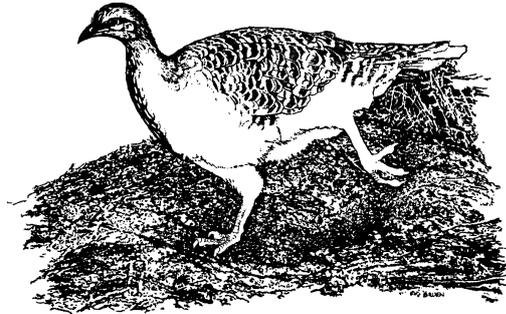
# The Malleefowl

## Description

The Malleefowl or Lowan (*Leipoa ocellata*) is about the size of a large domestic hen, shades of grey and brown above and white underneath. The back feathers have black and white crossbars and a prominent black stripe runs along the breast.

It prefers to walk or run away from danger, but its flight is rapid when it is cornered.

Although seldom heard, the Malleefowl has a loud, booming call, and is the only mound building bird to live in a dry area.



## Habitat

Mallee fowl live in dry areas of woodland and Mallee, and even in the desert, in New South Wales, Victoria, South Australia and Western Australia.



*Area of Mallee Shrubland*

## Food

Seeds (particularly *Acacia* species), berries and tubers are favourite foods but insects are also eaten. The birds search for food amongst the leaf litter.

## Mound building

The male digs a hole in the soil nearly a metre deep and 2 metres wide. This is usually done in sandy soil and the work is relatively easy. Leaf litter from around the nest is scraped into the hole, thus filling it with a mixture of leaves, twigs and sand. The bird can drag litter from up to 50 metres around the nest site and the ground nearby becomes quite bare.

The construction of the nest begins early in winter. The male does most of the building and caring for the nest, rarely moving more than 300 metres from it. With the winter rains, the leaf litter in the nest becomes soaked and by August decay begins and the temperature of the mound rises (as happens in a compost heap). The male then digs out an egg chamber in the top of the nest. This is a hole 30 cm wide by 60 cm deep. Sticks are removed and the hole is

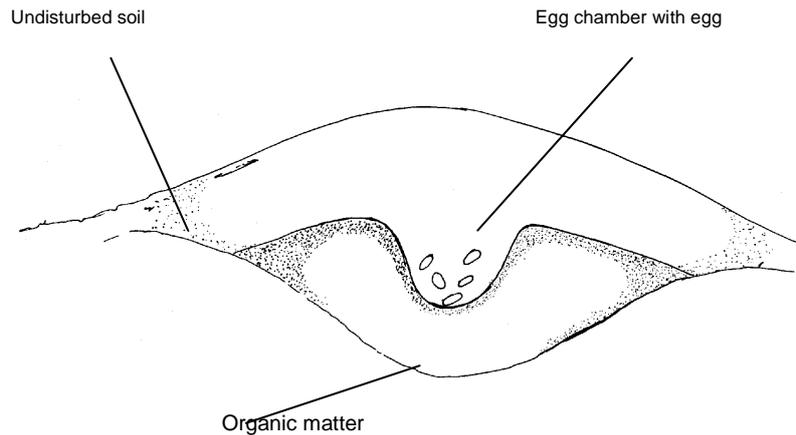
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re-filled with a mixture of broken leaves and soil. Soil is then heaped back over the nest to form a mound until it has a height of 1 metre and a diameter of up to 6 metres. If there is no rain, the Malleefowl will not nest.

While the male organises the nest mound the female prepares herself to lay the large eggs by eating more food. When she is ready to lay, the egg chamber of the mound is opened by the male. After each thin-shelled egg is laid the male carefully covers it with soil.

A very large egg, weighing about 10% of her body weight, is produced about once a week on average and the final number of eggs laid depends on the season. Between 6 and 30 eggs are laid in a season.



*Cross section of a Malleefowl mound*

The male has the job of keeping the egg chamber at a constant temperature of 33°C. This is quite a challenge when the air temperature can range from below freezing at night to more than 38°C during the day.

In order to achieve the required stable temperature, the male tests the temperature of the mound each morning by pushing his beak into the soil. The temperature is measured with the lining of the mouth or the tongue. If too hot, the bird opens the mound in the early morning to cool it down. In the cooler weather of autumn the mound is opened around mid-day and the sun's energy warms it.



*Malleefowl chick*

Each egg takes 7-9 weeks to incubate and after hatching the well-developed chick must push its way to the surface. The chick emerges from the mound dry and fluffy and after a short rest walks swiftly off into the surrounding scrub. It doesn't recognise its parents and can fend for itself as soon as it leaves the mound.

## Predators

Foxes are a great threat to the Malleefowl and they are feared by the adult birds. The native goannas, hawks and dingoes also eat them.

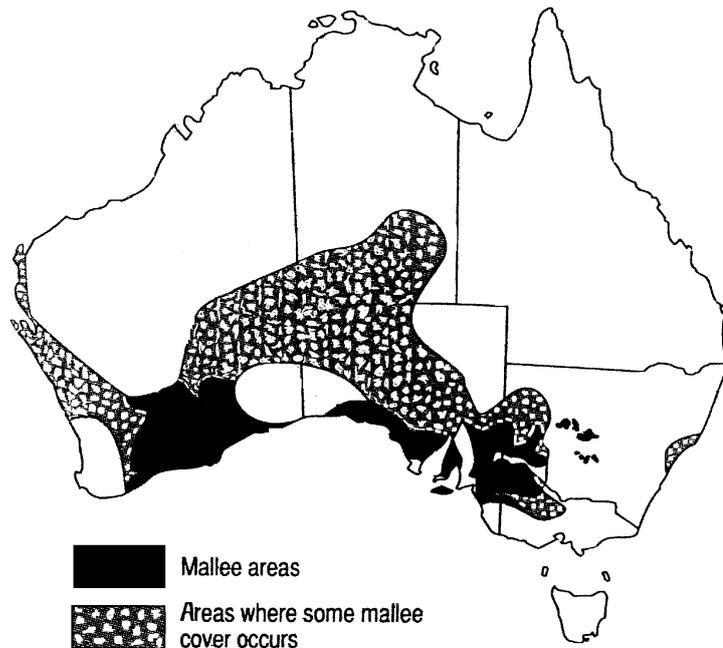
## Life Cycle

Birds are mature at 2 years and may live for 25 years. They live singly or in pairs.

## Conservation Status of the Malleefowl

Australia-wide the Malleefowl is considered VULNERABLE. Its conservation depends on active management of habitat areas.

## Distribution of the Malleefowl



*Distribution of the Malleefowl : past and present.  
Solid area- present distribution; stippled area- prior distribution.  
(Source : Blakers et al, 1984)*

## The Brush Turkey

This is another Australian bird which makes mounds to incubate its eggs. It lives in tropical and subtropical rainforest areas. Students may be interested in comparing this bird and its habitat with the Malleefowl.

## The Australian National Botanic Gardens

*Inspire, inform and connect people to the Australian flora*

# **Changing Views of the Mallee**

**These quotes could be used as stimulus material for creative writing.**

*“Mallee is one of the most barren regions in the world ...there were tufts of a prickly bush, which tortured the horses and tore to rags the men’s clothes about their ankles.”* Thomas Mitchell, Explorer 1836

*“. . . a more worthless sand-desert country, in its natural state, cannot be imagined. There is plenty of vegetation, but it is useless.”* William Lockhart Morton, Explorer 1861

*“The monstrous and dismal look of an extensive scrub is depressing. The equal height of the vegetation, the dull glaucous colour of the foliage, look in the distance like a rolling sea reaching the horizon.”* Dr Richard Schomburg, SA Government Botanist 1876

*“... as barren and unproductive as the worst country we have passed through.”* Sturt 1833

*“Most miserable country, thickets and spinifex... The most wretched country I have ever seen; not a bit of grass and no water... it is a most fearful country...”* Forrest 1875

*“Cheerless and waterless region... never ending spinifex... a vast, howling wilderness of high spinifex-clad ridges... ghastly desolation and hopeless dreariness.”* Carnegie 1896

*“God have mercy upon us for we are brought very low... Our miseries are not a little increased by the ants.”* Warburton 1873

*“Impossible to get a moment’s peace from the attacks of the flies.”* Giles 1889

*“Nobody knows who made the mallee, but the Devil is strongly suspected.”* The Bulletin 1902

*“The wholesale destruction of timber in the Mallee, which has brought about terrific dust storms now almost threatening to drive the settlers off the land, has also been the cause of the departure of many birds.”* Shaw Neilson, Poet 1938

*“Grazing herds of kangaroos broke our approach, astonished emus popped up, . . . Pink clouds of galahs and Major Mitchell cockatoos exploded, reformed and wheeled to scream at the intruders and the deep golden regent parrots flew eastward at incredible speeds to their morning drink. An occasional sandhill stood high above the rest and from these hills could be seen a sea of Mallee stretching to the horizon in every direction. It was a real wilderness . . . it is a delight to the naturalist.”* R. Kenyon, Naturalist 1968

*“Unfortunately the ecological diversity, complex forms of adaptation of Mallee flora and fauna, the role of Mallee vegetation in maintaining soil stability and regulating soil water tables and its intrinsic conservation and scientific values have not been understood or appreciated by the majority of Australians since the earliest colonial days.”* Dr Malcolm Calder, Botanist 1989

# **Mallee Bibliography (August 1998)**

## ***The Australian Environment – Deserts***

V. Serventy. Hodder and Stoughton, 1982

Good photos and diagrams, written in an easily understood style.  
Good for primary students.

## ***Deserts and Woodlands Activity Book***

D. Pugh. Rainforest Publishing, 1987

Excellent drawings and activities. Suitable for primary students.

## ***The Mallee in Flower***

I. McCann. Victorian National Parks Association, 1989

Beautiful photos of plants from the Mallee of Victoria, eastern South Australia and southern New South Wales.

## ***The Flowers of Central Australia***

A. Blombery. Kangaroo Press, 1989

Many plants depicted in this book occur in the Mallee. Some very good photos.

## ***Birds of the Victorian Dry Country***

Gould League of Victoria, 1976

This book has sections on land use in the Mallee as well as plants and animals of the Mallee.

## ***Malleefowl – the Incubator Bird***

P. Reilly. Kangaroo Press, 1990

A simple story with beautiful illustrations, suitable for primary students.

## ***Mediterranean Landscapes in Australia – Mallee ecosystems and their management***

Edited by J. Noble and R. Bradstock, 1989

This is a readable though quite scientific book, containing the latest information on many aspects of the Mallee ecosystem.

***ECOS*** Number 46, Summer 85/86

CSIRO publication on science and the environment

Two articles : Fire in the Mallee and Irrigation and Salinity

***ECOS*** Number 56 Winter 88

Article titled *Oil from Eucalypts*

## ***Search – Science and Technology in Australia and New Zealand***

March/April 1987

Salinity and waterlogging in the Murray-Darling Basin. For senior students.

## ***Australian Natural History***

Volume 21 Number 4, 1984. The Malleefowl.

# Pre-visit and Post-visit Ideas

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1. **Animals** of the Mallee are also very well adapted to the conditions which exist there. Find out about some of the following animals. Include a description of the animal, what it eats, where it lives, its reproduction, how it is specially adapted to the hot, dry conditions of the Mallee and any predators it has.

**Malleefowl**

**Grey kangaroo**

**Stumpy-tail lizard**

**Hairy-nosed wombat**

**Echidna**

**Mallee black-faced kangaroo**

**Pigmy possum**

**Mitchell's hopping mouse**

**Gould's sand goanna**

**Red-lored whistler**

**Mallee ringed parrot**

**Emu**

2. Mallee lands are under threat in a variety of ways. Choose two of the following and find out how it threatens these areas.

- broombush cutting
- feral animals, e.g. rabbits, cats and goats
- grazing and farming
- wind erosion

3. Write a story of 1-2 pages describing your life as an early settler/farmer in the Mallee.

*or*

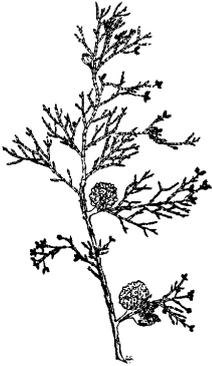
Write a story about your life as a member of an Aboriginal group living in the Mallee lands near the Murray River before the Europeans arrived.

4. Much of the Mallee has been cleared for farming, particularly agriculture. Find out about measures that are being undertaken to conserve remnant bushland.
5. The dust storm that hit Melbourne in February 1983 was very dramatic and some excellent photographs were published at the time and since. To people living in Mallee areas dust storms are not unusual. This time the Mallee blew into Melbourne, and even dirtied the snow in New Zealand. Find out how land management practices are changing in order to protect the soils that remain.

6. Here are three plants of the Mallee. Each has characteristics that are special to the natural ecosystem and/or to people. Investigate these plants further, and other Mallee plants in terms of their importance to:
- native animals
  - traditionally living Aboriginal people
  - people today

Scrub Cypress Pine (*Callitris verrucosa*)

Qld, Vic, SA, WA



- A multi-stemmed, bushy to erect shrub or tree to about 15m.
- Small leaves which adhere very closely to the stem.
- Produces large warty cones.
- The seeds have two narrow wings.
- Timber is resistant to termites.

Broombush (*Melaleuca uncinata*)

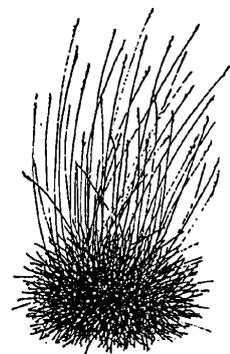
NSW, Vic, SA, WA, Qld



- Tall shrub to 5m which can withstand dry conditions.
- The fluffy, cream flowers appear in spring and summer.
- This shrub is cut and dried to make brush fencing.
- Leaves chewed by Aboriginal people to alleviate colds and respiratory complaints.

Porcupine Grass (*Triodia scariosa*)

NT, SA, NSW, Vic



- Often wrongly called 'spinifex'.
- Clump-forming grass with sharp, stiff leaves.
- Leaves curl tightly to reduce surface area.
- Resin from the base of the leaves of other *Triodia* species was used as a fixative by Aboriginal people.
- Very important as a refuge and foraging area for reptiles and small mammals.

