

Tasmanian Bushcare Toolkit

**A guide
to managing
and
conserving
the bushland
on your
property**

Tasmanian Bushcare Toolkit



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Tasmania

DEPARTMENT OF
PRIMARY INDUSTRIES,
WATER and ENVIRONMENT

Introduction



Welcome to the Tasmanian Bushcare Toolkit

Why manage native bush?

Reversing the loss of native bush is one of the most important environmental challenges facing Tasmania. Much of the native vegetation that existed before European settlement has disappeared. Clearing for agriculture and grazing; the introduction of new plants, pests, diseases and predators; and urban expansion have dramatically changed the landscape. The patches of native bush that remain on private agricultural land are often referred to as remnant vegetation or remnant bush. Remnant bush is extremely valuable and is the focus of the Bushcare program and the **Tasmanian Bushcare Toolkit**.

The benefits of native bush are being increasingly recognised. Retaining native vegetation protects the land from erosion, degradation and salinity; provides shade and shelter for livestock; helps protect wetlands, catchments and water quality; and maintains the natural diversity of plants and animals.

Bushcare

Bushcare is the most significant natural vegetation program ever carried out in Australia. It is funded by the Commonwealth Natural Heritage Trust. A growing number of landowners and community groups are actively protecting and managing areas of native vegetation following the launch of Bushcare in Tasmania.

Bushcare helps landowners integrate the management of remnant bush into their farm management practices. The program is implemented through a combination of direct grants, fencing subsidies, rate relief, management agreements and technical support. Some of the activities that landowners can become involved in are tree planting, plant surveys, fencing, improved grazing management and weed control.

Toolkit

The **Tasmanian Bushcare Toolkit** has been developed to enable you to assess the native bush on your property and develop strategies to manage it into the future. It is made up of nine kits:

- **Kit 1 Bush on Your Farm**
- **Kit 2 Managing Your Bush**
- **Kit 3 Weeds in Your Bush**
- **Kit 4 Revegetating Your Farm**
- **Kit 5 Threatened Plant Species in Your Bush**
- **Kit 6 Riparian Bush**
- **Kit 7 Grassy Bush**
- **Kit 8 Eucalypt Bush**
- **Kit 9 Other Bush Types.**



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Knowledge about managing native bush is continually evolving as new information comes to light. Your feedback on the **Toolkit** is most welcome. Please address your comments to the Bushcare Coordinator at the address given below.

Threatened Fauna Handbook

The Threatened Species Unit of the Department of Primary Industries, Water and Environment has prepared a book to help people identify and protect the threatened animal species in their area. The book, *Tasmania's Threatened Fauna Handbook: What, Where and How to Protect Tasmania's Threatened Animals*, is available from Parks' centres and bookshops around Tasmania. The book would be useful for farmers who want to manage their native bush and at the same time conserve many of Tasmania's most significant native animals.

Bushcare Network

A network of Bushcare officers is in place to help landowners and community groups manage remnant native bush. Regionally-based extension officers are on hand to provide advice on bush management and to help develop projects that will conserve or rehabilitate remnant native bush. They are backed up by a technical team that provides specialist advice. Bushcare Support, run by Greening Australia (Tas), supports groups that have been successful in receiving funding by providing training in a range of activities such as fencing, weed control, direct seeding and planting of native species.

Bushcare Webpage

Much of the information contained in this **Toolkit** can also be found on the Bushcare Webpage (www.bushcare.tas.gov.au) in addition to links with other information sites.

Your role

The **Tasmanian Bushcare Toolkit** gives general recommendations for managing native bush. However, you are the person who knows the native bush on your property and you already have considerable experience of managing that bush. Be guided by that knowledge and experience when using the **Toolkit**. Modify the recommendations given to suit your bush and your farm. We wish you all the best in your endeavours.

Any member of the Bushcare Network can be contacted via:

Bushcare Coordinator

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The **Toolkit** is the product of a collaborative effort between many individuals and organisations. The senior authors of the **Toolkit** are Professor Jamie Kirkpatrick, a senior lecturer in the School of Geography and Environmental Studies at the University of Tasmania, and Louise Gilfedder, a botanist at the Department of Primary Industries, Water and Environment (DPIWE). Several of the kits have been co-written by experts in their field. Many farmers and landowners have provided valuable advice and help in the development and writing of the **Toolkit** and their assistance is gratefully acknowledged.

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1

Bush on your farm



About this kit

This kit is the first in a series designed to help you manage remnant native bush on your property.

The topics covered in this kit include:

Benefits of native bush

Tasmanian bush types

Condition of your bush

Planning your bush management

Monitoring your bush management.

This kit includes a key that will help you decide what type of bush you have on your property. It does not provide guidelines for managing your bush. General guidelines on the principles of managing native bush can be found in **Kit 2 Managing Your Bush**. Guidelines for managing the specific bush types are found in **Kits 6-9**. The key that helps you work out what bush type you have will direct you to the relevant kit.

When you have read this kit you will need to read **Kit 2 Managing Your Bush** and the kit for your particular bush type. You may also need to refer to parts of the following kits for specific information on weeds, revegetation and threatened species:

- **Kit 3 Weeds in Your Bush**
- **Kit 4 Revegetating Your Farm**
- **Kit 5 Threatened Plant Species in Your Bush.**



Benefits of native bush

The benefits of maintaining and improving the health of native bush are numerous but they are not always obvious.

Biodiversity

Biodiversity is the variety of life, including genetic variation, species, and assemblages of species called communities. Over the last 200 years most of the natural vegetation of the drier parts of Tasmania has been converted to improved pastures, semi-natural pastures, crop land, roads, dams, gardens and buildings. This has meant that the types of natural vegetation that occurred on the flattest and most fertile land have been largely destroyed. Many species that were once common are now found in a few small populations. If we are to maintain the variety of life on our small planet we must look after those species and communities that have been most depleted. In Tasmania most of these occur on private land.

Personal well-being

Most owners of remnant bush appreciate its natural beauty. They feel personal satisfaction knowing that they are helping maintain native species and preserving some of the original landscape settled by their forebears.

Heritage value

Rural landscapes of rolling pastures interspersed with remnant native bush are part of our national heritage and are as much a part of the Australian identity as icons like Tasmania's wilderness. With changing land use, land degradation and rural tree decline we are losing that landscape.

Cost reductions

Farmers who understand and appropriately use native bush for grazing reap a number of benefits even though native pasture supports fewer sheep per hectare than improved pasture. It does not require expensive inputs such as fertiliser or insecticides, and it is associated with fewer animal health problems. It also requires less maintenance than improved pastures and expensive works like erosion rehabilitation are generally unnecessary.

Additional income

Many rural properties supplement their income by offering farm or colonial accommodation. The people who use this type of accommodation are often nature lovers who appreciate the opportunity for bush walks. Properties with remnant bush are more likely to attract visitors than those that are purely farming operations.

Real estate values

Land containing native bush is aesthetically attractive which increases its real estate value.

Bush products

With the high cost of firewood, fence posts and construction timber any wood that can be collected from the bush on a property will help save money. Wood gathered from remnants can be sold for firewood, timber or pulp. However, some trees with hollows should be left standing to provide nesting sites for native birds. Florists sell the flowers and foliage of many of the plants found in bush remnants. The sale of seed for horticulture and forestry can provide good financial returns to the landholder. There is also a growing market for native grass seed.

Increased productivity

Livestock and crop production can be increased when remnant vegetation acts as a windbreak, providing shade and preventing soil moisture loss. Remnant vegetation reduces cold and heat stress in livestock, increases wool production and stock live weight, and reduces birth mortality.

Grazing value

Native bush is valuable for grazing as sheep grazed on it produce highly-valued fine and superfine wool. It can be used to help prevent scouring and worm infestations in sheep. Native grasses are more drought resistant than introduced pasture grasses so rough grazing country can provide valuable drought relief. In native pastures the cover of perennial grasses is often higher than that in improved pastures. The main native perennial grass, kangaroo grass, grows best in summer when introduced grasses are dying back.

Soil conservation

Remnant bush offers soil conservation benefits. The higher ground cover in native and semi-native vegetation results in less loss of topsoil than when the ground is ploughed. Native forest or woodland keeps the watertable low which helps to prevent dryland salting of crop land and improved pastures.

Natural protection against pests and diseases

Trees in larger patches of remnant bush can better withstand dieback, insect attack and disease. The soils of native pastures contain insects that break down soils and litter, and eat pests. Native pastures are less susceptible to damage from pasture grubs than improved pastures. Native vegetation may also provide future biological controls for pest species such as the corby grub. In Victoria a parasitic species found on prickly box is thought to help control cockchafer beetles. Bush along streams acts as a filter for contaminants and may reduce the transport of diseases into watercourses.

Retention of plant nutrients

Large amounts of nutrients are held in the leaf and other litter on the ground. Deep-rooted trees can use nutrients leached from the surface soil layers.

Genetic resources

Some of the relatives of important agricultural crops are found in the Tasmanian bush. These plants may provide valuable genetic material in the future. For example, soya beans are the world's main protein crop. Fourteen of the 16 soya bean species grow only in Australia and three of these grow in Tasmania. The Australian species do not suffer from rust so they may provide important genetic material for drought or frost resistant varieties. Many of our rare herbs such as the paper daisy are widely used in horticulture. Other native plants such as the native pepper and the yam daisy may prove to be profitable crops in view of the diversification of Australian cuisine. Their survival in the wild will ensure that their genetic resources are available for future development.

Tasmanian bush types

The keys in this section will help you identify the bush type on your property. They will also direct you to the kit that discusses your particular bush type and its management.

Keys to bush types

To identify your bush type go to a typical patch of the bush and work through the steps outlined below.

Key 1: A broad description of your bush

Which of the following sentences best describes your bush? When you have decided which one fits best go to the relevant key and follow the directions given there.


BROAD DESCRIPTION	GO TO	PAGE
Bush along watercourses or around wetlands.	Key 2	5
Bush that is treeless.	Key 3	5
Bush with a tree layer made up of eucalypt trees.	Key 4	8
Bush with a tree layer made up of trees that are not eucalypts.	Key 5	11



Key 2: Bush along watercourses or around wetlands

Bush found along rivers, creeks, streams and wetlands is known as riparian bush regardless of the type of vegetation present.


The management of riparian bush depends on the bush type present. Therefore, you will need two kits in order to find out how you can manage your riparian bush. The first is **Kit 6 Riparian Bush** which discusses riparian bush and its management in general. The second kit will depend on the bush type present. To determine which bush type makes up your riparian bush go through the last three sentences in Key 1 again and find the one that best describes your riparian bush. Then go to the relevant key and follow the instructions given there.

SUMMARY	BUSH TYPE	DESCRIPTION
<p>Bush found along watercourses or around wetlands</p> 	Riparian bush	<p>Riparian bush is vegetation found along streams, creeks, rivers and wetlands. A variety of bush types make up riparian vegetation, including rainforest, wet forest, dry forest and scrub. Riparian bush may have a grassy, heathy, sedgey or shrubby understorey. Some riparian vegetation may be treeless and many rivers in Tasmania have extensive river flats of silver tussock grass as riparian vegetation. Alongside the stream there is often a strip of vegetation containing moisture-loving herbs, sedges, rushes and reeds that are periodically inundated. Within the stream are aquatic plants that are often referred to as macrophytes, which may float on the surface or emerge through it.</p> <p>Kit 6 Riparian Bush</p>

Key 3: Bush that is treeless

All the bush types in Key 3 are treeless or almost treeless.

Go through the key until you find the summary that best describes your bush. Then go to the corresponding description to see if it accurately describes the bush. If it sounds correct go to the relevant kit for more detailed information about the bush type and its management. If the description does not fit repeat the process until you find the bush type that most closely describes your bush. If you need help contact a Bushcare officer or a Parks and Wildlife Service botanist on (03) 6233 6556.

SUMMARY	BUSH TYPE	DESCRIPTION
<p>Vegetation dominated by succulent herbs and shrubs, and tussocky plants. Subject to occasional inundation by the sea.</p> 	Saltmarsh	<p>Saltmarsh occurs in areas that are periodically inundated by the sea. It is therefore largely confined to estuaries and inlets. Near the mouths of estuaries and inlets, where the inundating water is highly saline, saltmarshes are dominated by succulent herbs and shrubs. Where inflowing rivers and streams make the water less saline, tussock rushes, tussock sedges, tussock grasses and non-succulent herbs are more prominent.</p> <p>Kit 9 Other Bush Types</p>

Vegetation dominated by species confined to the coastal zone. Found on coastal sand dunes, cliffs and rocky shores.



Dry coastal vegetation

Dry coastal vegetation occurs on well-drained soils along the coast. It can occur on sand dunes, cliffs and rocky shores. It is dominated by plants that are confined to the coastal zone. The most common dominant species are sea rockets, marram grass, coast fescue, coast spinifex, blue daisy-bush, boobyalla, coast wattle, coast beard-heath and coastal tea-tree.

Kit 9 Other Bush Types

Vegetation usually dominated by aquatic herbs, sedges and rushes. Area usually flooded for at least part of the year.



Wetland

Wetlands are areas of shallow water that are usually flooded for at least part of the year. They are distributed from the coast to inland areas and may occur at low and high altitudes. They include areas of marsh, fen and peatland, and may be found in streams and around lakes. On some farms a small wetland may simply be a swampy area that has reeds and rushes. Many wetlands have dried out during the drought periods of the last 15 years. However, they may refill in the future.

Kit 9 Other Bush Types

Vegetation dominated by native grasses in the tallest layer. Land less than 600 m above sea level.



Lowland grassland

There are two types of lowland grassland: lowland silver tussock grassland and kangaroo grass tussock grassland. Lowland silver tussock grassland is generally found on alluvial river flats less than 600 m above sea level. It also occurs in coastal areas on sand ridges or next to wetlands. The dominant grass is silver tussock which is a narrow-leaved species that forms dense tussocks up to 1 m in height. Kangaroo grass tussock grassland is found on well-drained, fertile valley floors in low rainfall, low altitude areas. It is also found on shallow soils on well-drained hilltops and ridges. Kangaroo grass tussock grassland is dominated by kangaroo grass which is a deep-rooted, summer-growing, perennial grass. It has a distinctly-shaped flowering head and its foliage is red-green during the non-growing season.

Kit 7 Grassy Bush

Vegetation dominated by sedges and rushes. Buttongrass hummocks prominent.



Buttongrass moorland

Buttongrass moorland is found on poorly-drained and infertile soils. It is the most common vegetation type in lowland western Tasmania. It can also occur on poorly-drained infertile flats elsewhere in the state. Buttongrass moorland is less than 2 m tall and is dominated by buttongrass hummocks with a rich mixture of shrubs, sedges and rushes in the gaps between the hummocks.

Kit 9 Other Bush Types

Vegetation dominated by small-leaved prickly shrubs less than 2 m tall. Land less than 1000 m above sea level.



Heath

Heath is usually found close to the coast on highly infertile sandy plains. The most extensive areas of heath in the state are found in the Furneaux Group of islands and in the north east. Small areas of heath are occasionally found on poorly-drained inland sites and rock plate hill tops. Heath is dominated by shrubs less than 2 m tall in the tallest layer. The most common dominant species are tea-tree, paperbark, banksia, casuarina and grass-tree.

Kit 9 Other Bush Types

Vegetation dominated by native grasses in the tallest layer. Land higher than 600 m above sea level.

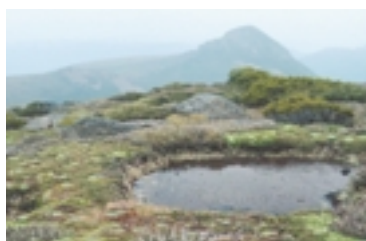


Highland grassland

Highland grassland is found in fertile valleys and plains between 600 m above sea level and the lower limit of alpine vegetation (approximately 1000 m above sea level). The dominant grass is silver tussock which is a narrow-leaved species that forms dense tussocks up to 1 m in height. A rich variety of wildflowers can often be found in the gaps between the tussocks.

Kit 7 Grassy Bush

Land higher than 1000 m above sea level.



Alpine vegetation



Alpine vegetation is found above the tree line, in treeless areas and among subalpine forests. It is less than 2 m tall. The alpine vegetation of Tasmania is extremely unusual globally in that most of it is dominated by small-leaved shrubs or hard cushion plants. However, there are also substantial areas dominated by grasses, herbs or sedges.

Kit 9 Other Bush Types

Key 4: Bush with a tree layer made up of eucalypt trees

All the bush types in Key 4 have a tree layer or canopy of eucalypt trees. However, the shrub and ground layers that make up the understorey vary depending on the bush type. When trying to determine your bush type do not worry about the canopy at this stage. Instead, focus your attention on the understorey.

Go through the key until you find the summary that best describes your bush. Then go to the corresponding description to see if it accurately describes the bush. If it sounds correct go to the relevant kit for more detailed information about the bush type and its management. If the description does not fit repeat the process until you find the bush type that most closely describes your bush. If you need help contact a Bushcare officer or a Parks and Wildlife Service botanist on (03) 6233 6556.

SUMMARY	BUSH TYPE	DESCRIPTION
Understorey dominated by grasses, saggos and wildflowers. Shrubs over 2 m tall sparse.	Grassy woodland and forest (also known as dry sclerophyll forest)	Grassy woodland and forest occurs naturally on fertile soils, usually in low rainfall areas. This vegetation type is one of the most characteristic bush types of the Midlands and the central east coast. The understorey is dominated by a diversity of grasses, saggos, lilies, daisies, orchids, peas and other wildflowers. The canopy can be dominated by a range of eucalypts. Kit 7 Grassy Bush
		
Understorey dominated by grasses and small-leaved shrubs less than 2 m tall. Bush is a mixture of grassy and heathy woodland or forest.	Grassy/heathy woodland and forest (also known as dry sclerophyll forest)	Grassy/heathy woodland and forest has an understorey in which small-leaved shrubs and grasses make up more than 30% of the cover in the layer that is less than 2 m in height. Typical shrubs include heaths, acacias and legumes. Typical grasses include wallaby, plume, spear and tussock grasses. There may be a taller subsidiary layer in which wattles and she-oaks are prominent. This layer is sparser than the lower one. The canopy may be dominated by a range of eucalypts. Kit 8 Eucalypt Bush
		

Understorey dominated by small-leaved shrubs less than 2 m tall and/or bracken.



Heathy woodland and forest
(also known as dry sclerophyll forest)

Heathy woodland and forest has an understorey that is less than 2 m tall and dominated by small-leaved shrubs and/or bracken. Typical shrubs include acacias, heaths and legumes. The canopy may be dominated by a range of eucalypts. It is usually associated with nutrient-poor sandy soils that form on sandstone, quartzite and sand sheets. Heathy understoreies can also be found on shallow soils on dolerite where the rainfall is moderate to high.

Kit 8 Eucalypt Bush

Understorey dominated by small-leaved shrubs more than 2 m tall.



Shrubby forest
(also known as dry sclerophyll forest)

The understorey of shrubby forest is dominated by small-leaved shrubs more than 2 m tall, such as tea-trees and wattles. The canopy can be dominated by most types of eucalypt forest. It is usually found in moist conditions that are intermediate between those of wet forest and either heathy forest or grassy woodland and forest.

Kit 8 Eucalypt Bush

Understorey dominated by broad-leaved tall shrubs and small trees.



Wet forest
(also known as wet sclerophyll forest)

Wet forest has an understorey in which broad-leaved tall shrubs and small trees, such as dogwood, musk and blanket leaf, form a prominent layer. The shrub understorey is often dense. Alternatively, wet forest can have a ground layer in which ferns, excluding bracken, are dominant, or an understorey dominated by temperate rainforest trees, such as myrtle beech, sassafras and celerytop pine. The canopy of wet forest may be dominated by a range of eucalypts. Wet forests occur on moderately fertile to fertile well-drained soils in areas of high rainfall.

Kit 8 Eucalypt Bush

Myrtle, sassafras, horizontal, leatherwood or celerytop pine prominent in the understorey.

Mixed forest

Mixed forest has an understorey of rainforest species and an overstorey of eucalypts that becomes sparse as the forest matures. Mixed forest is often dominated by gum-topped stringybark, brown-topped stringybark, giant ash or alpine yellow gum. The eucalypts are usually taller than 30 m and the rainforest understorey is typically 10-20 m tall, except in some subalpine situations. Mixed forests are extensive throughout the state, with the exception of the Midlands. They tend to occur on sites that are protected from fire. In many locations they form a band between rainforest and wet forest. Mixed forests occur in reserves such as the Hartz Mountains, Cradle Mountain-Lake St Clair, Mount Field and Wild Rivers National Parks.

Refer to Wet forest in Kit 8 Eucalypt Bush

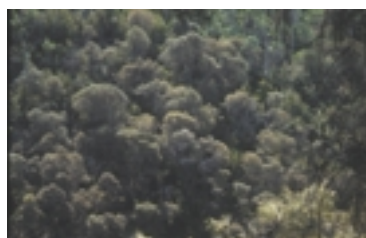


Tree layer dominated by she-oak but eucalypts also present.

She-oak woodland and forest

She-oak is a small, drooping tree. Because it reaches a lower maximum height and has a slower growth rate than eucalypts it usually only dominates native vegetation in places where eucalypts find it hard to grow. These are generally north-facing slopes with shallow and rocky soils in areas receiving less than 700 mm of rainfall. Therefore, she-oak woodland and forest is widespread in dry eastern Tasmania and on the eastern Bass Strait islands, most commonly near the coast. She-oaks can be found as the dominant trees in woodland and forest. However, they can also form a major understorey component of eucalypt forest.

Kit 9 Other Bush Types

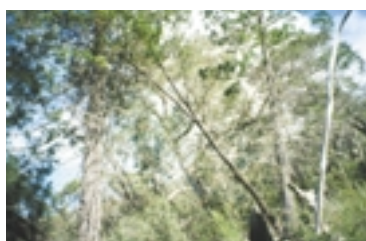


Tree layer dominated by Oyster Bay pine or South Esk pine but eucalypts also present.

Oyster Bay pine and South Esk pine woodland and forest

Tasmania has two native cypress pine species. Oyster Bay pine woodlands and forests occur along the east coast from Cape Pillar to the Douglas-Apsley National Park and in the Furneaux Group. The threatened Tasmanian endemic, South Esk pine, is found near a few rivers in the east of the state, including the Apsley, Swan, St Pauls and South Esk Rivers, where it forms a low woodland or forest community. Native cypress pines can be found as the dominant trees in woodland and forest. However, they can also form a major understorey component of eucalypt forest, and they occasionally occur in heath.




Kit 9 Other Bush Types



Key 5: Bush with a tree layer made up of trees that are not eucalypts

All the bush types in Key 5 have a tree layer or canopy that is dominated by trees other than eucalypts. When trying to determine your bush type focus your attention on the trees in the canopy. Do not worry about the understorey at this stage.

Go through the key until you find the summary that best describes your bush. Then go to the corresponding description to see if it accurately describes the bush. If it sounds correct go to the nominated kit for more detailed information about the bush type and its management. If the description does not fit repeat the process until you find the bush type that most closely describes your bush. If you need help contact a Bushcare officer or a Parks and Wildlife Service botanist on (03) 6233 6556.

SUMMARY	BUSH TYPE	DESCRIPTION
Tree layer dominated by banksia.	Banksia scrub and woodland	Banksia varies in appearance, forming a shrub or small tree. It is widespread in Tasmania. It forms scrub and woodland on coastal sand dunes where the fire frequency is low. Banksia trees also form groves in the Midlands, usually on sandy soils. Some of these groves are extensive, up to 2 km in length with magnificent old trees, although the majority are small copses. Kit 9 Other Bush Types
		
Tree layer dominated by she-oak.	She-oak woodland and forest	She-oak is a small, drooping tree. Because it reaches a lower maximum height and has a slower growth rate than eucalypts it usually only dominates native vegetation in places where eucalypts find it hard to grow. These are generally north-facing slopes with shallow and rocky soils in areas receiving less than 700 mm of rainfall. Therefore, she-oak woodland and forest is widespread in dry eastern Tasmania and on the eastern Bass Strait islands, most commonly near the coast. Kit 9 Other Bush Types
		
Tree layer dominated by Oyster Bay pine or South Esk pine.	Oyster Bay pine and South Esk pine woodland and forest	Tasmania has two native cypress pine species. Oyster Bay pine woodlands and forests occur along the east coast from Cape Pillar to the Douglas-Apsley National Park and in the Furneaux Group. The threatened Tasmanian endemic, South Esk pine, is found near a few rivers in the east of the state, including the Apsley, Swan, St Pauls and South Esk Rivers, where it forms a low woodland or forest community. Kit 9 Other Bush Types
		

Tea-tree or paperbark dominant with a closed canopy.

Tea-tree and paperbark wet scrub and forest

Tea-tree and paperbark wet scrub and forest are dominated by manuka, soft-fruited tea-tree, shiny tea-tree, woolly tea-tree, swamp paperbark and scented paperbark. This bush type usually has an understorey containing rainforest species. In northern Tasmania and the Bass Strait islands dense forests dominated by swamp paperbark are widespread.

Kit 9 Other Bush Types



Blackwood dominant with a closed canopy.

Blackwood forest

Blackwood forest is widespread in lowland Tasmania, except on the most infertile soils. It may dominate forests in well-drained areas and in swamps.

Kit 9 Other Bush Types



Dense canopy dominated by native olive, pinkwood or dogwood.

Dry rainforest

Dry rainforest is rare. It is confined to deep, south-facing rocky gullies in the driest parts of the state. It has a dense, closed upper canopy of small trees, most notably native olive, pinkwood, and dogwood, with the occasional emergent blackwoods.

Kit 9 Other Bush Types



Canopy dominated by myrtle, sassafras, King Billy pine, pencil pine, horizontal, leatherwood, or Huon pine.

Temperate rainforest

Temperate rainforest is most extensive in western Tasmania and in the north east highlands. It also occurs sporadically in most mountain ranges in eastern Tasmania. The canopy is dominated, either singly or in combination, by myrtle beech, deciduous beech, sassafras, King Billy pine, pencil pine, leatherwood, horizontal, Huon pine, celerytop pine and Cheshunt pine.

Kit 9 Other Bush Types



Condition of your bush

Once you have determined the type of bush you have on your property you will need to assess its health or condition. The overall condition of the bush will help you decide what management is necessary.

Threatened species

Threatened plants and animals are not necessarily found in bush in excellent condition. Gorse provides shelter for bandicoots and prevents the grazing of some threatened plant species such as Gunns stackhousia (*Stackhousia gunnii*) and spur velleia (*Velleia paradoxa*). In areas where the habitat has been extensively modified only degraded habitat may remain for some species. Lowland silver tussock grassland, a community that is almost extinct in Tasmania, is often represented by badly degraded remnants. Despite the degradation these remnants are essential habitat for the threatened Ptunarra brown butterfly.

If you suspect that you may have threatened species on your property please contact the Threatened Species Unit of the Department of Primary Industries, Water and Environment on (03) 6233 6556. Descriptions and illustrations of the threatened plants you may find on your property are given in **Kit 5 Threatened Plants Species in Your Bush**.

General assessment of bush condition

Bush in all types of condition can be important. An area of bush in poor condition may be one of the few examples of its type that has survived and it may contain threatened species. Nevertheless, it is obviously better to have bush in excellent condition than bush in poor condition — as long as you do not destroy a population of threatened species in the process of improving it.

The condition of bush relates closely to its management needs. Bush in excellent condition has obviously been managed well and generally requires only a continuation of that management. Bush in good condition can generally be improved by modifying current management practices. Bush in poor condition usually requires active restoration measures to improve it.

To determine the condition of your bush you need to consider a number of things, including:

- the health of the bush;
- the presence or absence of widespread dead or dying trees;
- the presence or absence of weeds, pests and diseases;
- the presence or absence of soil erosion and land degradation;
- the impact of your present management practices, including stocking levels, fire regimes, drainage of wetlands, gravel and sand mining, and nutrient drift from adjacent land.

Excellent condition

Bush in excellent condition is entirely or almost entirely composed of native species in all its layers. There may be occasional exotic annual grasses such as hair grass (*Aira* species) or quiverry grass (*Briza* species), or exotic herbs such as flatweed (*Hypochoeris* species and *Leontodon* species). However, exotic shrubs such as gorse or broom are absent or rare. Woodlands and forests in excellent condition have a healthy tree layer, a healthy understorey, and some evidence of younger trees emerging in the gaps. Treeless vegetation in excellent condition has sufficient spaces between the tussocks or shrubs to allow smaller species to survive.

Good condition

Bush in good condition has native species providing more than half the cover in all the layers. The exotic grasses and herbs can generally be distinguished from the native grasses and herbs by their greener and wider leaves. Most of these exotic species are found in pastures and as weeds in gardens. The most common exotic shrubs are gorse, broom, hawthorn and briar rose. Woodlands and forests in good condition may have unhealthy trees and little evidence of tree regeneration in the gaps but the understorey will be dominated by a rich variety of native plants. Treeless vegetation in good condition may be dominated by natives but may have little space for smaller species between the tussocks or shrubs.

Poor condition

Bush in poor condition has exotic species comprising more than half the cover in at least one layer. If the trees are healthy there may be little or no regeneration in the gaps and an understorey dominated by exotics. If the trees are dying or dead there will also be little or no regeneration and the understorey will be dominated by exotic species.

Where native species comprise less than ten percent of the cover in all layers the area is no longer regarded as bush. However, some such areas may have populations of threatened species and will therefore be worthy of attention.

Characteristics of healthy bush

The characteristics of healthy bush vary with the different vegetation types. For example, bush is often considered to be in good condition if there is a diversity of tree and shrub species, habitat provided by old trees and logs, and a rich ground layer of twigs and small branches. In grasslands and wetlands, where there are no trees, these components will not be present but the bush may still be in excellent condition. Similarly, you may wish to maintain the grassiness of your understorey and reduce the number of shrubs. Their absence does not mean that the bush is in poor condition. Rather, its condition is the result of the management option you have chosen. Nevertheless, healthy bush generally has a number of characteristics that are described below.

Made up of layers

Healthy bush is usually made up of a number of layers.

A thin layer of mosses and lichens on the ground is considered to be an important component of healthy bush, particularly in grasslands and grassy woodland. This layer, known as the cryptogamic mat, appears as a fine speckling of white, brown and green on the soil surface.

A litter layer helps protect the soil from rain and wind, and provides important habitat for invertebrates, spiders and reptiles. This layer is made up of twigs, sticks and leaves. In treeless grassy vegetation there is still usually a thick litter layer of dead grasses. Bacteria and fungi are important components of the litter layer as they break down the litter and release nutrients. Larger branches, limbs and logs are other important components of the litter layer because they provide habitat for a range of species. Old fence posts left lying on the ground along the edges of paddocks can also provide valuable habitat.

A rich and diverse ground layer made up of grasses, lilies, sedges and wildflowers is usually considered to be an indicator of healthy bush, particularly in grassy bush. Bush with a healthy and diverse grassy understorey is relatively rare — the understorey is often reduced to a few species such as wallaby grass and spear grass. In bush where shrubs and heaths dominate the understorey the ground layer may be less developed. In some situations such as in the saline herb fields that fringe wetlands only one or two species may be dominant. The absence of a diverse ground layer does not necessarily indicate poor condition. In some bush types the ground layer may be dominated by ferns, particularly in wet forests along creek lines and in damp gullies, or a dense layer of bracken may be prominent. This is not necessarily a problem and may reflect the use of frequent cool burns as a management tool. Dense bracken can protect young seedlings from grazing and in some bush it is the only place where young saplings can grow. It can also be important in preventing soil erosion.

An understorey of native shrubs is an important component of many bush types. This layer can be in poor condition in bush that is heavily grazed, particularly by cattle or goats. It may also be in poor condition in bush that has been burned so frequently that the shrubs have been eliminated because they were unable to flower and set seed between fires. Even shrubs that resprout after fire will eventually be weakened and killed by too many fires in quick succession. A shrub layer is less prominent in grassy vegetation although some low shrubs are still present. Shrubs are important as a nectar and food source for many insects and some birds. On a warm day, species such as ants delight are covered in ants, flies, beetles, wasps, moths and spiders. Shrubs also offer habitat for small animals. Prickly shrubs help protect some species, such as wrens, from predators. They are also important structural components for web-building spiders, particularly in heavily-grazed areas.

The tree canopy in most Tasmanian bush consists of an upper layer of a dominant eucalypt and a few co-dominant eucalypts. A lower layer of small trees and shrubs such as wattles, native cherry and she-oak is often also present.

Range of habitat

Healthy bush provides a range of habitat for small mammals, birds and invertebrates. Types of habitat found in remnant bush include:

- large old trees and dead trees
- tree hollows for nesting
- bush of different fire ages
- areas of dense vegetation — even gorse patches can be important habitat for bandicoots
- riparian vegetation
- logs and branches on the ground
- twigs and leaves
- thin soils on rock plates, particularly on dolerite
- rocky areas
- wetlands.

Regenerates itself

Healthy bush regenerates itself. The bush is likely to be in good condition if the ground layer, the understorey of shrubs and small trees, and the tree canopy are being replaced by young seedlings and saplings. This is particularly important in long-lived vegetation. The lack of regeneration is a major concern in the Midlands where rural tree decline is occurring and no young trees are replacing the dying canopy eucalypts.

Surrounding landscape

The nature of the surrounding landscape will affect the health of a patch of bush. If it is surrounded by bushland or is adjacent to a neighbour's bush it is likely to be in better condition than if isolated. If bush is surrounded by cropping land or pasture it is more likely to suffer from weed invasion and other problems.

Links to other bush

Bush that has a compact shape is more likely to be in good condition than bush that is long and thin with a high perimeter to area ratio. Long thin strips of bush are more prone to weed invasion, disturbance, accidental fertiliser drift, and the effects of wind. However, such strips can remain in good condition with appropriate management.

The habitat value of a patch of bush may be enhanced if it is linked to or is close to other patches, particularly if it is small. Small patches of bush close to each other provide an opportunity to establish vegetation buffers through strategic planting. These can also act as shelterbelts. There is much potential for landowners to work together to jointly manage their bush.

Planning your bush management

Managing your bush requires careful planning based on the priorities you have determined are most appropriate for your property. The following section outlines a few ideas that may be helpful when developing a long-term management plan for your bush.

Whole farm nature maps

Developing a whole farm nature map is the first step towards developing a management plan for your bush. The primary purpose of the map is to show the location of the different types of bush on your property. It is also used to show areas of weed invasion.

The best way to map the vegetation on your property is to use aerial photographs. Aerial photographs can be readily obtained from the Department of Primary Industries, Water and Environment. The colours, tones and textures on these photographs should help you identify the different types of bush on the ground. For example, she-oaks and eucalypts have different crown shapes and textures, and heathy bush appears dark compared to grassy bush. If the photograph was taken in the wetter part of the year the colour of the vegetation can be used to gauge the degree of weed invasion. Exotic weeds tend to be blue-green in colour whereas native vegetation tends to be pastel.

It is also extremely important to map the location of any significant vegetation types and populations of threatened species. You will probably need to identify these using your knowledge of the property as they will not be obvious from the aerial photographs. If you suspect that you may have any significant vegetation types or threatened species on your property contact the Threatened Species Unit of the Department of Primary Industries, Water and Environment on (03) 6233 6556.

Management maps

You will need to develop a management map that shows your different management zones and compartments. This map can be cross-referenced with your usual system for recording management details on your farm, such as a notebook, computer spreadsheet or card index system.

Grazing compartments

If you have different types of bush or the same type of bush in varying condition you may need to apply different grazing regimes. Using your nature map you can plan new fences to accommodate these different needs. For example, you may have an existing paddock that is half native grassland and half heathy forest. If you are fencing this area the fence would be best placed between the two vegetation types.

Burning compartments

Burning compartments need to be defined by barriers to the movement of fire. These can be as inconspicuous as a stock track or they may be a road or firebreak. Burning compartments should usually be smaller than grazing compartments, following the principle that not all of a vegetation type should be burnt at once. Most burning compartments should be in the range of 1-5 ha.

Special management zones

If you have a population of threatened species that needs a different management regime from the surrounding area, the area should be marked on the management map. Similarly, if you have an area that you want to manage for a special purpose such as tree regeneration it should also be indicated on your map.

Monitoring your bush management

It is important to monitor the impact of your management practices on the bush so that you can change them if you are not achieving your goals.

Threatened plants

If you have threatened plant species on your property and they are in low number you can simply count the number of seedlings and adult plants. If the number is large you can gain an impression of any changes in number by walking through the centre of the population and counting the number of individuals in a selected area. If the area is large enough to show up on an aerial photograph you can map the distribution on your whole farm nature map.

Changes in bush vegetation

The simplest and quickest way of getting a reliable indication of changes in the vegetation making up your bush is to do a transect. To do a transect mark a line 50 m long with several stakes and lay a measuring tape between them. Walk along the line recording the distance in metres the thing you are measuring underlying the line, add up the distances for each attribute, and multiply by two. This will give you the percentage cover of any vegetation or environmental attribute. Useful attributes to measure include the cover of weeds, cover of bare ground, cover of shrubs or young trees, and the cover of large tussocks.

Tree health

One quick and simple way of gaining a broad picture of the health of trees in a stand is to take a photograph from a fixed point on a regular basis. The condition of the trees in the photographs can then be compared from year to year. If the proportion of trees in the poorer health classes increases through time you have an ongoing dieback problem. If this proportion decreases then the stand is recovering.

2

Managing your bush



About this kit

This kit is designed to give you an overview of the principles of managing remnant native bush. However, as with all the recommendations in the **Tasmanian Bushcare Toolkit**, the guidelines are not meant to be followed rigidly. Rather, they are intended to give you some guiding principles for managing remnant bush. You can then modify the guidelines to suit your particular situation and needs.

The material covered in this kit includes:

General principles of bush management

Grazing management

Fire management

Weed and disease management

Natural regeneration management.

This kit only discusses the general principles of managing remnant native bush. It does not give specific guidelines for dealing with each particular bush type that may be found on your property. These are given in the kits dealing with the different bush types. Therefore, you will need to read this kit and the kit that discusses your bush type in order to decide on the best way to manage your patch of native bush.

You may also need to refer to parts of the following kits for specific information on weeds, revegetation and threatened species:

- **Kit 3 Weeds in Your Bush**
- **Kit 4 Revegetating Your Farm**
- **Kit 5 Threatened Plant Species in Your Bush.**



General principles of bush management

Native bush can be managed to make the most of its economic, nature conservation and land conservation values. Ten general principles for managing native bush are:

1. **DON'T CHANGE YOUR CURRENT MANAGEMENT PRACTICES UNLESS THERE IS AN OBVIOUS REASON TO DO SO.** If the bush is in good condition don't change your activities just to fit with what is seen as the 'best' method.
2. **DECIDE ON YOUR MANAGEMENT OBJECTIVES.** Determining the reason why you are managing the remnant bush helps you to decide what type of management is needed. Bush may be important for rough grazing, for shelter, or just because you like having bush on your property. You should be clear on the reasons why you are managing it.
3. **MANAGE TO PROTECT THREATENED SPECIES FIRST.** If you have threatened species in your bush, manage it to protect them first, to protect the threatened vegetation types second, and to maintain the bush in good condition third. Extinct threatened species cannot be resurrected. Vegetation types can reassemble themselves in the long term if all their species survive. Management that promotes good condition is not necessarily the management that promotes the survival of threatened species.
4. **VIEW THE BUSH ON YOUR PROPERTY FROM A BROADER PERSPECTIVE.** Don't just take a paddock-by-paddock approach. Rather, look at your farm as a whole unit, then consider where it fits in at a district level. Where bush or native pasture joins that of neighbouring properties a coordinated management approach will be more effective than an individual approach.
5. **MAINTAINING A VARIETY OF MANAGEMENT PRACTICES IS IMPORTANT.** If everyone followed the same management regime there would be far less diversity in the landscape. If you have a different management regime to surrounding farms, maintain it unless there is an obvious reason not to. For example, it is important that somewhere in the landscape we have bush that is never burned, bush that is burned regularly, bush that is burned in spring, and bush that is burned in autumn. Each farm will have a different mix of species as a result of the fire regime used.
6. **MANAGE BY NEED NOT FORMULAE.** The general recommendations for desirable burning and grazing regimes may not be appropriate for your bush and your aims. For example, decide when you need to burn or graze by looking at the size of the regenerating trees you want to keep. In particular, make sure they are large enough and tall enough to withstand a fire. In grassy bush keeping gaps between the tussocks is valuable for the regeneration of wildflowers, sedges and shrubs. Burning is needed when the gaps start closing up.
7. **THINK ABOUT THE IMPACT OF ANY NEW MANAGEMENT DECISION ON THE OVERALL VIABILITY OF YOUR BUSH.** In marginal rough grazing country it may be tempting to convert a small flat area to pasture but this could lead to gradual degradation of the area.
8. **MAINTAIN THE BUSH AS HABITAT FOR NATIVE ANIMALS AND BIRDS.** Older trees and dead trees should be left in place as they offer nesting hollows for birds and animals, especially parrots and owls, and provide a vantage spot or perching site for all birds of prey. If you are thinking of removing trees for fencing materials or firewood remember that coppicing and pollarding are more sustainable uses of trees. If you take firewood from the bush, ringbark some younger trees several years before you need the wood.

However, the bush is much more than just trees. Birds such as wrens, robins, honeyeaters and pigeons need a diverse and healthy understorey. Once the understorey is degraded aggressive birds such as noisy miners move in and displace the bush birds. Keeping a diverse shrub and ground layer is fundamental to managing a bush remnant. Prickly plants like needlebushes and some wattles offer nesting sites, shelter and food. Shrubs such as bottlebrushes, tea-trees and prickly box also provide food for insects that help to control pest species. Logs, dead wood, rocks and stones on the ground provide shelter for animals, birds and insects so they should be left untouched.

9. DON'T USE THE BUSH AS A TIP OR SUMP. Avoid dumping rocks, earth, garden waste and rubbish in the bush as this eliminates native plants and allows weeds to flourish. The diversion of water into native bush leads to invasion by weeds, especially if it is rich in nutrients. Fertilising bush favours the growth of exotic annuals over native perennials.
10. REMEMBER IT IS ALWAYS CHEAPER TO MAINTAIN OR IMPROVE BUSH THAN TO RESTORE OR RECREATE IT. Clearing is an irreversible action in the medium term. The re-establishment of bush on improved pasture or crop land is usually a very expensive exercise, involving ground preparation, propagation or seed collection, planting or sowing, and continuing weed control. While it may be easy to establish individual trees or shrubs on cleared land they take many decades to mature, and the hundreds of other species found in native vegetation may not return for centuries.



Grazing management

Many of the native plants in lowland Tasmania have evolved in an environment where the prevailing management regime involved grazing by native animals and regular burning by Aborigines. There is a wide diversity of native herbs, grasses and wildflowers. Most of these are drought-tolerant, and adapted to variable rainfall and infertile soils. They have evolved in the presence of soft-footed grazing marsupials, such as the wallaby. Hard-footed, close-cropping stock are now the dominant grazers in most bush. Many bush types are not suited to stock grazing, including rainforest, wet eucalypt forest and alpine vegetation. However, stock are not necessarily bad for native bush. Stock grazing can be used as a tool for improving remnant bush but problems can arise with too little or too much grazing.

Overgrazing is the main management problem in bush. An area that is overgrazed is likely to have fewer native plant species as overgrazing degrades native pasture and prevents regeneration. Surface soil erosion may occur where there is an incomplete ground cover as a result of overgrazing. Soil erosion is most prevalent on slopes with light textured soils on sandstone and mudstone, on flats with sandy soils, and on steep slopes on dolerite hills. Sedimentation of streams and wetlands can result when stock have uncontrolled access to their banks.

Undergrazing can also lead to a reduction in the diversity of native species when it allows dense native grasses and shrubs to occupy the inter-tussock spaces normally occupied by smaller species. Undergrazing can also result in the dominance of weed species normally kept under control by stock. The use of fertiliser can promote the growth of weed species in bush managed for grazing. Top-dressing bush is best avoided as there are few situations where it is beneficial.

Fencing off the bush

When fencing off areas of bush it is important to remember that at certain times of the year stock will be enticed by the greener grass on the other side. Be sure to use suitable materials in order to prevent collapsed fences and additional expenses. Fences should be strong enough to withstand damage from stock. Gates or other access points should be installed to allow for appropriate management practices such as crash grazing. In some cases fencing to stop rabbits destroying young plants will be necessary. It may be far more effective to rabbit-proof an area than to use stakes and bags to protect your plants. Consider the costs involved before making a decision.

Priorities for fencing

Fencing may seem expensive. However, the cost of replacing vegetation is much more expensive and the result is never as good as the original native bush. The effectiveness of your fencing must be maximised. The highest priority should be to protect existing remnant native vegetation, including riparian bush. Fencing off larger areas is probably more useful than fencing small isolated remnants. Bush with threatened species is a high priority. Special habitats such as wetlands and rocky areas are usually not productive areas but they are important habitat and are therefore worth fencing.

Type of fencing

The type of fencing will be determined by the situation and the type of animals to be excluded. You will probably be in the best position to know what type of fencing suits your property. *Farm Forestry Technical Information Sheet No. 18*, which can be obtained from Private Forests Tasmania, has information on fencing to exclude livestock and domestic animals, and the relative costs of different fencing options.

Electric fencing may be a cheaper alternative in areas where you do not require a permanent fence but it requires regular maintenance. You can use electric fencing to achieve regeneration in a patch of bush or around paddock trees. When the saplings are tall enough to survive grazing you can remove the fence.

Tax benefits

The costs of fencing to prevent or treat land degradation are deductible for tax purposes under Subdivision 387-A of the *Income Tax Assessment Act 1997*. A new Landcare rebate was introduced in July 1998 to provide an alternative to the deductions available under the Tax Act. The scheme provides a rebate of 34 cents in the dollar for expenses related to Landcare operations. For more information call the Landcare Rebate Hotline on 1800 060 425.



Fire management

Fire is used as a bush management tool for a number of reasons. Fire plays a vital role in maintaining the diversity of plants that make up the bush. It is also used to help protect life and property, improve bush pasture productivity, and control some weeds. Much of Tasmania's flora has evolved in an environment where fire occurred regularly. Aborigines burned the landscape for tens of thousands of years before the Europeans arrived. Plants such as eucalypts, tea-trees and paperbarks are all adapted to fire. They have thick bark, their seeds are protected in thick woody capsules, and trees can often resprout from woody bases (lignotubers) after a fire. Different plant species and vegetation types require different fire regimes, that is, different frequencies and intensities of fire. Some vegetation types, such as riparian bush and rainforest, do not require fire for their regeneration. However, most bush would degrade in the long-term absence of fire.

Protecting life and property

Bush fires can kill people and stock, and destroy property. A major aim of fire management is to reduce the chances of such disasters occurring.

- **FIREPROOF YOUR BUILDINGS.** Tasmania Fire Service can give you guidance on ways to fireproof your buildings. You can reduce the chances of losing your life and property during a bush fire by reducing the likelihood of sparks entering your buildings through not having flammable material in the roofs or under the floor boards, having clean gutters, and having water and other means of fighting fire on hand.
- Create a non-flammable space and/or a spark screen around your buildings. The traditional European-style garden of the Tasmanian countryside reduces the risk of fire spreading to buildings. However, if you prefer native trees and shrubs to exotics there are many species that resist burning and produce a good screen for sparks. These are mainly from the wetter forests of the state. They include musk (*Olearia argophylla*), blanket-leaf (*Bedfordia salicina*), sassafras (*Atherosperma moschatum*), leatherwood (*Eucryphia lucida*), and myrtle (*Nothofagus cunninghamii*). If you prefer dry country species try native oaks (*Allocasuarina* species) rather than eucalypts (*Eucalyptus* species) and make sure that you remove the needles from beneath the trees. It is important to have a large non-flammable space between your property and the more flammable bush.
- **REDUCE THE FUEL IN YOUR BUSH.** Low intensity bush fires seldom threaten property. You can control the intensity of a fire by manipulating the ground fuel levels. This can be done by low intensity burning, grazing, mechanical removal, or any combination of these measures. To protect life and property reduce the ground fuel levels within a 50 m radius of your house and buildings. If you have trees that you want to sell in the future keep the ground fuel levels around them low to prevent damage that may make them less valuable. Guidelines and other help in fuel reduction can be obtained from the Tasmania Fire Service.

Using fire for healthy bush

When using fire as a management tool it can be useful to start by experimenting with a small area. A diversity of fire management practices is important as the effect of fire on many species is not known.

- **CHOOSE A FIRE REGIME TO SUIT THE DESIRED OUTCOME.** You need to be clear why you are burning your bush. It may be to protect threatened species, to reduce fuel loads, to encourage tree and shrub regeneration, for weed control, or to produce greenpick for stock. The reason for burning will affect the regime chosen. For example, if you are

burning to reduce fuel loads then fires will need to be more frequent than if you were burning to promote tree regeneration.

- A DIVERSITY OF FIRE REGIMES IS USUALLY BEST. Maintaining biodiversity is best achieved by having a mixture of fire frequencies and intensities. This is partly because the requirements of many plants and animals are not known and having a mixture of fire frequencies lessens the risk of long-term damage. If you have an area of bush that has not been burned for many years it may be best to continue excluding fire.
- IF YOU HAVE THREATENED SPECIES CHOOSE A FIRE REGIME THAT SUITS THEIR NEEDS. Fire should favour the protection of threatened plant and animal species. In some cases the regimes needed by different species will conflict. For example, the fire frequency required to maintain the subterranean fungi that are the food source for bettongs may be at odds with the fire regime required to maintain some plant species. Seek expert help from the Threatened Species Unit of the Department of Primary Industries, Water and Environment.
- AUTUMN BURNS ARE PREFERABLE AS MOST OF THE PLANTS AND ANIMALS WILL HAVE COMPLETED THEIR LIFE CYCLE. Vegetation is likely to be fairly dry in autumn resulting in a good burn and the humidity at night will help to control the fire. An incomplete or unsuccessful burn, particularly in shrubby forests, may only provide more dry standing fuel for the next wildfire, thereby increasing its intensity.
- USE FIRE TO IMPROVE BUSH PASTURE PRODUCTIVITY. The burning of unpalatable older plants, such as silver tussock and gorse, produces palatable new shoots. **(See Kit 7 Grassy Bush.)**
- USE FIRE TO MANAGE TARGET WEED SPECIES. Some weed species are killed by fire or may be more easily controlled by other means after burning. For example, areas of established gorse can be burnt to remove impenetrable thickets. This allows easier access to the area so that the regrowth can be treated with chemicals. Burning weeds such as gorse and blackberry should take place when birds and animals have finished breeding.
- TREE SEEDLINGS NEED PROTECTION FROM FIRE TO ENABLE THEM TO GROW LARGE ENOUGH TO WITHSTAND LOW INTENSITY FIRES. You may need to avoid fire until the seedlings are tall enough to survive a fire.
- BURNING REDUCES THE DOMINANCE OF TUSSOCK GRASSES. Burning allows smaller grasses and herbs to grow. Some plants, including some rare and threatened species, need some form of disturbance such as grazing or burning to survive. These species would disappear in a thick grassy sward so burning can increase plant diversity.
- BURNING PROMOTES THE GROWTH OF PALATABLE NEW SHOOTS OF GRASSES, SAGGS AND SHRUBS. Fire creates a nutrient-rich ash bed that increases the palatability and nutritional value of new shoots and seedlings. However, it is important that burnt areas are not grazed too heavily or too soon after fire so that the new plants can regenerate.
- BURNING STIMULATES THE GERMINATION OF TREES, SHRUBS, GRASSES AND HERBS. The seed of some plants will only germinate after fire.

Fire intervals for different bush types

The fire regimes that best maintain the bush vary with the bush type and its condition. The following fire frequencies are recommended for the types of bush that are discussed in detail in **Kits 6-9**:

RIPARIAN BUSH	exclude fire
SALTMARSH	exclude fire
DRY COASTAL VEGETATION	exclude fire
LOWLAND GRASSLAND	2-5 years
BUTTONGRASS MOORLAND	5-20 years
SPHAGNUM BOG	exclude fire
HEATH	10-30 years
HIGHLAND GRASSLAND	5-20 years
ALPINE VEGETATION	exclude fire
GRASSY WOODLAND	4-10 years
GRASSY FOREST	6-18 years
GRASSY/HEATHY WOODLAND AND FOREST	8-20 years
HEATHY FOREST AND WOODLAND	10-30 years
SHRUBBY FOREST	20-40 years
WET FOREST	for regeneration after logging if needed
BANKSIA SCRUB AND WOODLAND	natural fires only
SHE-OAK WOODLAND AND FOREST	not necessary
OYSTER BAY AND SOUTH ESK	
PINE WOODLAND AND FOREST	exclude fire
DRY AND TEMPERATE RAINFOREST	exclude fire



Weed and disease management

Weed and disease management are major issues for maintaining the health of native vegetation. Weed management is covered in more detail in **Kit 3 Weeds in Your Bush**.

There are many diseases that occur in native vegetation, almost all of which predate European settlement. However, the root rot fungus (*Phytophthora cinnamomi*) is believed to have been introduced to Tasmania since settlement. The fungus has the potential to kill plants species and alter the ecology of susceptible bush types, such as buttongrass moorland, heath, and heathy woodland and forest.

The presence of root rot is characterised by the following:

- **DEATH OR DISEASE IN SUSCEPTIBLE SPECIES.** Species that are susceptible to the root rot fungus include members of the heath family such as swamp heath (*Sprengelia incarnata*) and the urn heaths (*Astroloma* species), many of the *Epacris* species with the exception of common heath (*Epacris impressa*), bush peas (*Pultenaea* species and *Aotus ericoides*), parrot pea (*Dillwynia glabberima*), guinea-flowers (*Hibbertia* species), grass trees (*Xanthorrhoea* species), and Christmas bells (*Blandfordia punicea*).
- **DISCOLOURATION OF THE FOLIAGE OF DISEASED PLANTS.** The leaves and branches turn red or yellow.
- **RESISTANT SPECIES REMAIN HEALTHY.** Species that are resistant to the root rot fungus include wattles (*Acacia* species), she-oak and bull-oak (*Allocasuarina* species), blanket leaf (*Bedfordia salicina*), dolly bush (*Cassinia aculeata*), native cherry (*Exocarpos cupressiformis*), cutting grass (*Gahnia grandis*), buttongrass (*Gymnoschoenus sphaerocephalus*), manuka (*Leptospermum scoparium*), saggs (*Lomandra* species), scented paperbark (*Melaleuca squarrosa*), daisy bush (*Olearia* species), rice flower (*Pimelea* species), dogwood (*Pomaderris apetala*), dusty miller (*Spyridium* species), and stinkwood (*Zieria arborescens*).
- **EVIDENCE OF DEATH OF PLANTS OVER TIME.** This will help to distinguish between death due to a natural event such as drought and death due to disease. A natural event such as drought is more likely to result in trees that appear to have died at about the same time. In contrast, root rot fungus generally results in a mix of plants that are dying, have recently died, and have been dead for a number of years.
- **SHARP BOUNDARIES BETWEEN HEALTHY AND DISEASED VEGETATION.**

Root rot fungus requires warm moist soils if it is to reproduce and spread. This generally limits its distribution in Tasmania to areas below 700 m and prevents it occurring in low rainfall areas such as the Midlands. Root rot may be spread by the transport of infected soil or plant material by people or animals. It may also be transported by water percolating through soil or in creeks. People can transport the fungus to new areas through dirt on their vehicles, farm machinery and footwear. As root rot fungus is widespread in Tasmania it is important that any disease-free susceptible vegetation remains free of disease. Once root rot is introduced to a site there is no way of completely removing it. The guidelines given below will help to prevent the spread of root rot fungus:

- Wash off any dirt on vehicles, machinery and footwear if you are travelling from an infected area to an uninfected area.
- Ensure that all gravel and soil brought onto your property come from uninfected areas (including soil associated with plants for revegetation). If in doubt do not bring it in.

Natural regeneration management

Natural regeneration is the process by which old trees and shrubs replace themselves without intervention. It is by far the best form of regeneration. Natural regeneration arises from seeds that have fallen from existing plants or from vegetative recovery such as sprouting from stumps or roots. Many bush species regenerate primarily from resprouting rather than seed.

Natural regeneration is a cheap and effective method of re-establishing or rehabilitating the bush on your property, particularly on a larger scale. It is cheaper to fence off and manage existing stands of bush than to re-establish trees for shelter or other purposes. There are many other advantages too. Natural regeneration occurs from plant material that is already present so it will be best suited to your environment and it will help to protect the genetic make-up of the bush on your property. Planting with seeds or seedlings collected from outside your property may introduce genetic traits that are not desirable in your bush.

This section refers only to natural regeneration. Information about revegetation can be found in **Kit 4 Revegetating Your Farm**.

Causes of poor natural regeneration

There are many reasons why there may be no successful regeneration in your bush. Some of the possibilities are:

- **STOCK LEVELS ARE TOO HIGH.** In many cases natural regeneration does occur but stock subsequently graze the young seedlings.
- **COMPETITION FROM GRASSES AND OTHER WEEDS.** Dense mats of grass prevent the germination of native seeds. They also compete for resources and suppress young seedlings. Recent research has shown that when grasses become dense the established plants of other species are often incapable of flowering and setting seed because of the competition.
- **COMPETITION FROM NATIVE SPECIES.** Some native species including eucalypts, she-oaks and bull-oaks produce chemicals that inhibit the germination of other species. This is called plant allelopathy. The area affected is generally the area that lies beneath the tree crown.
- **LACK OF A REGENERATING FIRE.** Fire plays an important role in natural regeneration though the role varies between vegetation types. For many species fire is almost essential for regeneration. However, some species, including hard-seeded species such as banksia, can regenerate in the absence of fire.
- **SOIL COMPACTION.** The heavy hooves of stock, particularly cattle and horses, compact the soil and destroy its structure. The use of heavy machinery or vehicles has the same effect, particularly if the soil is wet. It is more difficult for seedlings to germinate in compacted soils, and if they do they are more likely to die as less water penetrates the soil. It is also more difficult for plants to establish roots in compacted soil.
- **ABSENCE OF THE CRYPTOGAMIC MAT.** Healthy soils have a fine layer of cryptogams (mosses and lichens) that provide an important environment for seed germination, particularly in grassy vegetation.
- **PREDATION OF YOUNG PLANTS.** Plants may germinate only to be eaten by hares, rabbits, wildlife and stock. They can also be eaten by caterpillars, beetles, nematodes and other invertebrates. Red-legged earth mites are a particular problem.

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- **SEED HARVESTING BY ANTS AND PREDATION BY OTHER INVERTEBRATES.** Ants can harvest almost all the seed fall from some species, particularly wattles and bush peas. However, ants are also beneficial as they play an important role in germination by dispersing and burying a huge range of seeds.
 - **POOR CONDITIONS FOR SEEDLING SURVIVAL.** Seedling mortality is naturally high in many species. Many species require several wet winters in succession to germinate and survive. In addition, inappropriate management can lead to a high mortality of the few seedlings that establish. For example, the seedlings may be grazed, burned or trampled.
 - **LACK OF VEGETATIVE MATTER AND AN EXHAUSTED SEED BANK.** Some plants produce a large amount of long-lived seed. However, many others do not and regeneration may rely on vegetative spread (i.e. sprouting from roots or stumps).
 - **NATURAL SEED PRODUCTION IS LOW.** Many species produce little seed in most years and have occasional years of high seed production that results in mass regeneration. These years occur only a few times each century. Management should focus on protecting the seedlings that establish following a mass seeding event.

Techniques to help natural regeneration

A number of techniques that can be used to achieve natural regeneration are listed below. The appropriate method to use will depend on the health of your bush. If fencing is not an option try reducing your stocking rate in combination with some of the other techniques. It is recommended that you initially test the techniques over a small area.

Grazing

Fencing bush allows you to control the level of stock grazing. If regeneration has occurred, exclude stock until the young trees are out of their reach. This may take 3-5 years or longer. Leave dead branches on the ground as they form a 'cage' that protects young seedlings from browsing animals. If you see a young seedling in the bush place some old branches over it to protect it. If a dense grassy sward is limiting regeneration, crash grazing a mob of sheep for a short period can promote regeneration by reducing competition.

Fire

Experiment with fire to encourage regeneration. Burn a small patch of bush and see if any regeneration occurs. Autumn is probably the best time of the year to burn but experiment with burning in other seasons. Hard seeds stored in cones such as banksia and needle bush or eucalypt seed stored in gum nuts will be released after a fire. Fire will also create an ash bed for many species. Be aware that an intense fire may kill many of the old trees.

Weed control

Weed control may aid the regeneration of native species. Refer to **Kit 3 Weeds in Your Bush** for further information.

Soil preparation

In some cases scarification or light raking of the soil at the time of seed fall may be needed to help create a seedbed and bury or hide seed so that it is not harvested by ants.

Fertilising

Do not fertilise your bush or the area you are rehabilitating unless the topsoil has been removed. Bush plants are adapted to low levels of soil nutrients. Weedy species such as annual grasses are adapted to higher levels of nutrients and they will thrive and offer greater competition to the regenerating species if fertilised.

Record your activities

Don't be afraid to experiment and don't be disheartened if you don't get good results first time. Regenerating the bush can be difficult and there is much to learn about it. Document your activities. Take photographs. Record the species present, the methods used, the time of the year, the weather conditions, how long it took, and how long before germination occurred. All these details help to build up a picture of success and failure, both of which are equally important. This information can later be shared so that others can learn from your experience.



3

Weeds in your bush



About this kit

This kit is designed to help you manage weeds that may be present in your native bush. It provides guidelines to help you develop effective weed management programs and gives specific advice on how to control a range of weeds.

The information covered in this kit includes:

What is a weed?

Why manage weeds in native bush?

How bush weeds are managed

Networking

Preparing a weed plan

Weed control methods

Precautions when using herbicides

Choosing a herbicide

Weed control measures for particular species

Weeds information people

Other sources of information.

Further information about managing weeds in native bush can be obtained from your local Bushcare officer and your regional weed management officer. Contact numbers for these and other useful people can be found on page 27. A list of informative resources, including a web site and weed service sheets, is included on page 28.



What is a weed?

A weed is often defined as “a plant growing where it is not wanted”. In bush managed for nature conservation this means any plant introduced from overseas and in some instances Australian natives that did not naturally grow at that location.

Why manage weeds in native bush?

Weeds can adversely affect native bush by replacing the native plants and destroying the animal habitat. They can also affect the natural environment by changing the shape of the land, fire regimes and stream flows. In the more severe cases there are native plant species under the threat of extinction because of the invasion of weeds. For instance, the South Esk pine is threatened by the invasion of gorse. In addition to these environmental costs there are also economic costs. Weeds that degrade the bush may also reduce farm and forest production. For example, gorse is estimated to cost the grazing industry in excess of one million dollars per year in lost animal production. Managing these weeds in bush blocks will assist in getting regional control over the spread of these weeds.

The main objectives for managing weeds in remnant bush are:

- to manage or minimise the threat to Tasmania’s biological diversity caused by weeds;
- to control and prevent the spread of weeds in accordance with community-based regional weed programs and State Government legislation.

How bush weeds are managed

Healthy undisturbed bush generally has a low incidence of weed invasion. However, most native bush that has been used for grazing, forestry or other uses will have suffered weed invasion. Land management practices that disturb the soil or decrease the native vegetation cover increase the capacity for weeds to invade and establish. Changing these land management practices will be as critical to achieving long-term weed control as treating the weeds themselves. Considering land management practices that create weed problems together with the treatment of weeds is known as integrated weed management.

To apply integrated weed management to your bush you must first understand the needs of the native plants and animals that are present. For instance, in grassy bush some threatened plant species require soil disturbance for their survival. Eradicating all the weeds in the area is likely to eradicate the threatened species. The kit relating to your bush type will provide the management information needed for you to develop an integrated weed management program. It is recommended that you read this information before moving on to planning your weed management.

As weeds do not respect property boundaries you may find that weed management is better achieved by a cooperative and coordinated approach in your area. Whether you make informal arrangements with neighbours or join a regional weed management strategy group (described later in this kit) you may get greater benefit from such an approach.

It is important to be realistic about what can be achieved when managing the weeds in your bush. Many introduced grasses and flat weeds are widespread in grassy bush types. They disperse readily or have large seedbanks and are aggressive colonisers. In most cases eradication of these weeds will not be possible. Where weeds cannot be eradicated, it may be possible to minimise the detrimental impact on the bush by managing fire regimes, soil disturbance or other management practices that contribute to the severity of weed infestations.

Each weed problem is unique. The plant species present, the history of the site (e.g. fire frequency, level of weed infestation), and the environmental sensitivity (e.g. presence of threatened species, wildlife, erosion risk, land use) all lead to different considerations. As a result, the choices for the best methods of weed control will vary. This kit is designed to provide a framework for weed management planning and present options to help decision making rather than providing a set of simple prescriptions. A weeds information contacts list is included at the end of the kit for those wanting to seek further advice on specific problems.

Networking

In 1996 the Tasmanian Government in consultation with the community developed the WeedPlan: A Weed Management Strategy for Tasmania. This plan outlines the approaches needed to coordinate and implement effective weed management in Tasmania. The document is available free of charge from the regional weed management officers and the Department of Primary Industries, Water and Environment (DPIWE), or it can be downloaded from the DPIWE web site. Some of the key programs established under this strategy that may help with your weed management problems are described below, along with some of the other resources available to you. Contact telephone numbers are given at the end of this kit.

Regional weed management strategies

Regional weed management strategies aim to develop the coordination of weed management within the community. They may be based on catchments or other geographical areas that the community feels is appropriate. Although the Government supports the development of regional weed strategy groups the groups are owned and managed by the community. Some of the longest running examples are the Tamar Valley Weed Strategy and the Meander Valley Weed Strategy.

The benefits of becoming involved in or forming one of these groups include:

- the ability to address regional problems such as weed spread along roadsides;
- improved effectiveness of control programs through coordination between landowners and government;
- improved public education and awareness of weeds and the problems they cause;
- provision of weed management assistance including weed control programs.

Regional weed management strategy groups can be simply established by a few landholders joining forces. To find out more contact your local regional weed management officer (DPIWE).

Weed mapping assistance

The Tasmanian Weed Mapping Network was formed by people involved in mapping weeds around the state. Its purpose is to exchange advice and promote a standard approach to weed mapping. The group publishes guidelines and can offer advice. Contact your local regional weed management officer or download the guidelines from the DPIWE web site.

Identifying a new weed

A Weed Alert Network is being established in 1999 to detect new weeds introduced into Tasmania. If an unusual new plant is found on your property it is important that you quickly report it for identification. Be aware that it could be a rare native plant and not necessarily a weed. The Weed Alert Network includes the regional weed management officers of the DPIWE and the Bushcare officers. They can advise you on how to collect a weed specimen for identification.

General weed management help

Your local Bushcare extension officers are the first point of call for assistance with any aspect of weed management. They may refer you to specialist weed management officers. Bushcare officers can also put you in touch with the local weed control officers and authorities such as the Department of Transport and local councils.

Obtaining off-label permits

By law herbicides can only be used in accordance with the instructions on the herbicide label. If it is necessary to apply a herbicide using methods not included on the label, such as when treating a weed that is not listed on the label, an off-label permit is required. This is commonly needed when treating bush weeds. If you are uncertain as to whether a herbicide can be used legally consult the Registrar of Chemical Products, Department of Primary Industries, Water and Environment (Telephone (03) 6233 3565).

Funding assistance

There are Federal funding programs, including the Natural Heritage Trust and Coastcare, that can provide money for managing bush threatened by weeds. Contact your local Bushcare officer for advice on how and when to apply.

Preparing a weed plan

This section provides a step-by-step guide to developing a weed management plan. The extent to which you may need to write up the planning process will depend on the scale and complexity of the problem. Nevertheless, the process can and should be applied to even minor weed control problems to ensure that you have considered all the relevant issues. The recommended process for weed management planning is shown below.



Ideally, the outcome of this process should:

- result in an integrated approach to weed control;
- protect weed free areas;
- manage the invasion of new weeds, including garden plants;
- manage the weeds that have the most severe impact;
- contain and reduce existing weed infestations;
- enhance the native flora and fauna and the natural environment;
- provide an achievable program with the resources available.

Don't just develop a plan for a single bush block. If possible extend it to the whole property or include the land bordering the bush for greater benefit.

1. Define the problem

The first step in preparing a weed plan is to define the problem. To do this visit the site and look around. Take note of what weeds are present, the severity and distribution of any infestations, and the impact the weeds are having on the bush. Look for possible causes of the infestations. This process can be broken down into a series of steps.

a) Identify all your weeds

Identify your weeds and make a collection of pressed weeds or photographs for future reference. If help is needed contact a Bushcare officer.

b) Map the weeds

It is important to obtain a clear picture of the extent of the weed problem. There are a variety of different ways to map weeds, including simply drawing lines on maps, recording weed densities, and using photographic records. Choose the method appropriate to your needs. The weed mapping guidelines produced by the Tasmanian Weed Mapping Network provide further details.

c) Map or note features that may be affected

This includes environmental, economic and cultural features that could be affected by weeds or weed control programs.

Aboriginal heritage is protected by law and weed control programs must be undertaken sensitively at these sites.

d) Assess the beneficial or historical properties of the weeds

Some weeds help stabilise slopes and offer protective habitat or food for wildlife. Wildlife can be identified by observing at different times of the day and night, or by identifying scats, diggings, nests, etc. Determine if these beneficial properties can be maintained if the weeds are removed. Check that the weeds do not have any cultural significance. For example, introduced pines may be considered weeds today but after the Second World War many commemorative plantings of pines were undertaken and these should be respected.

e) Identify the problem weeds

Decide which weeds need to be tackled first. Consider the adverse impact of individual weed species and their rate of spread. Look for evidence of woody weeds crowding out native plants or climbers, and scrambling weeds smothering the native vegetation. Weeds that are spreading rapidly can be identified by the large numbers of young plants that occur away from the mature plants. Grasses and flat weeds may be best dealt with as a group rather than individually. Find out if there is a regional weed management strategy group in your area and what weed programs they are running. Bushcare officers can also provide information on which weeds may be more important to control.

2. Plan an integrated weed management strategy

a) Assess the impact of land management

Consider which land management practices favour weed invasion or increase the severity of infestations and how these may be modified to favour the native vegetation instead. Refer to the relevant kit for your bush type to identify the management practices needed to maintain that bush in a healthy state. Any proposed change in land management practices to control weeds must also maintain the native vegetation. Common practices that you may consider managing to reduce ongoing weed problems are:

- soil disturbance (access by vehicles, machinery, etc);
- grazing regime (grazing pressure and timing);
- fertilising (nutrient input from adjacent paddocks, house and road drainage lines);
- fire (frequency and timing);
- farm hygiene practices (importation of materials, machinery, washdown, etc);
- monitoring for new weed invasions or resurgence at old sites.

This approach is particularly important as it will help protect your weed free areas, which is your highest priority. Consider whether local or regional cooperation and coordination could play a role in protecting your land from reinvasion by weeds. Discuss this with your regional weed management strategy group.

b) Combining land management with weed control

Where the land management practices identified above will not be enough to allow you to gain control over particular weeds a specific weed control program will also be needed. These control programs should target problem weeds that will not re-establish rapidly in large numbers. Decide which are the priority weeds by assessing the potential damage and the ease of control of each weed. For example, serious weeds that are not well established should be treated before weeds that are well established.

c) Prioritise the areas where problem weeds will be treated

For the most efficient use of resources weed infestations should be contained by treating the outlying plants first before working inwards towards the major infestations. This will be the quickest way to reduce the size of the infested area.

Recommended highest priorities are:

- small outlying infestations and individuals;
- infestations that may spread rapidly, e.g. along creek lines or tracks. It is better to work downhill when undertaking control programs to avoid reinfestation;
- infestations that affect significant values such as threatened plant species.

d) Selecting weed treatment methods

A range of effective control methods are outlined in this kit. Choose a method that will suit your conditions while not adversely affecting the native vegetation. A combination of control methods often yields better results while minimising potential impacts. For example, combining chemical control with hand weeding. If a weed occurs at two sites under different circumstances you may need to change your choice of control methods to suit the conditions at each site. Talk to your neighbours as they may have already tried the methods you are about to attempt and may be able to offer some good advice. Consider your rehabilitation/revegetation needs. If you stagger your weed control over a period of time the cost of rehabilitation will be reduced as natural revegetation gradually occurs.

e) Document your strategy

It is best to write down the integrated weed management strategy you decide on. Include information from each of the points considered above, along with your weed maps.

3. Develop your integrated control program

This step puts your strategy into a timetable of tasks that can be achieved with the resources available. It is recommended that the control program be based on a three year timetable as this allows for a follow-up period. In the third year the program should be updated for the next three years based on progress to date. Incorporate weed control into your existing farm management systems or develop a separate weed program that lists actions, their timing and costs, and any other resources needed.

a) Determine the resources that can be committed

You have the choice of working within your means or seeking assistance through a regional weed strategy group or various funding programs such as Bushcare. It is better to concentrate your resources on solving one weed problem than spreading them inadequately over many problems.

b) Allocate resources to priority actions and record them in your management program

Develop a program of tasks starting with the highest priority jobs until the available resources (time and money) are committed. Focus your program on these priority tasks. Knowing the biology of your weeds can help save resources and time. For instance, you can estimate how long control will take to achieve by being aware of the life span of seed stored in the soil and what time of year the majority of seed germinates. Ensure that your program maintains the benefits that were identified in Step 1d. For instance, do not remove the weed cover needed by wildlife until alternative native plant cover has been established.

Factors that should be included in the program include:

- work needed to bring about changes in land management (e.g. fencing for stock management, burning);
- management prescriptions (e.g. timing of stock movements, weed monitoring);
- actions that must be done at a specific time (e.g. gorse spraying).

4. Implementation

Even the best laid plans can go awry. Be aware of the effects of drought and other events that may put plants under stress and reduce the effectiveness of herbicides by reducing the uptake of herbicide or associated rehabilitation programs. In these circumstances it may be better to reschedule tasks or modify the control methods you use. Otherwise, record the hours taken, rate of herbicide application and the weather conditions at the time. This will provide valuable information for future monitoring and for planning further treatments.

5. Monitor and review

Monitor the success or otherwise of your plan on an annual basis. Walk around the treated area to look for plants that were missed during control treatments and natural regeneration of native plants. Mark the next treatment areas on your weed map and assess the level of control achieved in the last. If control is unsatisfactory consider the reasons and how you could modify the program. Discuss your results with others in the community, particularly any regional weed strategy groups or neighbours who could benefit from the techniques developed.

Weed control methods

The following methods may be used individually or in combination to control weeds. They should be matched with good land management practices to obtain the best results. Issues to consider when selecting a method include:

- degree of infestation
- native plants present and how they should be protected
- presence of soil erosion
- likelihood of prolific regeneration of the weeds from seed
- ability of the weeds to resprout from their roots
- likelihood of losing habitat for native wildlife.

Physical weed control methods

The following methods are most commonly used to avoid the introduction of herbicides into the environment. They can be very effective.

Over-planting

Over-planting or shading out weeds can be used in revegetation programs where establishing a canopy of native shrubs or trees can help control herbaceous weeds. This is a long-term strategy that is normally combined with other weed control methods.

Hand-pulling and grubbing

Hand-pulling is a labour-intensive but very effective method for reducing the size of weed populations. A number of weeds can be easily hand-weeded from the bush, particularly young plants that have not developed an extensive root system. This method of control can be very effective when dealing with small populations of weeds, including boneseed, broom, sweet pittosporum, and many other woody and grassy weeds. Hand-pulling is best carried out when the soil is damp, when the root systems are more easily dislodged and less damage is done to the soil structure. For some plants such as montbretia (*Crocasmia X crocosmiiflora*) and narrow-leaf plantain (*Plantago lanceolata*) hand-pulling can be more effective when using a bulb trowel. The trowel can be used to loosen the bulb or root and ensure that the entire plant is removed. If the plants are in flower or in seed time can be saved by removing the reproductive parts of the weed and disposing of them in a way that will not cause further infestation.

Mechanical control

Some environmental weeds cannot be hand-weeded but they can be removed or reduced in number by mechanical means. For example, felling, slashing or mowing can be used to restrict invading shrubs or trees in some situations. Grubbing (i.e. digging out) African boxthorn with a bulldozer has been carried out successfully in many locations, followed by treatment of any shoots or seedlings that appear. Try to ensure that further contamination does not occur from soil left on the machinery. Mechanical methods of weed removal may not be effective without follow-up treatment such as herbicide spraying. Mechanical control is of limited use in remnant bush except for major regeneration projects.

Burning

Some weeds are killed by fire or may be more easily controlled by other means after burning. For instance, areas of gorse can be burnt as an initial control method. This allows access to treat regrowth which may require 5-10 years to eliminate. Burning the base of

some weeds such as willows has been used followed by spraying or continuous cutting of the regrowth. Fire can also be used to promote the germination of some weed seeds in order to exhaust the seedbank. Follow-up treatment is always required in this case.

As fire can have a profound effect on plant and animal communities professional advice should be sought before burning native bush.

Grazing

Grazing by cattle, sheep or goats is a useful weed control measure for farmland but it is not much use for native bush. Grazing should only be contemplated in those areas that have a long history of grazing and where specific grazing regimes have been shown to maintain a native cover that can compete with the weeds present.

Cultivation

Soil cultivation has a minimal role in controlling weeds in native bush. Weeds with extensive root systems that store food such as rhizomes and tubers will generally survive cultivation and this method will be ineffective.

Scalping

Grading or scalping off the top layer of the soil is a useful technique for removing the seedbank. However, it creates massive soil disturbance that could have adverse effects on the native bush. It is best suited to areas dominated by weeds where a rehabilitation program is planned.

Mowing and slashing

Mowing and slashing can be effective in reducing further seeding but they are unlikely to kill the existing plants. Do not use these methods for plants that may regrow from fragments. Dispose of the waste vegetation in an appropriate way such as burning.

Steam

Steam has not been fully explored yet. It has been used with some success by a Landcare group on the east coast to control Spanish heath (*Erica lusitanica*). The process involved slashing followed by steaming of the regrowth. The method has also been used by several local councils at sites such as school grounds for the control of flat weeds.

Chemical weed control methods

Though chemical control methods can have significant adverse side effects if misused they provide a very useful technique for managing large infestations where resources are limited and physical methods may not work. It is recommended that marker dyes formulated for herbicide use be used with all chemical treatments. Dyes mark the plants that have been treated and alert you to any non-target damage. Take extra care when using herbicides in higher concentrations such as when using the cut and paint method.

Cut and paint

For this method you need secateurs and an applicator. The applicator can be a shoe polish container with a foam applicator pad or a hand spray bottle. Be sure to label the container. After use, empty the container, clean it thoroughly, and store it safely. Cut the plant as near to the base as possible and apply the herbicide. This should be applied within 15-30 seconds of cutting or it will be ineffective. Keep the applicator pads as clean as possible to maximise the effectiveness of the treatment. Some herbicide labels that recommend the cut and paint method also include treatment of the bark below the cut for improved effectiveness. When carrying out cut and paint be particularly careful as the herbicides used are more concentrated than those used for spraying.

Drill and fill - frill and fill

Drilling and filling involves drilling holes around the trunk of a tree, usually at about 150 mm spacings, and filling the holes with a quantity of herbicide. Frilling is similar but is done with a chisel and hammer and the spacing is much closer. The chisel is held at a slight angle to the trunk, hit with a hammer and the herbicide applied. The aim is not to drill or chisel too deeply but to target the layer just under the bark that transports the chemical throughout the plant (cambium layer). It is important not to ringbark the tree when frilling as this will reduce the dispersal of the herbicide. When carrying out drill and fill or frill and fill be particularly careful as the herbicides used are more concentrated than those used for spraying.

Stem injection

A number of stem injection guns and hand axes are available for treating trees. They are expensive and are best suited to large scale tree poisoning programs. Allow herbicides to work before felling the trees.

Spray

Applying herbicides by spraying may provide cost effective control when resources are limited. Methods of spraying include:

SPOT-SPRAYING: This involves spraying specific plants with a hand spray or using a knapsack with a single nozzle.

KNAPSACK: This is used to treat small or remote areas. Spray to the point of runoff (when leaves start to drip) or if you have a pressure calibrated knapsack measure the flow rate and apply at the rate recommended on the label.

BASAL BARK: This involves spraying or painting the lower stems of woody weeds.

HAND GUN OR BOOM SPRAY: This is suited to medium to large jobs where access to the area is good. It has limited application in bush areas.

LOW VOLUME SPRAYING: This method has increased portability, greater spray drift risks and is commonly used for large infestations. It requires specialised equipment. It has limited application in bush areas.

Precautions when using herbicides

It is recommended that anyone handling and using herbicides attend a one day training course on farm chemical use. Contact the Tasmanian Rural Industry Training Board on (03) 6331 2131 for more information.

The following precautions apply when using any herbicide:

- Store in a safe place.
- Store in the original container: never decant into other bottles or use unlabelled containers.
- Do not store near foodstuffs, seeds, fertilisers or other chemicals.
- Do not re-use the container for other purposes.
- Avoid contact with eyes, skin and respiratory system.
- Use protective clothing, i.e. face shield, goggles, impervious gloves, etc.
- Wash thoroughly before eating and drinking.
- Do not spray in conditions where the wind may blow spray droplets onto non-target

plants. Some herbicides produce vapours that may move in air currents. Such vapours are more readily produced on a hot day.

- When carrying out cut and paint or drill and fill or frill and fill be particularly careful. The herbicides used for these techniques are more concentrated than those used for traditional spraying so the safety margins are much lower.
- Do not contaminate streams, waterways, reservoirs or channels.
- Avoid working in poorly-ventilated areas.
- Wash contaminated clothing after use.
- Thoroughly wash spray equipment after use and before using another pesticide.
- If poisoning occurs seek medical help. Read the label.
- Some herbicides are toxic to bees. As a general rule avoid applying herbicides when and where bees are foraging. Always read the label.

Poison Schedule

The Poison Schedule indicates the toxicity of the herbicide: Schedule 7 products are very hazardous, Schedule 6 are moderately hazardous, Schedule 5 are slightly hazardous, and unclassified herbicides are very slightly hazardous.

Protective clothing

The table below outlines the recommended protective clothing that should be worn when handling chemicals. More or less protective clothing may be required to suit particular circumstances — always consult the product label.

POISON SCHEDULE	LABEL CAUTIONS	HEALTH HAZARD RATING	MEASURING AND MIXING PRECAUTIONS	SPRAYING PRECAUTIONS
Schedule 7	DANGEROUS POISON S7	Very hazardous	PVC apron, full protective hood, respirator, overalls, gloves & boots	Full protective hood, respirator, overalls, gloves & boots
Schedule 6	POISON S6	Hazardous	PVC apron, goggles, respirator, hat, overalls, gloves & boots	Respirator, hat, overalls, gloves & boots
Schedule 5	CAUTION (The word WARNING is used now but it will be phased out by June 2000)	Low to moderate hazard	PVC apron, face shield, hat, overalls, gloves & boots	Respirator, hat, overalls, gloves & boots
Unclassified	KEEP OUT OF REACH OF CHILDREN	Low hazard	PVC apron, face shield, hat, overalls, gloves & boots	Hat, overalls, gloves & boots

Herbicides, why so many types?

The use of chemicals, other than herbicides specifically formulated for the task, is strongly discouraged and illegal unless covered by an off-label permit approving that use.

Herbicides may be classified by their selectivity in the plants they affect. The three broad classifications are:

- selective herbicides that kill grasses and sedges;
- selective herbicides that kill broad-leaved plants such as woody weeds, bulbs and herbs;
- non-selective herbicides that kill plants across all the major groupings.

Herbicides kill plants by different means. Different chemicals will be more or less effective according to the plant's biology. Two types are recognised:

- **CONTACT HERBICIDES:** These affect only the parts of the plants that are treated and therefore work best on annuals which do not have food reserves in their root systems, e.g. seedlings and plants without the capacity to regrow from root stock or protected buds. These are usually non-selective herbicides.
- **TRANSLOCATED HERBICIDES:** These herbicides are transported through the plant. They damage the roots and protected buds as well as the foliage. Translocated herbicides are more effective against woody weeds and plants with stored energy in their root systems. These herbicides may be selective or non-selective.

The rate at which herbicides break down is important. Residual herbicides are those that are slow to degrade. Therefore, they remain active and are likely to cause continuing plant mortality after initial treatment. They may be designed to control germination of weeds over time. They are commonly delivered by soil injection. Residual herbicides should not be used where they may create a problem for other nearby plants that need protecting.

Choosing a herbicide

When choosing a herbicide there are a number of factors to consider:

- Only use herbicides that are registered for the intended use. Check the label for situations where it can be used and for the weeds it may be applied to. If in doubt contact a regional weed officer at the Department of Primary Industries, Water and Environment. Contact the Registrar of Pesticides if an off-label permit is required.
- Is a selective or non-selective herbicide needed?
- Is a residual or non-residual herbicide required and for how long will the residual herbicide be active?
- What safety and environmental protection requirements apply to the use of the herbicide?
- What are the registered rates and application methods for the herbicide?
- Herbicide product labels carry a letter code A, B, C, etc. which relates to their mode of action that will help in avoiding resistance. To prevent or delay the development of herbicide resistance:
 - observe the new A, B, C groupings on the label;
 - when using herbicides rotate between groups;
 - keep accurate spraying records for each paddock or area of application.

The characteristics of some of the common active ingredients of herbicides are shown below. The active ingredient is the chemical component of the herbicide that kills the plant.

Characteristics of some common active ingredients

ACTIVE INGREDIENT (a number of companies supply most of these herbicides)	RESIDUAL	SELECTIVITY	POISON SCHEDULE	COMMENTS
Glyphosate	No	Non-selective	S5 (Roundup)	Disperses through the plant and inhibits cell growth
Metsulfuron methyl	6-9 months	Kills broad-leaved plants	Unscheduled	Absorbed by leaves and disperses through the plant. Interferes with cell division at growing points
Metsulfuron methyl + glyphosate	Metsulfuron is residual 6-9 months	Non-selective	S5 (Trounce)	See individual chemical constituents
Dicamba	3-6 months	Kills broad-leaved plants	S5 (Banvel 200)	Absorbed by roots and foliage, readily translocated to growing points where it affects cell growth & stem elongation
MCPA, dicamba	3-6 months	Kills broad-leaved plants	S5 (Banvel M)	See individual active ingredients
Triclopyr, picloram	Picloram is residual 12 months +	Kills broad-leaved plants	S6 (Grazon)	Triclopyr is readily translocated and affects cell division. Picloram is translocated and affects cell elongation and other processes
Clopyralid	9-12 months	Kills broad-leaved plants	S5 (Lontrel)	Absorbed by leaves and is transported through the plant. Interferes with cell division
Triclopyr	No	Kills broad-leaved plants	S6 (Garlon 600)	Readily transported through the plant and affects cell division
MCPA	No	Kills broad-leaved plants	S5 (MCPA 500)	Absorbed by leaves and is translocated through plant. Interferes with cell division and other growth processes
Haloxfop	3-6 months	Kills grasses and sedges	S6 (Verdict 104)	Transported and inhibits cell division
Picloram + 2,4-D	Residual 12 months +	Kills broad-leaved plants	S5 (Tordon 75-D)	See individual active ingredients

Weed control measures for particular species

The herbicides listed below are subject to the product being registered or the user being issued an off-label permit. It is the user's responsibility to check that the product registration or off-label permit covers the proposed use. Always read the herbicide label. If in doubt check with the Registrar of Chemical Products, Department of Primary Industries, Water and Environment (Telephone (03) 6233 3565).

Glyphosate products come in a number of different formulations produced by many different manufacturers. Application rates provided in this kit are all specified for a product concentration of 360 g/L of glyphosate. If using glyphosate along creeks or waterways Roundup Biactive*, Weed Master* or similar glyphosate products specifically registered for this purpose must be used. Roundup* and some other glyphosate products have had their registration for this use withdrawn. If in doubt check with the Registrar of Chemical Products, DPIWE.

There will be more chemical control options available with time as further off-label uses of herbicides are obtained for use in native bush. It is wise to check the service sheets on the DPIWE web site, or check with a Bushcare extension officer or regional weed officer for the latest information.

If considering the use of fire seek professional ecological and fire management advice to ensure that your methods are both appropriate and safe.

Banana passionfruit (*Passiflora mollissima*)

Banana passionfruit is a vigorous climber with large three-lobed, light green leaves and striking flowers. It is shade tolerant. This weed will smother plants and reduce the recruitment of native species. It has a life span of 20 years and reproduces from seed and fragmentation.

CONTROL METHODS

HAND-PULLING: Cut the climbing vines and dig out or hand-pull the roots in winter/spring. Leave the vines to die on the support plant if pulling them down will cause too much damage. Collect any fruit. Hand removal of seedlings is effective and removes all the roots. Treat regrowth in spring with glyphosate or hand-pulling.

HERBICIDES: The table below shows the herbicides suitable for control of banana passionfruit. Do not apply herbicides if the plants are under stress.

Type of application	Herbicide (active ingredient)	Commercial products (concentration of active ingredient)	Application rate	Comments
Foliar spray	Glyphosate	Many different brands available, e.g. Glyphosate 360® (360 g/ L) Roundup® (360 g/ L) Roundup Biactive® (360 g/L) Weed Master® (360g/ L)	All 10 ml/ L	Add a penetrant, e.g. Pulse® or Freeway® at rate given on label

Note: Adding other products to most herbicides alters their effectiveness. Carefully consult the label for specific directions before adding any other products.

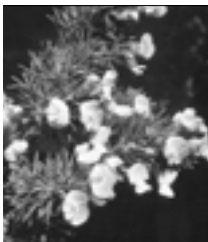
When using herbicides follow the precautions outlined on pages 10-11.



Blackberry (*Rubus fruticosus* agg.)

Blackberry is the name commonly used for a number of closely-related brambles. Blackberry plants within Tasmania vary considerably in size, strength and shape. This variation affects their susceptibility to control measures such as herbicide use and biological control. At least nine species including the distinctive cutleaf blackberry are known to occur in Tasmania but there may be others not yet identified. Blackberry occurs in all settled areas of the state. It grows most vigorously in higher rainfall areas and may be restricted to the edges of creeks and rivers in drier areas. The plant flourishes on waste and neglected land where it creates a fire hazard and a haven for vermin. It is particularly prevalent along waterways and roadsides. It can quickly over-run large areas, often in association with bracken. Under favourable conditions it is capable of spreading in pasture. *Fig 1*

Please refer to the DPIWE Weed Service Sheet for detailed information on the control of blackberry.



Blue butterfly-bush (*Psoralea pinnata*)

Blue butterfly-bush is an erect shrub or small tree with willowy branches. The leaves are needle-like and the scented lilac-blue pea flowers occur sporadically throughout the year but mainly in summer. It is a massive producer of long-lived seed that builds up in the soil. Germination is triggered by fire. Plants will re-sprout after physical damage and fire. Control measures need to be undertaken over 4-8 years to eradicate this species. *Fig 2*

CONTROL METHODS

HAND-PULLING: Seedlings and young plants can be hand-pulled.

HERBICIDES: The table below shows the herbicides suitable for control of blue butterfly-bush. Do not apply herbicides if the plants are under stress.

Type of application	Herbicide (active ingredient)	Commercial products (concentration of active ingredient)	Application rate	Comments
Foliar spray	Glyphosate	Many different brands available, e.g. Glyphosate 360° (360g/L) Roundup° (360g/L) Roundup Biactive° (360g/L) Weed Master° (360g/L)	All 10 ml/ L	
Cut and paint	Glyphosate	360 g/ L products as above 200 ml/ L	200 ml/ L (1:5)	Cut close to the ground and apply immediately after cutting

Note: Adding other products to most herbicides alters their effectiveness. Carefully consult the label for specific directions before adding any other products.

When using herbicides follow the precautions outlined on pages 10-11.



Boneseed (*Chrysanthemoides monilifera* ssp. *monilifera*)

Boneseed is a South African evergreen woody shrub that commonly grows to two metres or more in height and diameter. Boneseed is capable of invading and dominating the understorey of forests and bushland areas. It is particularly invasive in coastal areas and in some instances it may form dense thickets that exclude all other plant species. The plant can thrive in a range of environments, including coastal sands. Boneseed has a relatively shallow root system. While the plants are young this makes manual removal quite simple but in larger plants the root mass is large and physical removal is difficult. Boneseed is common in several coastal areas of Tasmania, especially along the north coast east of Wynyard and on parts of the east coast. It is common in the Tamar Valley and in the cities and suburbs of both Launceston and Hobart. *Fig 3*

Please refer to the DPIWE Weed Service Sheet for detailed information on the control of boneseed.



Boxthorn (*Lycium ferocissimum*)

African boxthorn is a woody shrub that reaches up to 4 m in height. It can grow on a wide range of soil types and it forms an extensive root system. Boxthorn is found throughout most agricultural areas of the state, including King Island and Cape Barren Island. It is commonly found along fencelines and beneath overhead wires as the seed is released by birds perching on the wires. It is also common along roadsides, railways and waterways. *Fig 4*

Please refer to the DPIWE Weed Service Sheet for detailed information on the control of boxthorn.

Bridal creeper (*Myrsiphyllum asparagoides*)

Bridal creeper is a perennial climbing or woody herb up to 3 m in height with persistent tubers and red berries that are shed over the summer. The foliage is annual with new stems arising from the tuber each year. Seed production is high and spread by birds. There is almost no long-term seedbank but some seed will persist at the soil surface. Bridal creeper is tolerant of shade, drought and will resprout if damaged. About 80% of the plant is made up of underground tubers so hand pulling and digging are not considered viable options in most circumstances. Herbicide treatment is preferred. All infestations of bridal creeper should be reported to DPIWE regional weed officers as this weed is undergoing an eradication program from the Tasmanian mainland. Assistance with control may be available.

CONTROL METHODS

STOCK MANAGEMENT: Heavy grazing has been used to reduce the density of bridal creeper prior to spraying.

HERBICIDES: The table below shows the herbicides suitable for control of bridal creeper. Do not apply herbicides if the plants are under stress.

Type of application	Herbicide (active ingredient)	Commercial products (concentration of active ingredient)	Application rate	Comments
Foliar spray	Metsulfuron mixed with a glyphosate product	Brush-Off® mixed with Roundup® (360 g/ L)	1.5 g/10 L mixed with 100 ml/10 L	Must add Pulse @ 40 ml/ 10 L. Spray July to October. Repeat annually. Off-label permit has been obtained for Tasmania

Note: Adding other products to most herbicides alters their effectiveness. Carefully consult the label for specific directions before adding any other products.

When using herbicides follow the precautions outlined on pages 10-11.



Canary broom (*Genista monspessulana*)

Canary broom is an erect shrub usually less than 2 m in height with a deep tap root system. The yellow pea flowers appear in August-October, followed by abundant long-lived seed shortly afterwards. Seed production starts at two years, with plants producing 5-8 seeds in each pod, and even young plants producing a large number of pods. The seed persists in the soil for many years. Canary broom is rarely grazed and can be toxic to stock if grazed excessively. It will resprout following physical damage and fire. Fire also promotes germination. *Fig 5*

CONTROL METHODS

HAND-PULLING: Hand-pulling of seedlings is effective but a firm tap root develops early so that plants are difficult to remove by the time they are about 30 cm high. The task is made easier and more effective when the soil is wet. Hand-pulling may be complemented with spraying or cutting and painting of larger plants. If appropriate, burning may be used to promote mass regeneration of seedlings to reduce seedbanks but follow-up control must take place. Seed germination following control is to be expected.

HERBICIDES: The table below shows the herbicides suitable for control of canary broom. Do not apply herbicides if the plants are under stress.

Type of application	Herbicide (active ingredient)	Commercial products (concentration of active ingredient)	Application rate	Comments
Foliar Spray	Glyphosate	Many different brands available, e.g. Glyphosate 360° (360g/L) Roundup® (360g/L) Roundup Biactive® (360g/L) Weed Master® (360g/L)	All 10 ml/L	Add surfactant in accordance with the label
	Triclopyr + picloram	Grazon DS	2.5 ml/L (summer) 3.5 ml/L (autumn/winter)	
Cut and paint	Glyphosate	360 g/L products as above (Permits for more effective cut & paint herbicides may be available from mid 1999 - contact Bushcare officers)	200 ml/L	Cut close to the ground and apply immediately after cutting

Note: Adding other products to most herbicides alters their effectiveness. Carefully consult the label for specific directions before adding any other products.

When using herbicides follow the precautions outlined on pages 10-11.



Cape wattle (*Paraserianthes lophantha*)

Cape wattle is a small tree or tall spreading shrub with a close resemblance to silver wattle. It has dark green feathery foliage, greenish-yellow flowers in spring, and large wattle-like reddish brown seed pods in summer. It is a prolific seed producer and the heavy seeds may be dispersed by ants, water or human activity. Cape wattle was introduced from Western Australia and it is widely grown in gardens. *Fig 6*

CONTROL METHODS

HAND PULLING: Seedlings and small shrubs may be removed by hand when the soil is moist.

RINGBARKING: Large plants may be ringbarked as close to the ground as possible.

HERBICIDES: The table below shows the herbicides suitable for control of cape wattle. Do not apply herbicides if the plants are under stress.

Type of application	Herbicide (active ingredient)	Commercial products (concentration of active ingredient)	Application rate	Comments
Foliar spray	Glyphosate	Many different brands available, e.g. Glyphosate 360° (360g/L) Roundup® (360g/L) Roundup Biactive® (360g/L) Weed Master® (360g/L)	All 10 ml/L	Add surfactant in accordance with the label
Cut and paint	Glyphosate	360 g/ L products as above (Permits for more effective cut & paint herbicides may be available from mid 1999 - contact Bushcare officers)	200 ml/L	Cut close to the ground and apply immediately after cutting

Note: Adding other products to most herbicides alters their effectiveness. Carefully consult the label for specific directions before adding any other products.

When using herbicides follow the precautions outlined on pages 10-11.

Cotoneaster (*Cotoneaster* species)

Three species of cotoneaster pose a threat to native bush:

Cotoneaster franchetti - A tall shrub with long cane-like branches and salmon pink to pale orange fruit persisting through to July. It flowers November-January.

Cotoneaster glaucophyllus - A tall spreading shrub with larger leaves than the other two species. It has masses of small red fruit that appear in February-August. It flowers October-November.

Cotoneaster pannosus - A shrub with tangly wiry branches and red berries persisting through to July. It flowers in November.

All three species produce a large quantity of bird-dispersed seed, grow in shady areas, are fairly drought-resistant, and have the same control methods. It is important to try to locate the seed source and destroy it to prevent further invasion. See inset cover for illustration.

CONTROL METHODS

HAND-PULLING: Small seedlings can be hand-pulled.

SHADING: Less seed is produced under shady conditions but shade will not kill existing plants.

HERBICIDES: The table below shows the herbicides suitable for control of cotoneasters. Do not apply herbicides if the plants are under stress.

Type of application	Herbicide (active ingredient)	Commercial products (concentration of active ingredient)	Application rate	Comments
Foliar spray	Glyphosate	Many different brands available, e.g. Glyphosate 360° (360 g/ L) Roundup® (360 g/ L) Roundup Biactive® (360 g/L) Weed Master® (360 g/ L)	All 10 ml/ L	
Cut and paint	Glyphosate	360 g/ L products as above	200 ml / L	Cut close to the ground and apply immediately after cutting

Note: Adding other products to most herbicides alters their effectiveness. Carefully consult the label for specific directions before adding any other products.

When using herbicides follow the precautions outlined on pages 10-11.

English broom (*Cytisus scoparius*)

English broom is a shrub 1-2 m in height with many branches and yellow flowers in August-November. Mature plants are leafless most of the year. Seed production starts at two years with around 300 seeds, rising to 12,000-30,000 seeds per mature bush per season. Seeds are dispersed by water, soil movement, and deliberate planting. Fire results in prolific seed germination and existing plants will resprout. Physical damage also results in regrowth. The seedbank lasts for 80 or more years. Germination occurs in autumn to spring. Plants are tolerant of frost, shade and drought.

CONTROL METHODS

HAND-PULLING: English broom can be easily pulled when less than 1 m tall so hand-pulling is good for the removal of seedlings.

STOCK MANAGEMENT: Goats and sheep can be used to control plants but once grazing stops the plants will re-establish. This weed can be toxic if excessively grazed. Beware! English broom can be confused with the native broom spurge (*Amperea xiphoclada*). Both are leafless for much of the year but when they are in flower the differences are obvious.

HERBICIDES: The table below shows the herbicides suitable for control of English broom. Do not apply herbicides if the plants are under stress.

Type of application	Herbicide (active ingredient)	Commercial products (concentration of active ingredient)	Application rate	Comments
Foliar spray	Glyphosate	Many different brands available, e.g. Glyphosate 360 [®] (360g/L) Roundup [®] (360g/L) Roundup Biactive [®] (360g/L) Weed Master [®] (360g/L)	All 10 ml/L	Add surfactant in accordance with the label
	Triclopyr	Garlon 600 [®]	1.7 ml/L	
	Triclopyr + picloram	Grazon DS [®]	2.5 ml/L (summer) 3.5 ml/L (autumn/winter)	
Cut and paint	Triclopyr	Garlon 600 [®]	1:48 mix of Garlon and diesel	Cut close to the ground and apply immediately, paint sides of stem too

Note: Adding other products to most herbicides alters their effectiveness. Carefully consult the label for specific directions before adding any other products.

When using herbicides follow the precautions outlined on pages 10-11.

English ivy (*Hedera helix*)

English ivy is a vigorous climber with dark green glossy leaves and an extensive root system. It tolerates shade and poor soils. The flowers appear December-March with abundant blue-black berries present in June-September. Ivy will re-sprout when damaged, is frost hardy, produces a large amount of bird-dispersed seed, and spreads rapidly by opportunistic roots along the stems.

CONTROL METHODS

DIG OUT: Cut the ivy at the base and allow the tops of the plant to die in the trees. Be sure to locate all the places where the ivy may have taken root along the stems. Dig out the roots when the soil is soft. If the roots cannot be removed paint the stumps with herbicide. If you pull down the ivy remove it from the site and burn or bury it deeply to prevent regrowth.

HERBICIDES: The table below shows the herbicides suitable for control of English ivy. Do not apply herbicides if the plants are under stress.

Type of application	Herbicide (active ingredient)	Commercial products (concentration of active ingredient)	Application rate	Comments
Cut and paint	Glyphosate	Many different brands available, e.g. Glyphosate 360 [®] (360g/L) Roundup [®] (360g/L) Roundup Biactive [®] (360g/L) Weed Master [®] (360g/L)	All 200 ml/L	Cut near the ground and strip the bark down at least 20 cm further, paint immediately

Note: Adding other products to most herbicides alters their effectiveness. Carefully consult the label for specific directions before adding any other products.

When using herbicides follow the precautions outlined on pages 10-11.



Foxglove (*Digitalis purpurea*)

Foxglove is a tall biennial herb that grows up to 2 m. It has masses of large purple flowers on a spike up to 50 cm long. It produces vast quantities of very fine, highly viable seed. Foxgloves can invade disturbed shrubby or wet eucalypt forest. They are prominent in open disturbed bush but disappear once the canopy closes up and may reappear with further disturbance. Foxglove is toxic so take precautions when handling all parts of the plant. *Fig 7*

CONTROL METHODS

HAND-PULLING: This is an effective and easy way of removing foxgloves. If an infestation is just starting to appear you may be able to hand-pull the first plants. If there is any hint of seed on the plants cut the tops off and place them in a bag for removal and burning then hand-pull the plants.

HERBICIDES: The table below shows the herbicides suitable for control of foxglove. Do not apply herbicides if the plants are under stress.

Type of application	Herbicide (active ingredient)	Commercial products (concentration of active ingredient)	Application rate	Comments
Foliar spray	Glyphosate	Many different brands available, e.g. Glyphosate 360° (360g/L) Roundup® (360g/L) Roundup Biactive® (360g/L) Weed Master® (360g/L)	All 10 ml/L	

Note: Adding other products to most herbicides alters their effectiveness. Carefully consult the label for specific directions before adding any other products.

When using herbicides follow the precautions outlined on pages 10-11.



Fuchsia (*Fuchsia magellanica*)

Fuchsia is a small to medium-sized shrub with surface roots and red tubular flowers. It is currently a popular garden plant. The seeds are produced in large numbers and are dispersed by birds. It thrives in any soil. It is competitive in areas of wet forest while in dry soils disturbance is required for its establishment. *Fig 8*

CONTROL METHODS

HAND-PULLING: This is very effective for small plants and seedlings. The surface roots release easily and hand-pulling can be a very effective form of control.

HERBICIDES: The table below shows the herbicides suitable for control of fuchsias. Do not apply herbicides if the plants are under stress.

Type of application	Herbicide (active ingredient)	Commercial products (concentration of active ingredient)	Application rate	Comments
Foliar spray	Glyphosate	Many different brands available, e.g. Glyphosate 360° (360g/L) Roundup® (360g/L) Roundup Biactive® (360g/L) Weed Master® (360g/L)	All 10 ml/L	
Cut and paint	Glyphosate	360 g/ L products as above	200 ml/L	Cut close to the ground and apply immediately after cutting

Note: Adding other products to most herbicides alters their effectiveness. Carefully consult the label for specific directions before adding any other products.

When using herbicides follow the precautions outlined on pages 10-11.

Gorse (*Ulex europaeus*)

Gorse is one of Tasmania's most widespread and troublesome weeds. Its dark green leaves and stems are ridged and covered with a waxy cuticle to help minimise water loss. This together with its deep root system allows gorse to proliferate in areas of very low rainfall. The flowers are primarily pollinated by bees. Gorse is present in most agricultural and urban areas. It is particularly dense in the Midlands, rendering many hectares of grazing land useless. As an environmental weed gorse has become a major problem by invading native bush and conservation areas throughout the state. Due to the surrounding vegetation and terrain it is usually difficult to eradicate gorse in these situations. Gorse is spread mainly by seed, however, cultivation and spread of the root system occasionally allow some fragments to regenerate.

Please refer to the DPIWE Weed Service Sheet for detailed information on the control of gorse.



Hawthorn (*Crataegus monogyna*)

Hawthorn is a medium-sized, multi-stemmed, winter-deciduous prickly shrub that grows up to 4 m in height. It has white to cream flowers during October-November and red berries persist into winter. A large quantity of bird-dispersed fruit is produced and the life of the seedbank is unknown. Plants will resprout when damaged and recover from a minor fire. The life span of hawthorn could be up to 150 years. Be aware that hawthorn hedges can have historic cultural values. *Fig 9*

CONTROL METHODS

HAND-PULLING: This is an effective method for seedlings and young plants. Use thick gloves.

HERBICIDES: The table below shows the herbicides suitable for control of hawthorn. Do not apply herbicides if the plants are under stress.

Type of application	Herbicide (active ingredient)	Commercial products (concentration of active ingredient)	Application rate	Comments
Foliar spray	Glyphosate	Many different brands available, e.g. Glyphosate 360 [®] (360g/L) Roundup [®] (360g/L) Roundup Biactive [®] (360g/L) Weed Master [®] (360g/L)	All 10-13 ml/L	Add surfactant in accordance with the label. Apply after flowering until leaf yellowing in autumn
	Triclopyr + picloram	Grazon DS [®]	2.5 ml/L (summer) 3.5 ml/L (autumn/ winter)	If less than 2 m tall, apply after flowering to leaf yellowing in autumn
Cut and paint or basal bark	Triclopyr + picloram	Access [®] (triclopyr 240 g/L + piclogram 120 g/L)	Mix in diesel: 17 ml/L diesel	Cut close to the ground and apply immediately, to cut and stem

Note: Adding other products to most herbicides alters their effectiveness. Carefully consult the label for specific directions before adding any other products.

When using herbicides follow the precautions outlined on pages 10-11.



Mirror bush (*Coprosmma repens*)

Mirror bush is a shrub or small tree that reaches up to 8 m in height. It is multi-stemmed with glossy dark green leaves and masses of translucent orange-red berries. Seed production is high and seeds germinate under light shade and where the ground is disturbed. Seed is dispersed by birds. It is a popular ornamental plant that is readily available in nurseries. *Fig 10*

CONTROL METHODS

HAND-PULLING: Manual removal of seedlings is effective. Grubbing of larger plants where the soil is shallow is also successful.

RINGBARKING: Where you have a few seed-producing trees ringbarking together with hand removal of smaller plants can be used.

HERBICIDES: The table below shows the herbicides suitable for control of mirror bush. Do not apply herbicides if the plants are under stress.

Type of application	Herbicide (active ingredient)	Commercial products (concentration of active ingredient)	Application rate	Comments
Foliar spray	Glyphosate	Many different brands available, e.g. Glyphosate 360 [®] (360g/L) Roundup [®] (360g/L) Roundup Biactive [®] (360g/L) Weed Master [®] (360g/L)	All 10 ml/L	Add a penetrant in accordance with the label
Cut and paint	Glyphosate	360 g/ L products as above	200 ml/L	Cut close to the ground and apply immediately after cutting. Will need follow-up

Note: Adding other products to most herbicides alters their effectiveness. Carefully consult the label for specific directions before adding any other products.

When using herbicides follow the precautions outlined on pages 10-11.



Monterey pine/Radiata pine (*Pinus radiata*)

Monterey pine is a large long-lived erect tree that grows up to 15 m in height. It is able to colonise areas of little or no disturbance, produces large quantities of wind-dispersed seed, is drought tolerant, and can grow on poor soils. Plants start to produce seed at around 8-10 years of age. The seed is released in late summer, 18 months after flowering. When established Monterey pine shades out other plants and secretes toxic chemicals in the soil that prevent other plants growing around it. Over time this will reduce the species diversity of the area. *Fig 11*

CONTROL METHODS

HAND-PULLING: This is very effective for plants less than 60 cm high.

FELLING: Cut down the trees where felling will not cause damage.

RINGBARKING: Ringbark as close to the ground as possible. Use this method when it is safe to leave dead trees standing.

BURNING: Monterey pines are killed by moderate or high fire intensities. If there is continuous fuel (dead needles, etc.) from the ground to the canopy of the trees burning can be very hazardous. Young trees are easily killed by low intensity fires.



Old mans beard (*Clematis vitalba*)

Old mans beard is a vigorous woody climber with stems up to 30 m long. White flowers appear in December-March and feathery seeds in March-late April. It is capable of smothering vegetation and it prevents germination of native species by blocking out sunlight. A massive amount of fruit is produced, with each square metre of clematis cover producing 17,000 viable seeds. The seed viability is high initially but drops off over time, with the seedbank lasting five years. Physical damage and grazing will result in re-sprouting. Plants will recover from drought. Plants start to produce seed at between 1-3

years. They can grow 2 m in one season and re-root constantly giving the plants a long life span. The effects of fire are unknown. Reseeding is likely to be a major problem whatever form of control you adopt and ongoing work will be required. *Fig 12*

CONTROL METHODS

HAND-PULLING: This method is effective for seedlings and small plants.

HERBICIDES: The table below shows the herbicides suitable for control of old mans beard. Do not apply herbicides if the plants are under stress.

Type of application	Herbicide (active ingredient)	Commercial products (concentration of active ingredient)	Application rate	Comments
Frilling	Glyphosate	Many different brands available, e.g. Glyphosate 360° (360g/L) Roundup® (360g/L) Roundup Biactive® (360g/L) Weed Master® (360g/L)	1:1 water	Frill close to the ground, do not ring-bark, apply immediately

Note: Adding other products to most herbicides alters their effectiveness. Carefully consult the label for specific directions before adding any other products.

When using herbicides follow the precautions outlined on pages 10-11.



Pampas grass (*Cortaderia selloana*) Pink pampas grass (*Cortaderia jubata*) Toetoe (*Cortaderia richardii*)

Pampas grass has been used as an ornamental plant and as a wind break and fodder plant on farms. It is a tall tussock grass with large white to pink flower heads on spikes up to 4 m high. Vast quantities of seed are produced that may be spread up to 25 km by wind. All three species are considered serious weeds and a major eradication program is underway in Tasmania. Sprayed plants can be left standing and will continue to provide an effective wind break for two or more years while another wind break is established. Forestry Tasmania may be able to provide assistance with control. Contact Forestry Tasmania district offices or Forestry Tasmania weed liaison officers for information. *Fig 13*

CONTROL METHODS

HAND GRUBBING AND MECHANICAL REMOVAL: Pampas grass can be removed using an excavator followed by burning of all the material. Deal with the regrowth by spot-spraying with glyphosate 2-3 months later. Seedlings and small plants can be hand-pulled.

BURNING AND SPRAYING: To reduce herbicide use on large plants the plants may be burnt or cut off near ground level and allowed to regrow. Spray when the treated plants reach 0.5 m in height.

HERBICIDES: The table below shows the herbicides suitable for control of pampas grass. Do not apply herbicides if the plants are under stress.

Type of application	Herbicide (active ingredient)	Commercial products (concentration of active ingredient)	Application rate	Comments
Foliar spray	Glyphosate	Many different brands available, e.g. Glyphosate 360° (360g/L) Roundup® (360g/L) Roundup Biactive® (360g/L) Weed Master® (360g/L)	All 20 ml/L	Add a penetrant in accordance with the label
Wick wiper	Glyphosate	As above	1:2 parts water	Apply to small plants only, less than 40 cm. Wipe both ways

Note: Adding other products to most herbicides alters their effectiveness. Carefully consult the label for specific directions before adding any other products.

When using herbicides follow the precautions outlined on pages 10-11.

Ragwort (*Senecio jacobaea*)

Ragwort is widely distributed throughout the grazing areas of Tasmania, with the exception of the Midlands where it occurs only as isolated plants and small patches. Infestations also occur on the shores of several lakes on the Central Plateau and along roadsides in many areas. The heaviest infestations occur on land that has been cleared in the past but never properly developed for agriculture and on run-down pastures and grasslands. Pastures grazed by cattle are particularly prone to ragwort invasion as the death of desirable plants by cattle hooves creates openings for the seedlings to establish. As cattle normally avoid grazing ragwort it also has a competitive advantage over other pasture plants that are grazed. Ragwort is poisonous to all types of livestock. Preventing seed production is an essential component of any successful ragwort management plan.

Please refer to the DPIWE Weed Service Sheet for detailed information on the control of ragwort.

Serrated tussock (*Nassella trichotoma*)

Serrated tussock is a perennial, tussock-forming grass with a deep fibrous root system that is similar in appearance to several native tussocks. The young plants are erect and densely tufted with tightly inrolled leaves. The leaves are bright green and the leaf sheaths at the base are pale, more slender and more closely packed than in the native tussocks. As the plant grows to maturity the later leaves become longer and the tips turn to brownish green or in winter a bleached straw colour. Leaves at all stages of growth feel rough or serrated if the finger and thumb are drawn down the blade. The known infestations of serrated tussock are limited to two areas: one to the south east of Hobart and the other, much smaller, in the south of King Island. Dense infestations may completely swamp out other pasture components, rendering large areas incapable of supporting livestock.

Serrated tussock is a highly significant weed in Tasmania and any potentially-new infestations should be reported to the regional weed management officers at DPIWE.

Please refer to the DPIWE Weed Service Sheet for detailed information on the control of serrated tussock.



Spanish heath (*Erica lusitanica*)

Spanish heath is an erect multi-stemmed shrub with many surface roots and a tap root system. Delicate dull pink buds open to white flowers in autumn-winter, with fruit falling in early spring. Seed production is high and a well developed shrub in full flower is capable of producing nine million seeds. Seed viability varies with site conditions. Spanish heath will grow up to 3 m high in undisturbed areas of woodland and is well adapted to shade. Plants start producing seed from 3-4 years of age, resprout if physically damaged even when very young, are resistant to grazing once over 5 cm, and re-sprout after fire. The soil seedbank of an infestation has been recorded at 480,000 seeds/m². Fig 14

CONTROL METHODS

BURNING: Burn and then spray the regrowth with herbicide.

SLASHING: Beware of slashing if the plant is well into flowering or in seed as this can spread the plant. Slashing will not kill the plant but it can be used to reduce flowering.

MECHANICAL CONTROL: This method alone is inadequate as the plant may regrow from fragments of root left in the soil.

HAND-PULLING: After rain when the soil is wet hand-pulling is very effective and can be used for seedlings and small plants.

HOT WATER: Steam treatment using a steam spray unit may give good results for smaller plants.

HERBICIDES: The table below shows the herbicides suitable for control of Spanish heath. Do not apply herbicides if the plants are under stress.

Type of application	Herbicide (active ingredient)	Commercial products (concentration of active ingredient)	Application rate	Comments
Foliar spray	Glyphosate	Many different brands available, e.g. Glyphosate 360° (360g/L) Roundup® (360g/L) Roundup Biactive® (360g/L) Weed Master® (360g/L)	All 10 ml/L	
Cut and paint	Glyphosate	360 g/ L products as above	200 ml/L	Cut close to the ground and apply immediately after cutting

Note: Adding other products to most herbicides alters their effectiveness. Carefully consult the label for specific directions before adding any other products.

When using herbicides follow the precautions outlined on pages 10-11.



Sweet briar (*Rosa rubiginosa*)

Sweet briar forms a deciduous shrub 1-3 m high with stems that carry prickles and bristles. It is found throughout the agricultural areas of the state, often along roadsides, on waste land, and in pastures where there is little grazing pressure and only moderate competition from other species. It appears to be equally prevalent in high and low rainfall areas. *Fig 15*

Please refer to the DPIWE Weed Service Sheet for detailed information on the control of sweet briar.

Sweet pittosporum (*Pittosporum undulatum*)

Sweet pittosporum is a dense evergreen shrub or tree that grows to 10 m in height. It flowers mainly in August-October, occasionally in autumn. The bird-dispersed fruit is available for long periods but the maximum fruit fall is in September. Plants take 4-5 years to start producing fruit, tolerate heavy shade, and produce suckers if damaged. Seed production is very high with germination taking place in late autumn to spring. Seeds germinate readily under shade but grow slowly. Follow-up control of seedlings need only occur every second year. Remove the pittosporum leaves from the area if trying to encourage natural regeneration as toxins released by the leaves inhibit seed regeneration.

CONTROL METHODS

HAND-PULLING: Remove small bushes and seedlings manually when the soil is damp.

BURNING: Young plants are killed by fire. Mature trees may survive the fire and produce suckers.

HERBICIDES: The table below shows the herbicides suitable for control of sweet pittosporum. Do not apply herbicides if the plants are under stress.

Type of application	Herbicide (active ingredient)	Commercial products (concentration of active ingredient)	Application rate	Comments
Cut and paint or frilling	Glyphosate	Many different brands available, e.g. Glyphosate 360° (360g/L) Roundup® (360g/L) Roundup Biactive® (360g/L) Weed Master® (360g/L)	All 200 ml/L	Cut close to the ground and apply immediately after cutting

Note: Adding other products to most herbicides alters their effectiveness. Carefully consult the label for specific directions before adding any other products.

When using herbicides follow the precautions outlined on pages 10-11.

Tree lupin (*Lupinus arboreus*)

Tree lupin is a tall shrub to small tree with drooping branches and creamy white flowers on the ends of the branches. It resprouts after fire and damage. The seeds are produced in large quantities, are long-lived, and are stimulated by fire.

CONTROL METHODS

HAND-PULLING: Manual removal of seedlings and even larger plants is possible in sandy situations.

BURNING: Fire followed by hand-pulling of seedlings or another fire within two years.

HERBICIDES: The table below shows the herbicides suitable for control of tree lupin. Do not apply herbicides if the plants are under stress.

Type of application	Herbicide (active ingredient)	Commercial products (concentration of active ingredient)	Application rate	Comments
Foliar spray	Glyphosate	Many different brands available, e.g. Glyphosate 360 [®] (360g/L) Roundup [®] (360g/L) Roundup Biactive [®] (360g/L) Weed Master [®] (360g/L)	All 10 ml/L	
Cut and paint	Glyphosate	360 g/ L products as above	200 ml/L	Cut close to the ground and apply immediately after cutting

Note: Adding other products to most herbicides alters their effectiveness. Carefully consult the label for specific directions before adding any other products.

When using herbicides follow the precautions outlined on pages 10-11.



Wattles (*Acacia baileyana*, *Acacia longifolia*, *Acacia pycnantha*, *Acacia paradoxa*)

Most of the wattles that are weeds in Tasmania are Australian native species so they are well-adapted to survival in the bush. They generally produce large quantities of seed that build up to a significant seedbank and germinate after fire. *Fig 16*

CONTROL METHODS

HAND-PULLING: Seedlings and smaller plants can be hand-pulled.

BURNING: Larger plants can be killed or reduced to ground level by fire, which also stimulates the germination of seed stored in the soil.

RINGBARKING: This should be done as close as possible to the ground to stop re-shooting.

HERBICIDES: The table below shows the herbicides suitable for control of wattles. Do not apply herbicides if the plants are under stress.

Type of application	Herbicide (active ingredient)	Commercial products (concentration of active ingredient)	Application rate	Comments
Foliar spray	Triclopyr + picloram	Grazon DS® (triclopyr 300 g/ L + picloram 100 g/ L)	5 ml/ L	
	Triclopyr	Garlon 600® Blackberry & Tree Killer® Tree Killer®	<2 m tall - 1.7 ml/ L or >2 m tall - 3.3 ml / L	
Cut and paint	Triclopyr + picloram	Access® (triclopyr 240 g/ L + picloram 120 g/ L)	Mix in diesel: 17 ml/L diesel	Cut close to the ground and apply immediately after cutting & on stem, may also be applied as basal bark spray

Note: Adding other products to most herbicides alters their effectiveness. Carefully consult the label for specific directions before adding any other products.

When using herbicides follow the precautions outlined on pages 10-11.

Willow (*Salix* species)

Willow control can cause severe damage to streams if not undertaken sensitively. For example, it may cause destabilisation of banks, water quality problems and loss of habitat. These effects may occur downstream as well as in the vicinity of the control area. It is strongly recommended that you consult with Bushcare officers and obtain the "Willow Management Guidelines" by Greg Parker and David Bower before you plan your willow control. The guidelines are available from DPIWE at Prospect (Telephone (03) 6336 5444).

Weeds information people

Bushcare officers

Penguin (03) 6437 2770
 Launceston (03) 6336 5419
 Hobart (03) 6223 6377

Regional weed management officers (Land and Water Management Branch, DPIWE)

Launceston (03) 6336 5429
 Devonport (03) 6421 7654
 Hobart (03) 6233 3654

Registrar of Chemical Products (DPIWE)

Hobart 1300 368 550, (03) 6233 3565

Poisons Information Centre

Tasmania 13 11 26

Other sources of information

DPIWE Weeds Web Site

The Weeds web site has a range of information, including the WeedPlan, weed service sheets, and weed mapping guidelines.

At the moment the site is located at <http://www.dpif.tas.gov.au>. Go to the *Land and Water* web page, followed by the *Weed Management* web page. However, the site is likely to move to <http://www.dpiwe.tas.gov.au> in the future.

Books

The *Tasmanian Weed Handbook* written by B. H. Hyde-Wyatt and D. I. Morris and published by the Department of Agriculture in 1989 is a useful guide for identifying the most common weeds found in crops and pastures in Tasmania. It costs \$11.00. (ISBN 072463734 6)

Weed Service Sheets

A series of weed service sheets have been published by the Department of Primary Industries, Water and Environment. They are available free of charge from the Weeds Web site or regional weed officers.

SS 60 - Ragwort (*Senecio jacobaea*)

SS 82 - Whiteweed (*Cardaria draba*)

SS 83 - Spear Thistle (*Cirsium vulgare*)

SS 95 - African Boxthorn (*Lycium ferocissimum*)

SS 96 - Rope Twitch (*Agropyron repens*)

SS 97 - Cumbungi/Bullrush (*Typha* spp.) *

SS 99 - Patersons Curse (*Echium plantagineum*)

SS 101 - Serrated Tussock (*Nassella trichotoma*)

SS 102 - Nodding Thistle (*Carduus nutans*)

SS 103 - Cotton Thistle (*Onopordum acanthium*)

SS 105 - Glyceria (*Glyceria maxima*)

SS 106 - African Feathergrass (*Pennisetum macrourum*)

SS 110 - Blackberry (*Rubus fruticosus*)

SS 111 - Sweet Briar (*Rosa rubiginosa*)

SS 112 - Docks (*Rumex* species)

SS 113 - Gorse (*Ulex europaeus*)

SS 115 - Boneseed (*Chrysanthemoides monilifera* ssp. *monilifera*)

SS 118 - Willow Herb (*Epilobium ciliatum*)

SS 120 - Californian Thistle (*Cirsium arvense*)

SS 123 - Slender Thistles (*Carduus tenuiflorus* & *Carduus pycnocephalus*)

Bracken Fern (*Pteridium esculentum*) **

Capeweed (*Arctotheca calendula*)

Paspalum (*Paspalum dilatatum*)

* Note two species of cumbungi are native plants.

** This is a native plant. Weed control is not normally recommended in the bush. It may be a weed problem in agricultural land.



Figure 1 *Rubus fruticosus* agg.



Figure 2 *Psoralea pinnata*



Figure 3 *Chrysanthemoides monilifera* ssp. *monilifera*



Figure 4 *Lycium ferocissimum*



Figure 5 *Genista monspessulana*



Figure 6 *Paraserianthes lophantha*



Figure 7 *Digitalis purpurea*



Figure 8 *Fuchsia magellanica*



Figure 9 *Crataegus monogyna*



Figure 10 *Coprosma repens*



Figure 11 *Pinus radiata*



Figure 12 *Clematis vitalba*



Figure 13 *Cortaderia selloana*



Figure 14 *Erica lusitanica*



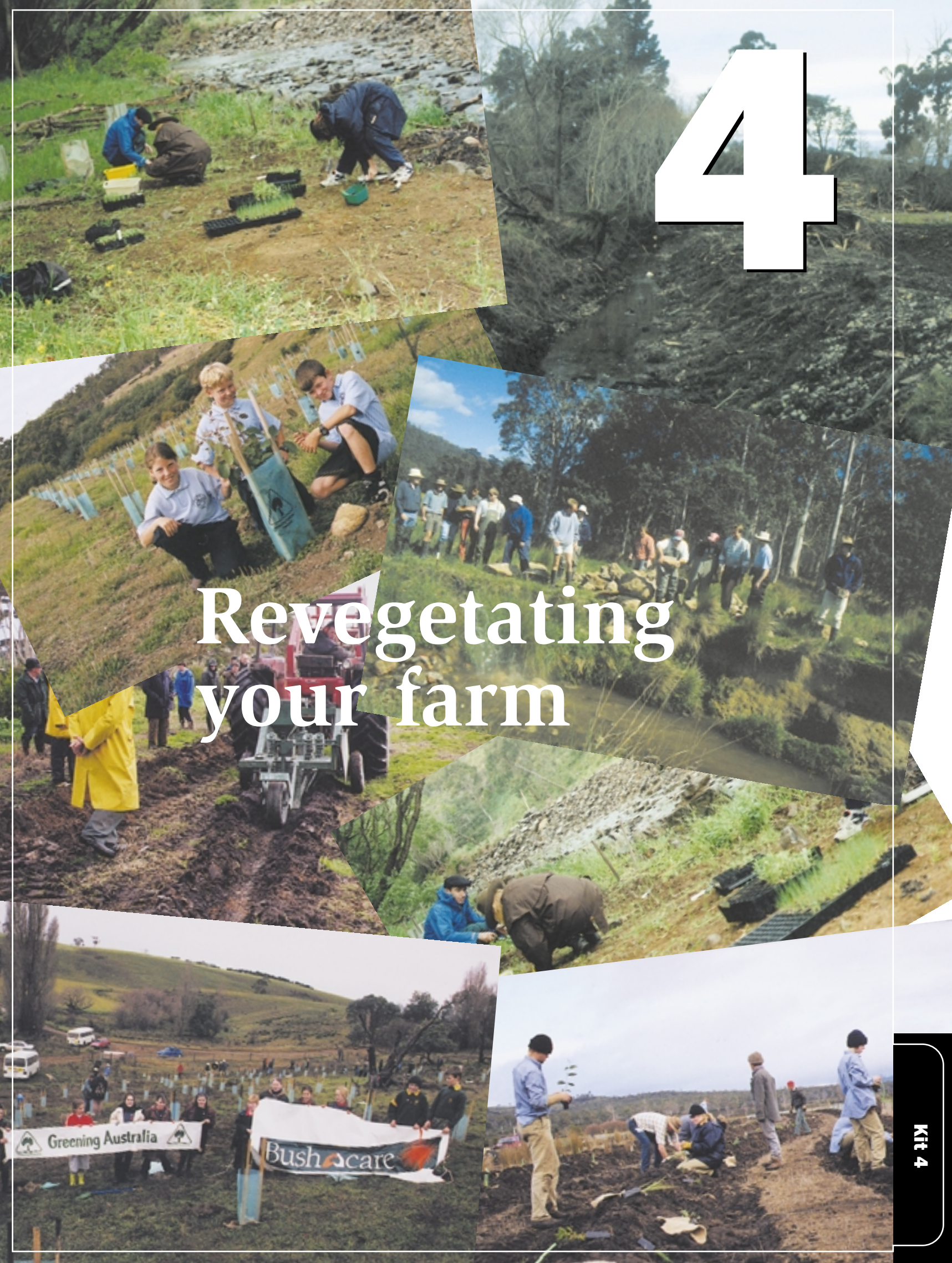
Figure 15 *Rosa rubiginosa*



Figure 16 *Acacia baileyana*

4

Revegetating your farm



About this kit

This kit is designed to help you plan your revegetation projects, such as shelterbelt establishment, in order to maximise the benefits for nature conservation as well as meeting your agricultural production needs.

This kit covers the following topics:

-
- Revegetation

 - Planning revegetation projects

 - Direct seeding

 - Direct planting of seedlings and tubestock

 - Monitoring.
-

Service sheets on revegetating and rehabilitating degraded bush are being developed by Bushcare Support, which is a Natural Heritage Trust program hosted in Tasmania by Greening Australia. The sheets will be available in 1999. They will include information on seed collection and germination, propagation and planting techniques, fencing options and costs, and site preparation. They will help you with the practical aspects of revegetation projects.

Revegetation

In the past two decades there have been many revegetation projects in Australia. Many of them have been undertaken through programs such as Landcare, One Billion Trees, and the Corridors of Green. Most of the projects have involved establishing shelterbelts, particularly on degraded land. Only a tiny proportion were planned specifically for the conservation of native bush and wildlife. However, many landowners said that although conservation was not the primary purpose of their planting it was a significant benefit. The challenge is to improve the wildlife habitat conservation aspects of these revegetation projects.

A good revegetation project is one that integrates the native bush into the whole farm enterprise. It may rehabilitate degraded land, use native vegetation productively, or improve wildlife habitat.

Revegetation is undertaken for a number of reasons, including:

- to establish wildlife habitat;
- to establish buffers to protect native bush;
- to link patches of remnant bush;
- to establish shelterbelts for stock or crop protection;
- to establish windbreaks for erosion control;
- to control run-off;
- to manage problems such as salinity and waterlogging;
- to establish commercial tree plantations or farm forestry.

It is much better to conserve your existing remnant bush and manage it well than try to re-establish it after it has been cleared. It cannot be emphasised enough that natural regeneration is the cheapest and most effective method of re-establishing or rehabilitating the bush on your property. Do not start thinking about any revegetation projects until you are sure that natural regeneration is not an option. Information on ways of maximising natural regeneration can be found in **Kit 2 Managing Your Bush**.

Revegetating to benefit wildlife

There are a number of ways that revegetation can be undertaken so that it maximises its value for wildlife.

Plant local native species

The best approach to revegetation is to plant local native species. Local native plants are those that occur naturally in your region. Plants native to other parts of Australia are not local native plants. For example, there are over twenty local species of wattle in Tasmania and these would be a better choice for revegetation than Ovens wattle or Cootamundra wattle which are not native to Tasmania. Similarly, Midlands wattle (*Acacia axillaris*) which is native to parts of the Midlands is being used across the state for revegetation projects but it should only be used in the St Paul, Elizabeth and Lake River catchments. Local species are more likely to provide the appropriate food, shelter and nesting materials for the insects, birds and animals of your area.

Revegetate to suit local conditions

Match your revegetation efforts to the local landscape. Choose species that suit the soil type and topography of your land. If you are revegetating a ridgeline, a north-facing slope or a riparian strip choose species that would naturally occur in that situation. This will also influence where you collect seed. For example, if you have collected blackwood seed from a swampy site it would not be advisable to use that seed or seedlings propagated from the seed on a nearby site if the soils were light and sandy or the site was drought-prone. This applies even if the site is only a few hundred metres away – it is important to match your plantings with the local environmental conditions.

Plant a diverse understorey

It is vital that revegetation is more than just planting trees – you need to establish a diverse understorey as well. The understorey is the layer of small trees, shrubs, herbs, grasses, ferns, mosses, fungi, lichens and creepers that occur naturally under trees. Look for a nearby patch of healthy bush that can serve as a template for what you are trying to re-establish on your farm. Determine how many layers there are in the bush and which species make up the different layers. Identify the dominant tree species. A mix of eucalypt species may be present, including smooth-barked species such as white gum, cabbage gum and black gum, and rough or stringy-barked species, such as peppermints and ashes. It is important to assess the structure of the shrub layer. There may be a need for tall shrubs and shorter shrubs in the species mix. There needs to be at least 20% shrub cover to provide habitat for birds. The ground layer is often overlooked in revegetation projects even though it is often the most important layer for wildlife. Try to include ground-hugging shrubs, grasses, sedges and wildflowers.

Establish a healthy ground layer

The ground layer plays a key role in the success of revegetation projects by helping to prevent soil erosion and retain moisture. This is particularly important where deep-ripping is required and where stock grazing has led to bare compacted topsoil. The ground layer provides habitat for small animals and invertebrates that contribute to the breakdown of litter and nutrients, and are a food source for bigger animals and birds. Healthy soils have a fine layer of cryptogams (mosses and lichens) that provide an important environment for seeds to germinate. Mosses and lichens are being added to seed mixes in some parts of Australia to improve the success of direct seeding projects.

Provide habitat

Habitat for wildlife can be provided by placing logs and branches on the ground. Leaf and grass litter, and small fallen twigs and branches are an important part of healthy bush. It is vital that you establish a ground cover similar to that which would have occurred naturally at the site. Include seed or seedlings of native grasses, herbs, ferns or small shrubs – whatever is appropriate – in your planting. Many birds need a diverse and healthy understorey. Once the understorey is degraded aggressive birds such as noisy miners move in and displace the bush birds.

It is also important to leave any older and dead trees as habitat for wildlife. Large old trees are used by many birds for nesting and foraging, and they provide a vantage spot or perching tree for some species. Tree hollows are also important for some species.

Bigger is better

The size of a patch of natural or revegetated bush is most important for wildlife: bigger is better. Wildlife conservation is improved by planting a single large block rather than several smaller ones or by revegetating around an existing small bush remnant to increase its size. Adding a buffer zone around an existing patch of bush creates more habitat and allows birds and animals to establish more easily. Smaller patches of bush support fewer animal and bird species and those that do establish tend to be generalist species such as possums and noisy miners.

Studies have shown that 10 ha is the minimum size for bush to provide habitat for most birds. Try and plant around small blocks so they are 10 ha or bigger. However, bush blocks smaller than 10 ha are still valuable for many species.

The rule that bigger is better also applies to the width of a natural or revegetated patch of bush. Try and make your revegetated patches as wide as possible. A compact shape is much better than a long thin strip. Most shelterbelts, even those planted as wildlife corridors, are long thin strips. Patches of natural or revegetated bush that have a high ratio of edge to area tend to be less viable. They are subject to ‘edge effects’ because they have a greater exposure to wind and sunlight, and a greater risk of weed invasion and damage by stock. Try to establish bush that has an interior and is not all edges. Stepping stones or small patches of bush may be better for conservation than a wildlife corridor.

Create a network of linked habitats

Try to plan your revegetation projects so that you create a set of bush networks or linkages. Small patches can be linked to larger patches. These links do not necessarily have to be connected – stepping stones that act as islands of habitat will allow some species to move from one area to the other. These patches should be no more than 1 km apart. Even isolated paddock trees surrounded by pasture may act as stepping stones for some species.

Planning revegetation projects

The key to successful revegetation is good planning. Your first step should be to decide on the aim or purpose of your project. Revegetation projects may have a number of aims and these will determine the plant species selected and the revegetation methods used.

Revegetation projects may need up to two years of planning before planting. If you wish to grow plants from the seed or cuttings of local plants you will need to collect the seed or plant material, propagate it, and grow the plants until they are ready for planting. In addition, site preparation will have to be done.

Select suitable plants

Before you start collecting seed it is important to work out a list of species that will suit your area and achieve your aims. Go to some nearby bush that is on a similar situation and soil type and see what is there. There are lots of books around to help you identify native plants so use these or ask your local Bushcare officer for help.

Each site will have a different set of criteria governing the plants selected for it. If you have a plant list from the bush in your area use it. Remember that some plant species are localised in their distribution so choose plants that grow in your area. For example, fringe myrtle (*Calytrix tetragona*) would be a suitable species for a coastal rehabilitation site on the Tasman Peninsula.

Seed is the most important ingredient for any revegetation project. Below are a number of rules that will help you improve the quality of the seed you collect:

- Use local native seed. Collect seed from as many plants as you can to increase genetic diversity.
- Collect seed from as close as possible to your site, or from sites with a similar geology, soil type, aspect and position on slope.
- Avoid collecting seed from isolated trees that are unlikely to have been cross-fertilised.
- Clean the seed by removing any leaves, twigs, flowers, etc.
- Store the seed in a plastic bag in the fridge, but make sure it is dry. Adding mothballs will kill any insects.
- Label the seed, write down the details of where it came from (aspect, slope, drainage, geology, etc.), and record the date of collection.
- Do not collect too much seed from one area or you may eventually cause extinction of some local species.

You are not allowed to collect seed from any threatened plant species that are listed on the Tasmanian *Threatened Species Protection Act 1995* without a permit from the Threatened Species Unit of the Department of Primary Industries, Water and Environment.

If you do not want to collect your own seed you can order it from various seed merchants in Tasmania. It is important to obtain provenanced seed because you need to know where the seed came from in order to understand what conditions will suit it. Involve your local nursery as they can be a valuable resource. Some plant growers are offering a service where they will come and collect seed from your local area, propagate it, and then plant it back on your property.

Prepare site

Site preparation increases the success of direct seeding and planting projects. It prepares a favorable niche for sowing and provides an environment that promotes root growth. When considering site preparation a number of factors need to be considered, including soil type, climate, topography, weeds and fencing.

Weed control is one of the most critical aspects of site preparation. Competition from weeds reduces the survival and growth of native species. Weed control is usually achieved through the application of herbicides, mulching of the site, or through mechanical or manual removal.

Deep ripping of sites may be beneficial to improve drainage. Find out from someone in your area or from Greening Australia what methods of ripping have been successful on your soil type. For example, deep or shallow, what spacing between the rip lines, what type of machinery to use, etc? Sandy soils derived from sandstone and windblown sands do not require deep ripping as they are well drained.

Fencing

One of the most important aspects of site preparation is fencing off the area to manage stock and native animal grazing. Fencing needs to be effective to make the financial investment worthwhile. The type of fencing will be determined by the situation and the type of animals to be excluded. Hills require different fencing to rivers, and cattle need different fencing to sheep. You will probably be in the best position to know what type of fencing best suits your property. If you need advice on fencing contact your local Landcare or Bushcare officer, Greening Australia, commercial fencing companies, or ask your neighbours.

Electric fencing may be a cheaper alternative in areas where you do not require a permanent fence or rabbit proofing. However, they do involve regular maintenance. You can use electric fencing while regenerating a patch of bush or around paddock trees and remove it when the seedlings and saplings are old enough to survive stock grazing.

When to direct seed or plant

The key to successfully establishing plants is to plant or sow when conditions are suitable. The key factor is adequate soil moisture, and this is more critical than sowing time. As a rule of thumb, August to September is the optimal time. However, use any window of opportunity. If you have heavy rain and you think the soil moisture will remain high for a while and you have plants ready then plant while conditions are good.

Short-term weather forecasting has become quite accurate. Ring the Bureau of Meteorology and check if conditions will be suitable – many farmers currently do this to select the most suitable time to sow a crop. Revegetating land is expensive and time consuming so this information will optimise your efforts. Long-term climatic information can also be helpful. For example, if an El Niño year is predicted it may be better to delay your revegetation until conditions are more suitable.

Follow-up

Follow-up watering should not be necessary if ground preparation and soil moisture at planting were right. Remember watering often promotes weed growth and may not be necessary for native plants – use your judgement.

Follow-up weed control is often required. A shielded sprayer or hand chipping can be used. This requires care and sometimes can be avoided if good weed control was achieved before planting. If the weeds are not causing any threat it is best to leave them alone as your efforts are likely to result in other weeds colonising the area.

After seeding or planting keep a record of the date and type of any maintenance, such as weeding, rabbit control or watering of seedlings.

In subsequent years replace your losses and continue to control weeds and feral animals. Record any replacement plantings. Some direct seeded projects may need thinning to reduce competition.

Direct seeding

Direct seeding is an efficient and economic option for revegetation projects, but there are many situations where it cannot be used. Direct seeding involves sowing the seeds of trees and shrubs directly into the soil. Large areas can be revegetated using direct seeding and it often allows a greater variety of species to be planted. The plants that establish are likely to be more hardy and will not have the added stress of having interrupted root growth while potted, and root hair damage during planting. In addition, there is little risk of introducing new weeds and harmful soil pathogens from the potting mix as can happen when direct planting is used.

For direct seeding to be successful you will need a plentiful seed supply and a moist, weed-free seedbed. Weed growth is a major factor in unsuccessful direct seeding, along with poor seedbed preparation, grazing by stock and native animals, and poor weather conditions.

Preparing your seedbed

The best preparation method depends on the soil type and the site conditions. The site should be weed free for about nine months after sowing to allow the seedlings to establish. A good seedbed can be prepared in a number of ways, including:

- grading plus scarifying or ripping;
- mouldboard ploughing;
- a combination of knockdown and residual herbicides;
- scalping one metre diameter spots with a mattock or rake-hoe;
- deep ripping 6-9 months before sowing, depending on the soil type and the past land use;
- burning to create an ashbed.

Sowing techniques

Some species will require pre-germination treatment before sowing to break dormancy or achieve higher germination rates. Direct seeding techniques include:

- Sow by hand and bulk seed with dry sawdust, vermiculite or sand. Cover seed lightly to a depth of about five times the diameter of the seed by dragging a weighted hessian bag or other means.
- Sow with a tree seeding machine (e.g. Chatfield, Eco, GreenTech, Shelterbelter, Redden or Hamilton Tree Seeders). Make sure that seeds are pressed into the ground and lightly covered. The Eco Tree Seeder and Chatfield Seeder require seeds to be bulked with chicken crumbles. Sand and sawdust are also used to bulk out seeds.
- Sow most seeds at a rate of 300-1,000 grams per kilometre. It is best to test the germination rate of each batch of seeds, although this can be costly, about \$35 per species.
- Don't be confined to direct seeding in rows. Some farmers have direct seeded in gentle waving lines around the contour of a hill which achieves a more natural effect in the long term.
- Bitumen emulsion or Curasol sprayed over the seedlings helps retain soil moisture and aids seedling establishment, especially of eucalypt seeds.

Direct planting of seedlings and tubestock

There are many situations where direct seeding is not an appropriate revegetation technique and it will be necessary to plant seedlings or tubestock. For example, the site may be too steep or rocky, the soils may be poor or difficult to work with, or access may be too difficult.

Getting your plants ready

A lot of leaves on the plant is not necessarily a good thing. Ideally, the plant should have an equal ratio of root to shoot. If your pot is 125 mm high the plant should be between 125 mm and 200 mm high. If your plants are too tall trim them to less than 150 mm but make sure that there are enough leaves left for them to survive. If too many leaves remain on the plant it causes movement of the root system due to wind. This means the new delicate roots will be constantly broken off and a good root system will not develop. This will result in a high plant mortality over the dry period.

Guard against rabbits and hares, and rabbit proof the entire area if possible. While this may seem like an expensive option initially, the costs of revegetating add up and may be less effective without it. Fencing your plantings allows more flexibility. For example, you may choose not to plant in rows.

When to plant

Plant when the soil is moist. Tubestock can be planted at any time of year as long as the soil is moist. Plants tend to grow roots in winter and leaves in summer so winter plantings are more beneficial and there is generally more moisture around. However, in frost-prone areas it may be more practical to plant between October and November. Bare-rooted seedlings should be planted in late winter.

Planting

Plant along the rip lines using a tree planting machine or a hand implement, such as a Hamilton Tree Planter, Potti Putki, or Hike Planter. Be sure to press the soil around the plant with a mallet or your foot to remove any air pockets. Watering also helps to reduce air pockets.

Water in plants if necessary. Mulch to reduce weeds and retain moisture, for example, with a 20 litre bucket of hardwood sawdust.

Monitoring

Monitoring your plantings helps you to improve on your early results and avoid repeating the same mistakes. If you have time you should record the following for each revegetation project:

- type and timing of ground preparation
- weed control methods
- climatic conditions leading up to and just after planting
- date of seeding or planting
- planting methods
- type of seeder
- type of tree guard
- type and quantity of mulch
- type of fertiliser, if used
- were the plants watered in and were there any subsequent waterings
- details of who supplied the seeds or plants
- size and quality of seedlings
- source of the seed (the supplier should be able to provide these details)
- number of individuals of each species planted
- survival of each species
- the height of the best performing species can be checked in the first six months after planting and should be measured at 2-3 years after planting.



5

Threatened plant species in your bush



About this kit

This kit is designed to help you identify any threatened species that may be present in your remnant native bush. After a brief introduction about threatened species and their importance, the kit lists most of the plants that are thought to be extinct, endangered or vulnerable in Tasmania.

The plants are listed alphabetically by their scientific name. A short description and a photograph are given for each species. Information on managing the species is also given where this is known — though in most cases this information is not currently available. An alphabetical list of the common names of the plants included in this kit can be found on page 22.

Further information about threatened plant species can be obtained from the Threatened Species Unit botanist on (03) 6233 6556.

What is a threatened species?

A plant or animal species is described as threatened if it is at risk of becoming extinct. Plants and animals become threatened through a range of factors that may be natural or human induced. A plant population may be destroyed by fire, flood or disease, or by land clearance for development or agriculture. Some Tasmanian plant species are highly localised and therefore more vulnerable to destruction. By far the biggest threat to Tasmania's wildlife is the loss of habitat through development and land practices such as forestry and agriculture.

In Tasmania threatened species are categorised into three classes depending on the level of threat facing them. These are endangered (including extinct), vulnerable and rare. All species assigned to these classes are included in the Tasmanian *Threatened Species Protection Act 1995*. Species are listed as extinct when they have not been seen in Tasmania in the last 50 years but there is a chance that they may be rediscovered. The best-known of the animal extinctions are the thylacine, King Island emu and Macquarie Island parakeet. Many plant species have also been lost forever, including the Giant New Holland daisy, coast banksia and brown guinea flower.

In the past, many landowners have been concerned that the presence of listed threatened species on their property would result in the compulsory acquisition of their land, or at least, reduce their ability to work the land. The Tasmanian *Threatened Species Protection Act 1995* has in it some provisions that can be used to protect a listed species, but does not include compulsory land acquisition. In most cases, the conservation and management of threatened species could be achieved by undertaking a cooperative approach with landowners and would involve negotiations with landowners to produce management agreements. The intention of these agreements would be to effectively integrate the conservation of listed species within the overall land management practices of the property.

In many cases the habitat of the threatened species is localised and only small areas need to be specially managed in order to preserve the species. In most cases the threatened species has co-existed with and is adapted to the existing management regime – otherwise it would have become extinct at the site. Therefore, it is often only necessary to modify – rather than significantly change – the current management practices. For example, stock may need to be excluded for a short period in late spring and early summer while the species flowers and sets seed in order to allow its regeneration and survival. This does not necessarily mean fencing off a whole paddock or bush run as often electric or temporary fencing can be used to protect the patch.

Threatened species on your land

If you have or suspect that you have any threatened species on your land please contact the Threatened Species Unit botanist on (03) 6233 6556. The botanist can help you with identification and provide management advice. He or she can also give you information about any assistance that may be available such as help with fencing costs.

If you have any threatened species on your property it is important to monitor their condition regularly. Try to visit the area once a year to collect basic information, which could include:

NUMBERS: Try to count or estimate the number of plants present. If this is not possible estimate the size of the patch. Re-evaluate this each year to see if the species is declining in number or area.

REGENERATION: Are the plants flowering and setting seed? Are there plants of different ages or are all the plants the same age? Have you ever seen young plants? Are there young plants that have established this season? Was flowering, seeding or the germination of plants related to a particular event such as a fire, heavy rain or a dry period?

SURVIVAL: Are insects or animals eating the flowers or seeds so that no seed is available? Are new seedlings being eaten by stock, rabbits, insects, etc?

WEEDS: Are there weeds present and are they a threat to the plants? Are they preventing regeneration by forming a dense cover?

Threatened plants found in bush on private land

The threatened species covered in this kit are only those listed as extinct, endangered or vulnerable in the Tasmanian *Threatened Species Protection Act 1995*. A number of orchids are also included as they have been proposed for listing under the Act following a major study of orchids in Tasmania. Many of the plant species are considered threatened at a national level and are also listed in the Commonwealth *Endangered Species Protection Act 1992*.

Each heading lists the botanical name, the common name, and the status (i.e. extinct, endangered or vulnerable) of the plant under the Tasmanian legislation. Where the species is endemic to Tasmania (i.e. only occurs in the state) this is indicated after the status. Species listed as presumed extinct, unless they are endemic to Tasmania, still occur on mainland Australia. The species are listed alphabetically by their scientific name.

***Acacia axillaris* - Midlands mimosa - vulnerable - endemic**

Midlands mimosa is a dense prickly shrub reaching up to 4 m in height with narrow modified leaves (phyllodes) that are tough and leathery with a very sharp point. Yellow flowers with short stalks are attached to the plant at the base of the stem (axil). It may be confused with southern spiny wattle (*Acacia riceana*), dagger wattle (*Acacia siculiformis*), and spreading wattle (*Acacia genistifolia*). These species can be distinguished from each other by differences in their leaf shapes and arrangement of flowers. Surviving populations usually occur in riparian bush (i.e. bush along streams). Threats to Midlands mimosa include clearing and inappropriate habitat management. Populations can tolerate either occasional fires or light grazing but not a combination of burning and grazing. Seed germination is enhanced by fire and other disturbance. The plant is able to resprout after damage. *Fig 1*

LOCATIONS: Midlands mimosa occurs as part of the riparian bush along the Elizabeth, St Pauls, Dukes and Lake Rivers, headwaters of Dukes Marsh, along watercourses on Mount Barrow, and in the Lake Leake Road area.

***Alternanthera denticulata* - lesser joyweed - endangered**

Lesser joyweed is a perennial herb with a tough, slender tap root and many stems that either hug the ground or are upright. The leaves are opposite, narrow and spear-shaped, smooth and soft to touch. The silver-white papery flowers can grow in clusters forming a tight ball. Growth occurs mainly in spring. Flowering occurs during spring-early summer but may continue throughout the year. New plants can grow from seed after soil disturbance or vegetatively as the stems readily form roots at the nodes. Lesser joyweed is palatable to stock. Grazing by introduced animals is harmful to the species but in the absence of grazing general soil disturbance may be beneficial. The species occurs on a wide range of soil and vegetation types but in Tasmania it is mainly associated with wet forest.

LOCATIONS: Lesser joyweed is found in damp ground in the Midlands and northern Tasmania. Populations that were known at Epping Forest and the South Esk River may now be extinct.

***Amphibromus macrorhinus* - swamp wallaby grass - endangered**

Swamp wallaby grass is a perennial tufted, upright grass that grows up to 70 cm high. Its blades are limp and narrow (approximately 2 mm wide), ribbed and coarse to touch. It has many seed heads and is tightly branched. Swamp wallaby grass is distinguished from other similar grasses by the characteristics of its reproductive parts. It persists through fire, grazing and general disturbance but is adversely affected by drought. *Fig 2 shows seed structure.*

LOCATIONS: Swamp wallaby grass is found in damp soaks. It occurs in waterholes and low-lying wet areas in the Midlands. In Tasmania there are three populations with hundreds of individuals. The species is protected in the Tom Gibson Nature Reserve (Epping Forest).

***Argentipalium spiceri* - Spicers everlasting - endangered - rediscovered December 1997**

Spicers everlasting is a small, spreading, multi-stemmed shrub that usually grows to 0.5 m or less. It has grey foliage and papery white flowers that have pink highlights. The species was recently rediscovered near Leslie Vale within an area of native vegetation comprising white peppermint and an understorey dominated by saggys. It has always been rare and only ever found in the Huonville district so very little is known about it. *Fig 3*

LOCATIONS: Based on available information it is likely to occur near Leslie Vale around the 250 m contour line in association with dry sclerophyll forest that has an understorey of saggys.

***Aristida benthamii* - three awned spear grass - endangered**

Three awned spear grass is a tufted perennial grass that grows up to 40 cm in height. Its leaves are flat at the base, inrolled upwards and grow to about 15 cm. The bases where the blades join the stem are purple. The flower heads are narrow, loosely branched and held well above the leaves. The species grows in poor gravelly soils associated with heathy plants. It tolerates stock grazing and fire.

LOCATIONS: Only one colony is known at Royal George, Fingal Valley. The species is very localised but extensive at this site. It is thought to have been introduced from the mainland but this is unconfirmed.

***Asperula charophyton* - strap leaf asperula - presumed extinct**

Strap leaf asperula is a perennial herb with slender quadrangular stems. The leaves form whorls and the flowers are small with four petals. It is distinguished from other Tasmanian *Asperula* species by the stems which are elongated and the leaves (5-27 mm long) which are strap-shaped, smooth and limp. *Fig 4*

LOCATIONS: This species is known from only one herbarium specimen collected from the River Severn.

***Asplenium hookerianum* - Hookers spleenwort - vulnerable**

Hookers spleenwort is a fern with small tufted fronds 5-15 cm long, mid to dark green in colour, and oblong to triangular in shape. It is similar to *Asplenium bulbiferum* but *Asplenium hookerianum* is smaller and the lobes on the fronds have small stalks. It occurs in rainforest or sometimes on drier sites in sheltered gullies in areas of moderate rainfall. It can be found on the edges of watercourses, mainly on very steep banks in moist, well-drained spots such as rock fissures. It can occasionally be found growing on rock or low down on the trunks of tree ferns (*Dicksonia antarctica*). Possible threats include invasion by blackberry and damage to the banks from flooding. Little active management is required for its survival. It is very rare in Tasmania. *Fig 5*

LOCATIONS: The only known sites are Hellyer Gorge State Reserve, Drys Bluff Forest Reserve and on private property near Orford.

***Atriplex suberecta* - saltbush - vulnerable**

Saltbush is a sprawling herb that grows to about 60 cm in height and branches from the base of the plant. The leaves are thin, diamond-shaped and toothed around the edges. Flowers form in small clusters close to the stem and appear in spring-summer. Saltbush is found in a wide range of habitats on most soil types, including saline areas, but is found most often in disturbed areas. *Fig 6*

LOCATIONS: Saltbush is found on some islands in the Furneaux Group, including Chappell Island. One record is from near Sandy Bay, Hobart.

***Ballantinia antipoda* - southern ballantine - presumed extinct**

Southern ballantine is a small, hairy annual herb. The lower leaves vary in shape from lance-shaped to oval and can be divided. The upper leaves are linear. The flowering stems are 2-10 cm high and erect. The white flowers are cross-shaped with four tiny heart-shaped petals. The seed capsules are oval and about 4 mm long. *Fig 7*

LOCATIONS: Southern ballantine was once recorded from dry fertile areas in the north, in association with grassland and grassy woodland.

***Barbarea australis* - native wintercress - endangered - endemic**

Native wintercress is an erect biannual or short-lived perennial herb up to 1 m tall. The leaves form a rosette and it produces a long flowering stalk, 8-10 cm long, with yellow flowers. It is distinguished from the two introduced *Barbarea* species by differences in the shape of the leaves on the upper stem. Native wintercress occurs along rivers in grassy forest. It tends to favour slower reaches of the river and is found on shallow alluvial silt on rock slabs. Most sites where it occurs are invaded by crack willow. It is highly palatable to stock and sensitive to grazing so fencing of its habitat is required for its survival. The establishment of seedlings depends on disturbance created by floods. Damming of rivers and willow invasion has reduced flooding. *Fig 8*

LOCATIONS: Native wintercress was previously found in northern and central Tasmania. It is now restricted to the Central Highlands along the Shannon, Clyde and Ouse Rivers, and the Mersey River. All sites are on private land.

***Bertya rosmarinifolia* - bertya - vulnerable**

Bertya is a handsome, woody shrub 2-3 m high. The leaves are often bent down, narrow and linear with the edges rolled towards the hairy underside, and alternate up the stem. The flowers are golden and bell-shaped with short stalks and are clustered at the leaf base. Bertya is usually found in the understorey of wet forest (usually swamp/black gum *Eucalyptus ovata* woodland). It can tolerate fire and some disturbance such as digging. It is able to recolonise into adjacent areas of open ground.

LOCATIONS: Bertya occurs along rivers and streams in the north and east of the state such as the South Esk, St Pauls and Aspley Rivers. Currently only six populations are known.

***Blechnum cartilagineum* - gristle fern - vulnerable**

Gristle fern has rhizomes (underground stems) that are semi-upright or horizontal and coarse. The fronds are mid-green, narrowly triangular, upright (150 cm tall) and clustered towards the tip of the rhizomes. Young fronds can be tinged dusky-pink, bronze or lime green. The frond stem is long, grooved, pale brown, becoming darker near the base. The leaflets that make up the frond are not further divided and have finely toothed margins. The spores on the underside of the leaflets are continuous along the midvein. Gristle fern can be confused with tall robust specimens of *Blechnum minus*. Gristle fern is very hardy but it seems to favour sheltered sites with moist but well-drained fertile soils within dry sclerophyll forest or on the margins of wet forest. It is common on streambanks where the fronds tend to droop, forming a curtain. It can cope with the drier conditions of open gullies and hillsides. Its main threat is habitat loss through logging and land clearance for agriculture, and possibly through mining activities and subdivision. Several populations have disappeared as a result of these activities. Management of this species requires the maintenance of suitable habitat. It is naturally rare and in Tasmania there are four known populations. *Fig 9*

LOCATIONS: Little Beach Creek (two sites), Tin Creek near Ansons Bay on the east coast, and Ferndene State Reserve on the central north coast.

Botrychium australe - austral moonwort, parsley fern - possibly extinct

Austral moonwort has a rhizome which is short, coarse and upright while the roots are fleshy and thick. It produces one frond (rarely two) which is upright (10-40 cm), fleshy and parsley-like. The leafy part is short and thick, and has both sterile and fertile parts that look different and share a common stalk. The sterile leafy part is broadly triangular and divided 2-4 times. The fertile leafy part is narrower, with many branches on a long, upright, fleshy stalk. Spores occur in two rows on the lateral branches, crowded and round. Austral moonwort can grow in a variety of habitats from lowland forest to subalpine grassland. Where moisture is adequate it may grow among mountain white gum (*Eucalyptus dalrympleana*) and cabbage gum (*Eucalyptus pauciflora*) grassy woodland on well-drained plains, near streams in subalpine regions, and in mossy soil near the base of granite hills. It sometimes occurs in disturbed habitats. The small, starchy roots may help it survive in exposed sites. Its threats are clearance, particularly of lower altitude grasslands and grassy woodlands, and degradation of what remains by weeds, cattle and rabbit grazing. The species is extremely rare in Tasmania, possibly extinct. *Fig 10*

LOCATIONS: Austral moonwort once occurred at Marlborough where it was recorded as being abundant and at Moriarty's Plains. Searches have failed to relocate these populations.

Brachyscome rigidula - hairy cutleaf daisy - vulnerable

Hairy cutleaf daisy is a small perennial daisy with purple flowers, many wiry, upright branches, and rough, small, linear leaves. It is similar to the common cutleaf daisy (*Brachyscome multifida*), a popular nursery plant. It occurs on basalt soils in dry areas in the inter-tussock spaces in kangaroo tussock grassland and cabbage gum woodland. The species appears to be sensitive to stock grazing but requires bare ground for regeneration. Fires in spring or summer may prevent regeneration. It grows easily from cuttings and seed. *Fig 11*

LOCATIONS: In Tasmania there are 12 known populations in the Midlands, on the east coast, and in parts of the Eastern and Central Highlands. Two populations are protected in the Township Lagoon Nature Reserve and the Risdon Brook Water Reserve.

Brachyscome tenuiscapa var. pubescens - hairy mountain daisy - presumed extinct

Hairy mountain daisy is a perennial herbaceous daisy that usually has mauve flowers (may be white) and leaves which form a basal rosette. The rootstock is erect, producing a number of stolons (similar to strawberry plants) from which it grows. The fibrous remains of dead leaves remain around the base of the plant. There are only two varieties of this species. It is distinguished from *Brachyscome tenuiscapa* var. *tenuiscapa* by differences in its leaf structure and shape. *Brachyscome tenuiscapa* var. *pubescens* is very similar to *Brachyscome decipiens* but the leaves are more rigid, hairy and usually longer. It generally occurs in alpine grassland but has been found in wet forest. *Fig 12*

LOCATIONS: In Tasmania this species has only been recorded once on the foothills of Mt Wellington.

Bromus arenarius - sand brome - presumed extinct

Sand brome is an erect annual up to 45 cm high with loosely tufted or solitary stems. The stems are slender, smooth and ribbed below the seed head. The lower leaf sheaths are very hairy. The seed head is open and branched, and up to 12 cm long. The seed spikes are green or tinged purple, eventually become flattened, and are heavy causing the branches to droop or nod to one side. The seeds have several husks and are hairy at the apex. Sand brome is common in drier areas. Most *Bromus* species respond to late winter rain and produce palatable spring feed. However, when in seed this species is not palatable and its bristles can cause irritation to the mouth, nose and eyes of stock. It is rare in Tasmania, possibly extinct. *Fig 13*

LOCATIONS: Sand brome has been recorded in a few locations on the south east coast.

Brunonia australis - blue pincushion or native cornflower - vulnerable

Blue pincushion is a herb with a perennial rootstock, distinctive bright cornflower blue flowers, and a basal tuft of soft, silky leaves (very similar to those of forget-me-nots). The flowers are crowded together forming a hemispherical head, up to 2 cm across, which is located at the end of a longish, leafless stem up to 30 cm high. Each plant produces one to two flowers at a time. It tends to occur in dry sclerophyll forest, often inland black peppermint (*Eucalyptus amygdalina*) forest, on sandy or gravelly soils. It is sensitive to grazing and will be eliminated if grazing is too heavy. Establishment of new plants occurs after soil disturbance if the area is not invaded by weeds. Occasional fires can be beneficial, helping with the establishment of the species. During winter the parts above ground die and the leaves reappear in spring. The species flowers between November and December. Clearing for agriculture and forestry is a major threat. It occurs only in the north of the state where it was once plentiful. There are probably more than 23 known populations, some with a handful of plants and others with many thousands.

LOCATIONS: Populations are widely separated with several occurring in the east and west Tamar regions, a number around the Launceston area, and the rest around the northern Midlands area near Perth, Epping Forest, Nile and Longford. New populations were recently discovered around the base of the Western Tiers but most of these areas are set aside for forestry activities. *Fig 14*

Caladenia species - spider orchids

Spider orchids have five flower segments ending in long spidery tails and a much shorter and wider central tongue. The tongue has toothed margins and rows of clearly visible glands on the blade. Spider orchids have an elongated hairy leaf close to the ground, usually a single flower about 4-6 cm across on a 10-20 cm long hairy stem. Most species flower in October-November. They are difficult to identify and as many are now restricted to just a handful of localities it is always worth having spider orchid colonies investigated, especially in the northern Midlands, along the north coast, and on the Furneaux islands.

Caladenia anthracina - black-tipped spider orchid - proposed to be listed as endangered - endemic

Black-tipped spider orchid has flower segments that are white to cream with distinct crimson lines ending in long, almost black tails that give this species its common name. The flower stands about 15 cm tall and is about 4-6 cm across with stiffly spreading segments. *Fig 15*

LOCATIONS: Four small colonies are known in native pasture and grassy woodland on private land in the Ross-Campbell Town area.

Caladenia campbellii - thick-stem caladenia - proposed to be listed as endangered - endemic

Thick-stem caladenia is superficially similar to the widespread and well known 'pink fingers' or 'ladies fingers' orchids. It is closely related to the more widespread *Caladenia alata* but has a sturdier stem, about 1.5 mm thick. Thick-stem caladenia has one or two pink flowers about 1.5 cm across with rounded flower segments on a slightly hairy stem that can be quite tall (14 cm) for the size of the flower. It flowers in October-November and has been found in only a few lowland locations on the north west coast in an area west of Sisters Beach. It has previously been found in remnant patches of coastal scrub, and more inland in heath and heathy forest on sandy, gravelly and loamy soils, which have mostly been developed for agriculture. *Fig 16*

LOCATIONS: West of Sisters Beach.

Caladenia cardiochila - heart-lip spider orchid - presumed extinct

Heart-lip spider orchid is a small-flowered orchid about 2.5 cm across with flower segments that are greenish pink to reddish with red lines. Its distinguishing feature is the tongue which is prominently heart-shaped with a dark maroon tip. Heart-lip spider orchid is believed to be extinct in Tasmania where it has not been seen since 1947. It has only been recorded once on Flinders Island but could be rediscovered on the Furneaux islands. Two other spider orchids recorded from the Furneaux Group are also presumed extinct and any spider orchids found there should be investigated. *Fig 17*

LOCATIONS: Flinders Island.

Caladenia congesta - black-tongue caladenia - proposed to be upgraded from rare to endangered

Black-tongue caladenia has 1-4 dark pink flowers about 3 cm wide on a tall stem about 30-40 cm high, sometimes longer. The distinguishing feature that gives the species its name is the tongue which has a thick black tip due to a dense covering of warty glands. Black-tongue caladenia is usually found as scattered individuals in heathy woodland and open forest in the north east but the Fingal Valley now appears to be one of its last strongholds. It grows on sandy, loamy and gravelly soils, often on dry slopes. *Fig 18*

LOCATIONS: North east.

Caladenia lindleyana - Lindleys spider orchid - proposed to be upgraded from rare to endangered - endemic

Lindleys spider orchid is about 4-5 cm wide with reddish flower segments ending in very slender dark tails. The tongue is relatively narrow with few teeth and is dark maroon in colour. It used to be more widespread, including the Circular Head area, but is now believed to be confined to the central north and northern Midlands. *Fig 19*

LOCATIONS: The last positive sighting of this species was in 1996 as a single plant south of Epping. It may reappear in heathy woodland or open forest remnants in agricultural areas in the northern Midlands.

Caladenia pallida - rosy spider orchid - vulnerable - endemic

Rosy spider orchid is similar to Lindleys spider orchid (*Caladenia lindleyana*) but it has yellowish to bright rosy pink flower segments that end in prominently glandular tails and a relatively small tongue. Its historic distribution last century includes Circular Head and the Derwent Valley but the last sightings of this species consist of just a few specimens near Epping in 1979 and Railton in 1985. Remnant woodland and open forest in agricultural areas of the northern Midlands are places where this species may be found again. *Fig 20*

LOCATIONS: Midlands.

***Caladenia patersonii* - Patersons spider orchid - proposed to be listed as endangered**

Patersons spider orchid is moderately tall (25 cm) and large-flowered (about 8 cm wide) with long, drooping creamy coloured segments that end in long brown to blackish glandular tails. The tongue is cream to white with darker marginal teeth that have white tips. It appears to be restricted to a few remnant populations along the north coast between Lulworth and Stanley. Although some flowering plants may be encountered in any year this species tends to flower abundantly the spring after a fire and remain dormant as a tuber among dense regrowth in subsequent years. *Fig 21*

LOCATIONS: North west.

***Callitris oblonga* - South Esk pine - vulnerable - endemic**

South Esk pine is a small, attractive multi-stemmed tree that grows to about 5 m in height with angled bluish-green foliage. It has male and female cones. Male cones are about 3 mm long and are held on the ends of the branches. Young female cones occur in stalked clusters near the base of the branchlets. Mature female cones are grey, oval but pointed, smooth except for a small abrupt bump near the apex of each woody scale. They open to shed numerous angular 1-3 winged seeds. South Esk pine is distinguished from the more common Oyster Bay pine (*Callitris rhomboidea*) by being smaller, having longer leaves in a dense crown, and an elongated and less angular cone. Young South Esk pine seedlings are palatable to stock and laying brush as a cage to protect the young plants is a cheap and effective way of encouraging successful natural regeneration. Repeated fire before the plants reach reproductive maturity will eliminate this species from any site. *Fig 22*

LOCATIONS: St Pauls, Apsley and South Esk Rivers.

***Calocephalus citreus* - lemon beauty heads - endangered**

Lemon beauty heads is a perennial herb that has slender wiry stems 30-60 cm high with silky white hairs on the stems and leaves. Fine, long, silvery leaves are arranged on opposite sides of the stem. Yellow flowers are produced in clusters of small tight balls at the end of the stems. Lemon beauty heads is not palatable to stock and it regenerates after disturbance. It is important to maintain the gaps between the grass tussocks as habitat for this species. *Fig 23*

LOCATIONS: Lemon beauty heads is found in silver tussock grasslands surrounding Hobart Airport, native pastures and roadsides at Shark Point, Orielson, Pittwater, Pontville and Bagdad.

***Calystegia sepium* - great bindweed - presumed extinct**

Great bindweed is a large perennial herb of the morning glory family that has a large spreading root system. Long creeping stems climb up to 3 m over supporting plants, with the stems twining in an anti-clockwise direction. The flowers are white, sometimes tinged with pink. *Fig 24*

LOCATIONS: Great bindweed has been recorded on riverbanks and at the margins of forests, particularly in the north of the state.

***Cheilanthes distans* - cloak fern - endangered**

Cloak fern grows in shallow soil on exposed north-facing rock ledges, dying off in dry times and reappearing after rain. It is recognised by the dense covering of scales on the undersurfaces of its short narrow dark green fronds. *Fig 25*

LOCATIONS: Several small colonies are located on privately owned land near Royal George and within the Douglas Apsley National Park. It is also thought to occur on Fingal Tier.

***Chorizandra enodis* - black bristle-rush - presumed extinct**

Black bristle rush is a rigid, shiny, perennial rush, usually with two leaves and erect flowering stems 30-45 cm high. *Fig 26*

LOCATIONS: In Tasmania black bristle-rush has only been recorded on damp sandy heath near George Town.

***Cooperhooikia barbata* - purple goodenia - presumed extinct**

Purple goodenia is a soft downy undershrub with single bluish-purple flowers covered in soft downy hairs that are borne on stems in the junction between the leaf and the branches. It has narrow lance-shaped leaves that are thick, 2 cm long, with a blunt tip. They have no stalk but small ear-shaped bases that clasp the stem.

LOCATIONS: Purple goodenia has been recorded only once in Tasmania in 1810 at Port Dalrymple.

***Cryptandra amara* - bitter cryptandra - endangered**

Bitter cryptandra is a small, spreading, dark green shrub with distinctly shaped leaves and white bell-shaped flowers. It is palatable to stock and is usually heavily browsed. A total lack of disturbance can lead to its local extinction. Light grazing can be beneficial, particularly for maintaining the gaps between the grass tussocks. However, it will

not tolerate heavy grazing or an increase in nutrients associated with sheep camps. Weed invasion of habitat is a problem as it leads to a decrease in open ground. *Fig 27*

LOCATIONS: Bitter cryptandra occurs on open ground in cabbage gum woodlands on shallow rocky soils on dolerite, basalt and mudstone at Tunbridge, Nile, Bothwell and Ross.

***Cyathea X marcescens* - skirted tree fern - vulnerable**

Skirted tree fern is a naturally occurring hybrid between *Cyathea australis* and *Cyathea cunninghamii*. It is a robust plant usually found close to water. Multi-headed crowns are occasionally formed. *Fig 28*

LOCATIONS: Skirted tree fern has been recorded at Marsh Creek, Little Beach Creek and King Island.

***Danthonia popinensis* - roadside wallaby grass - endangered - endemic**

Roadside wallaby grass grows up to 45 cm high. It is distinguished by abundant, relatively long hairs scattered between an upper and lower row of hair tufts on the grass seed and the broad, flat blades of the lower leaves. It resembles a spear grass. Roadside wallaby grass requires bare ground for regeneration and it has not been found in places heavily grazed by stock. A similar wallaby grass, *Danthonia tenuior*, which is highly variable, has been misidentified as *Danthonia popinensis*, and has sometimes been referred to as *Danthonia aff. popinensis*. It has smaller seed heads with shorter hairs, finer leaves, and is less robust than the closely related *Danthonia popinensis*. *Danthonia aff. popinensis* has been recorded at Avoca, Conara and west of Campbell Town. *Fig 29*

LOCATIONS: Roadside wallaby grass is known at two roadside locations at Ross and Kempton.

***Desmodium gunnii* - slender tick trefoil - vulnerable**

Slender tick trefoil is a small, perennial, herbaceous pea with leaves consisting of three narrow clover-like leaflets. The pea flowers are blue or lilac. It is similar in appearance to some of the native soybeans (*Glycine* species). The seed pods are strongly indented between the seeds. It is found in well-drained grasslands and woodlands and like many peas seems to be highly palatable to stock. The habitat of this species should not be grazed in spring or summer to allow regeneration. It is well-adapted to fire, having hard-coated seeds that germinate after heating. Fire opens up the gaps between grass and sagg tussocks to allow this species to establish. *Fig 30*

LOCATIONS: North and north east.

***Discaria pubescens* - austral thornbush - endangered**

Austral thornbush is a spiky, upright shrub that is usually found on moist, grassy ground close to streams. It is distinguished by its thorns which are opposite each other and alternate up the branch. Austral thornbush is similar to boxthorn and the native tree violet, both of which are spiny. It resprouts from the roots after fire and regenerates in areas subject to light or intermittent grazing. Gorse is a major problem for austral thornbush, out-competing it and creating a more fire-prone habitat. *Fig 31*

LOCATIONS: Austral thornbush is known at the Lake, Shannon and Ouse Rivers, Fingal, Longford and Billop. It is often found in black gum woodland on basalt. It was previously recorded at the Derwent River near New Norfolk.

***Doodia caudata* - small rasp fern - vulnerable**

The hairy small rasp fern occurs in small scattered populations on the banks of the River Leven, as well as on old railway cuttings beside the river. It is also reported on boulder rubble near the flood level in Cataract Gorge. It appears to have become locally extinct in the St Helens area. *Fig 32*

LOCATIONS: North and east.

***Epacris acuminata* - coral heath - vulnerable - endemic**

Coral heath is an erect heath usually branching near the base and growing up to 1.5 m tall. Slender branches bear thin concave leaves. The plant flowers in spring, with white flowers densely clustered along the terminal branches. The leaves are small and oval and the bases are partly folded around the stem. Nothing is known of its management requirements although its distribution suggests that it survives the occasional fire. Coral heath occupies two distinct habitats: subalpine heathy woodland on the eastern edge of the Central Plateau and lowland riparian dry sclerophyll forest in the Midlands and the Channel district. It is susceptible to the root rot fungus *Phytophthora cinnamomi*. *Fig 33*

LOCATIONS: Central Plateau, Midlands and the Channel district.

***Epacris apsleyensis* - Apsley heath - vulnerable - endemic**

Apsley heath is an erect, multi-stemmed shrub up to 1.5 m tall with slender branches and thin convex leaves. White flowers clustered at the ends of branches begin to appear in January, peak in autumn, and continue sporadically until late spring. Apsley heath is found in dry sclerophyll forest on moderately sheltered flats, lower slopes and mid slopes in the Apsley River catchment. It is susceptible to the root rot fungus *Phytophthora cinnamomi*. *Fig 34*

LOCATIONS: Apsley River catchment.

***Epacris barbata* - bearded heath - endangered - endemic**

Bearded heath is an erect multi-stemmed shrub up to 1.6 m tall. It has robust branches and thick convex leaves. Flowering begins in early spring and is complete by late spring. The flowers are white and clustered at the ends of the branches. Bearded heath occurs in open heathland, heathy woodland and heathy forest in hilly and low-lying terrain on Freycinet Peninsula and Schouten Island. It is susceptible to the root rot fungus *Phytophthora cinnamomi*.

LOCATIONS: East coast.

***Epacris exserta* - South Esk heath - vulnerable - endemic**

South Esk heath is a multi-branched, erect shrub 60-100 cm tall, often densely covered with short spikes of flowers on the main and side branches. The leaves are flat, narrow, erect or spreading and 5-7 cm long. The tubular white flowers are large and solitary, appearing from September to November, usually in short heads but sometimes in long spikes along the length of the stem. South Esk heath is similar in appearance to several other heath species. Little is known of its ecology but based on current knowledge an appropriate management regime is exclusion of fire and grazing, and control of gorse and willow. South Esk heath is susceptible to the root rot fungus *Phytophthora cinnamomi*. It is local in the north in riparian heath and scrub on the banks of several rivers including the South Esk and St Pauls. *Fig 35*

LOCATIONS: North east.

***Epacris grandis* - great heath - vulnerable - endemic**

Great heath is well named, distinguished by its robust growth form and its height (up to 3 m). It is an erect single-stemmed shrub rarely branching at the base. Its robust branches bear thin, slightly concave and distinctively long leaves. The flowers are white and densely clustered along the terminal branches. They appear in spring, encased in hairy leaf-like structures called bracts. Great heath is endemic to the central east coast, occurring in dry sclerophyll forest on sheltered slopes on dolerite foothills near Bicheno, and along the Apsley and Douglas Rivers. *Fig 36*

LOCATIONS: Central east coast.

***Epacris limbata* - border heath - vulnerable - endemic**

Border heath is an erect, single-stemmed shrub sometimes branching near the base and growing up to 2 m tall. Long slender branches bear thin, tough, concave leaves. Border heath flowers in late spring to summer and the white flowers are densely clustered along the terminal branches. It is susceptible to the root rot fungus *Phytophthora cinnamomi*. Border heath occurs on the margins of marshes where sedgely black gum forest grades into other forest types. *Fig 37*

LOCATIONS: Three populations are known on the east coast near the Apsley River.

***Epacris stuartii* - Stuarts heath - endangered - endemic**

Stuarts heath is an erect or semi-prostrate, multi-stemmed shrub that grows to 1 m in height. The branches are robust and bear heart-shaped leaves. White flowers appear in late winter-early spring and are crowded along the upper parts of the branches. Stuarts heath is known only on an exposed dolerite headland at Southport Bluff but it could occur on private land in the district. The root rot fungus *Phytophthora cinnamomi* occurs in an area close to the population and efforts are being made to ensure it does not spread. *Fig 38*

LOCATIONS: Southport Bluff.

***Epacris virgata* - Dans Hill heath - vulnerable - endemic**

Dans Hill heath is an erect, multi-stemmed shrub that sometimes branches near the base and grows up to 2 m tall. The branches are slender and bear thick, convex leaves. Delicate white tubular flowers appear in autumn, scattered along the upper branches. The leaves are narrow, spreading or semi-erect, 4-6 mm long with flat pointed tips. Dans Hill heath is susceptible to the root rot fungus *Phytophthora cinnamomi*. It is restricted to damp areas in dry sclerophyll forest in the foothills of the Dazzler Range near the Asbestos Range National Park.

LOCATIONS: North.

***Eryngium ovinum* - blue devil - endangered**

Blue devil is a very prickly perennial herb, possibly short-lived, with erect rigid branched stems 15-30 cm high. It has bright green leaves which form a low rosette that are not very rigid. The flowers are blue and lie in compact forked heads. Its size and frequency are reduced by heavy grazing but less intense grazing and other disturbances are beneficial due to a decrease in competition from other species. Blue devil occurs on agricultural land and grassy woodland sites on mudstone and hard clay in areas of low rainfall in southeast and eastern Tasmania. *Fig 39*

LOCATIONS: South east and east.

***Eucalyptus morrisbyi* - Morrisbys gum - endangered - endemic**

Morrisbys gum is one of the rarest and most endangered eucalypts. It is a small tree 6-12 m tall and up to 0.6 m in diameter. The flowers are creamy white and the buds and fruits occur in threes as in white gum. The trunk is smooth and greyish-white with deciduous bark, sometimes with pink markings. Sites on private land are grazed by stock and sometimes rabbits which has led to poor regeneration so there are few seedlings. Weed and pest control is important. Seed orchards have been established to help conserve this species. Planting of seedlings on private land has been most successful at open sites rather than beneath a forest canopy. Morrisbys gum is well adapted to fire but needs a fire-free period to build up a sizeable seedbank in the crown and to allow the seedlings to establish. It is very localised in its distribution at Risdon where it grows on sandy mudstone soil and near South Arm on dolerite.

LOCATIONS: Risdon and South Arm.

***Euphrasia amphisysepala* - shiny cliff eyebright - vulnerable - endemic**

Shiny cliff eyebright is a short-lived perennial herb or undershrub with an upright to straggling habit. It is usually no more than 25 cm in height. It can occasionally grow to a large diameter with hundreds of branches though it is more commonly found with less than 50. The flowers are creamy white and they can have deep purple striations and the back of the hood can be tinted with pink to purple shades. Eyebrights are semi-parasitic, forming attachments to the roots of a wide variety of plants. Two populations of shiny cliff eyebright are known but it could be found elsewhere in the south east. The known localities are restricted to the Tasman Peninsula and are less than 20 km apart. The largest population is found near Mt Raoul along a 2-2.5 km stretch of south west facing coastal cliffs. The other population at Cape Hauy extends along the 2.5 km stretch of south east facing coastal cliffs starting from the tip of the Cape. *Fig 40*

LOCATIONS: Tasman Peninsula.

***Euphrasia phragmostoma* - Buftons eyebright - vulnerable - endemic**

Buftons eyebright is a short-lived perennial herb or undershrub with an upright to straggling habit. It is usually no more than 40 cm in height. It can occasionally grow to a large diameter with hundreds of branches though it is more commonly found with less than 50. Buftons eyebright is generally restricted to dolerite cliff faces and is usually found on ledges, rock crevices and on patches of bare ground extending from the base to the tops of cliffs where the vegetation is not too dense. The only known population is restricted to a 1.5 km stretch of coastal cliffs extending from Dolomieu Point to the unnamed point before Thumbs Point on the Tasman Peninsula but it could occur on other cliffs on the Peninsula.

LOCATIONS: Tasman Peninsula.

***Euphrasia scabra* - yellow eyebright - endangered**

Yellow eyebright is a short-lived perennial, semi-parasitic herb that grows up to 50 cm. Small bright yellow flowers are clustered up the stem. The leaves are small, rough, toothed and clasp the stem. Yellow eyebright in Tasmania is much less widespread than it used to be. Bare ground is needed for establishment from seed and plants generally appear after fire or where grazing and soil disturbance have created bare patches. It grows in dry sclerophyll forest and grassy marshes in the Eastern Tiers. A small patch was recently found at Lenah Valley in white peppermint forest. *Fig 41*

LOCATIONS: Eastern Tiers, Lenah Valley.

***Euphrasia semipicta* - Port Arthur eyebright - vulnerable - endemic**

Port Arthur eyebright is a perennial herb that grows up to 15-35 cm tall. It is branched at the base and has erect stems. The toothed leaves, up to 13 mm long, become widely spaced in the upper part of the flower spike. The flowers are white to mauve with red striations and they form a dense spike at the end of the stem. Port Arthur eyebright is found in forests on the eastern half of the Tasman Peninsula. *Fig 42*

LOCATIONS: Tasman Peninsula.

***Genoplesium morrisii* - bearded midge orchid - proposed for listing as endangered**

The bearded midge orchid has a short (about 4 cm) flower spike consisting of tiny, densely packed flowers on a stiff stem about 20 cm long. The characteristic feature of this species is the dark purple colour of the flowers which on close inspection have distinctly hairy flower parts. The central tongue is also hairy and trembles in the slightest breeze. This species is only known from four small colonies in widely scattered locations – Lune River, Coles Bay, Lefroy and Flinders Island. It may be encountered in late summer in raised clay pans in peaty sedgeland as well as drier sandy heathy or grassy environments. *Fig 43*

LOCATIONS: Lune River, Coles Bay, Lefroy and Flinders Island.

***Glycine latrobeana* - native soybean - vulnerable**

Native soybean is a small perennial purple pea with leaves made up of three narrow leaflets like clover. It is covered in short brown hairs. *Glycine microphylla*, a near relative is smaller, and other Tasmanian species have a climbing habit. Native soybean occurs in tussock grassland and grassy woodland, particularly where there are dense sags to protect it from grazing. It is highly palatable to stock and is adapted to fire by having hard-coated seeds that germinate after heating. It should not be grazed in spring or summer. *Fig 44*

LOCATIONS: Midlands and the lower slopes of the Eastern Tiers and the Central Highlands.

***Gompholobium ecostatum* - dwarf wedge-pea - endangered**

Dwarf wedge-pea is a low spreading shrublet with tough, wiry, downy-haired stems. The leaves have three leaflets (4-12 mm long) that are crowded along the branches. The large showy pea flowers are apricot-red with a yellow centre and appear in late summer. Dwarf wedge-pea is restricted to Flinders Island where it grows close to the roadside. It is under threat from inappropriate roadside management. *Fig 45*

LOCATIONS: Flinders Island.

***Goodenia amplexans* - clasping goodenia - presumed extinct**

Clasping goodenia is an erect aromatic undershrub that grows up to 1 m in height. The soft downy leaves are 2-9 cm long and have a pointed tip, toothed margins and clasp the stem. The flowers, which are yellow and covered in soft hairs, are found on small stems at the bases of the leaves. *Fig 46*

LOCATIONS: In Tasmania clasping goodenia has only been recorded at the Nile River but it has not been seen for nearly a century.

***Hakea ulicina* - furze hakea - vulnerable**

Furze hakea is a many-branched shrub 1-1.5 m tall with branches covered in soft downy hairs. The leaves are flat and needle-like. The grevillea-like flowers are white, occasionally pinkish, stemless and clustered at the bases of the leaves. The hard conical seed capsule is smooth and small (12-18 mm) with a small straight beak. Furze hakea is susceptible to the root rot fungus *Phytophthora cinnamomi*. It is found in fertile heaths on Flinders Island and much of its habitat continues to be cleared. *Fig 47*

LOCATIONS: Flinders Island.

***Haloragis aspera* - rough raspwort - vulnerable**

Rough raspwort is a perennial trailing herb that grows up to 30 cm and has tiny red flowers. The leaves are rough, linear and have coarse teeth. The rough raspwort is distinguished from its close relative varied raspwort (*Haloragis heterophylla*) by its larger flowers and divided leaves. It appears to be sensitive to stock grazing, which is best excluded from areas in which it occurs. Nothing is known of its response to fire but it is likely to be favoured by regular burning of its habitat. Small-scale soil disturbance is beneficial to rough raspwort, helping it to regenerate. It occurs in damp soaks in silver tussock grassland and black gum woodland in the Midlands, north and south east. *Fig 48*

LOCATIONS: Midlands, north and south east.

***Hardenbergia violacea* - false sarsparilla - endangered**

False sarsparilla is a hairless wiry scrambler that forms brilliant purple garlands of pea flowers on banks and sandstone ledges. It is very similar in appearance to the cultivated *Hardenbergia* from the mainland. The leathery net-veined leaves are lance-shaped and 5-10 cm long. False sarsparilla is a palatable species that can be very heavily browsed, often only occurring on sites such as rock ledges where it is inaccessible to stock. Although it is commonly grown in gardens in Tasmania the only known natural population is in the Pontos Hills near Richmond. Research has shown that the plants at Richmond are not garden escapes. *Fig 49*

LOCATIONS: Richmond.

***Hibbertia obtusifolia* - hoary guinea flower - endangered**

Hoary guinea flower is a small, erect shrub with many branches that grows to about 30 cm in height. The young stems and leaves have scattered short, clumped hairs that are almost star-shaped. The linear spade-shaped leaves are flat or the margins are slightly curved. This species has solitary golden flowers. It was originally known in Tasmania only at Clarke Island in Bass Strait where it was collected in 1892 but it has recently been found near Conical Rocks Point on the west coast in heathy eucalypt forest. *Fig 50*

LOCATIONS: Clarke Island and west coast.

***Hibbertia rufa* - brown guinea flower - presumed extinct**

Brown guinea flower is a small woody shrub that has slender, trailing, reddish stems. The lance-shaped leaves are broader at the base and have a minute tuft of white hairs on the tip. The solitary flowers are almost stemless and reddish (whereas most guinea flowers are golden).

LOCATIONS: Brown guinea flower has only been collected once in Tasmania from the St Helens area in 1892.

***Hyalosperma demissum* - moss sunray - endangered**

Moss sunray is a tiny, hairy annual daisy with white flowers and tiny leaves, the shapes of which distinguish it from other tiny annuals. It occurs on scalded bare soil in grassland and white gum grassy woodland, and appears only briefly in early spring. Grazing or burning in late winter and spring may lead to its local extinction if it is not allowed to set seed each season. Maintenance of the scalds is also important for its survival so grazing should continue at other times. *Fig 51*

LOCATIONS: Tasman Peninsula, Mt Direction near Hobart, Pontville and Epping Forest.

***Hydrocotyle laxiflora* - stinking pennywort - vulnerable**

Stinking pennywort is an unpleasant-smelling herb that has round leaves which are divided into lobes on long stems. Groups of 30-40 small flowers are clustered and have two forms – male and female – on the same plant. Stinking pennywort relies on soil disturbance for its regeneration. It often appears where there has been excessive digging for drains and on the edges of tracks and roads. *Fig 52*

LOCATIONS: In Tasmania stinking pennywort is only recorded at Queens Domain in Hobart but it may occur in grassy bush on private land in the south east.

***Hypolepis distans* - scrambling ground fern - vulnerable**

Scrambling ground fern has often been misidentified as the common ground fern (*Hypolepis australis*) but it is a wiry scrambling species. The upright bright green fronds are lacy in appearance. The much-branched roots are a long, creeping rhizome covered with brown hairs. Scrambling ground fern is found in north west Tasmania and on King Island, occurring in tea-tree scrub and on the margins of swampland. *Fig 53*

LOCATIONS: North west, King Island.

***Isoetopsis graminifolia* - grass cushions - endangered**

Grass cushions is a tiny, annual daisy found on basalt soils in very dry areas. The white daisy flowers are clustered at the bases of thin grass-like leaves. It is found on bare shallow soils in the gaps between the grass tussocks in grasslands and cabbage gum woodlands. These bare spaces need to be kept open to ensure its survival. Avoid burning and grazing in spring so that the plant can set seed for the following year. *Fig 54*

LOCATIONS: Orielton, Pontville, Teatree and Tunbridge. Grass cushions has become locally extinct in the Queens Domain, Hobart.

***Isopogon ceratophyllus* - horny cone-bush - vulnerable**

Horny cone-bush is a low, dense, prickly shrub that grows up to 60 cm in height. Its yellow tubular flowers resemble a small waratah and are massed into terminal heads that are almost hidden among the hard, rigid, much-divided parsley-like foliage. It is adapted to a regular fire regime that aims to maintain species richness in heathland. Like many relatives such as banksia it is likely to be susceptible to the root-rot fungus *Phytophthora cinnamomi*. *Fig 55*

LOCATIONS: Heathlands on Flinders Island.

***Lasiopetalum micranthum* - Tasmanian velvet bush - vulnerable - endemic**

Tasmanian velvet bush is a small shrub with slender branches. The pale bluish-grey leaves have short stalks and are narrow and oblong in shape (2-6 cm long). The upper surface of the leaf is smooth while the underside has rusty-coloured hairs. The flowers are few in number, small and star-shaped. This velvet bush is found in dry sclerophyll forest on very stony sites east from Swanport to the St Pauls River. *Fig 56*

LOCATIONS: North east coast and central east coast.

***Lepidium hyssopifolium* - peppercress - endangered**

Peppercress is a weedy-looking perennial herb in the cress family that can grow up to 50 cm in height but is generally 20-30 cm high. The linear leaves vary in shape and are often toothed and slightly hairy. It is difficult to distinguish from other *Lepidium* species, including the weed African peppercress. Peppercress is characterised by thick hairs on the fine stalks supporting the tiny seed capsules that appear as soft fur to the naked eye. It naturally occurs in grassland and grassy woodlands on flat ground on both light and heavy soils, usually in areas of low rainfall. Peppercress is mostly found on roadsides beneath exotic trees. Being a cress it is palatable to stock but is found on lightly grazed or ungrazed sites. It is associated with bare ground and is absent where the understorey is dense. Soil disturbance is important for its regeneration. *Fig 57*

LOCATIONS: Northern and southern Midlands, Kingston and Bream Creek.

***Leptorhynchus elongatus* - lanky buttons - endangered**

Lanky buttons is a bright yellow daisy with flowers arranged in a 'button' in a funnel-shaped cup of overlapping brown-tipped bracts. The lance-shaped dark green leaves have rough hairs and are arranged in a rosette flat on the ground with a few very reduced leaves on the stem. The species is eliminated by heavy stock grazing and it appears to need bare ground for establishment. In Tasmania it is only known in one paddock in the Midlands, in the Jericho and Bothwell cemeteries, and at Liawenee Moor on the Central Plateau. *Fig 58*

LOCATIONS: Midlands, Central Plateau.

***Leucochrysum albicans* var. *tricolor* - hoary sunray - endangered**

Hoary sunray has white flowers with deep magenta outer petals and a bright yellow centre. It is easily distinguishable from other daisies by its stiff, white flower head and its fine, narrow, silvery-blue leaves that form a small tussock. It is most likely to be found on non-sandy soils where bare ground has resulted from heavy grazing or other causes. Hoary sunray originally occurred in cabbage gum woodland and tussock grassland, most of which is now improved pasture or crop land. It will disappear where bare ground is absent for a decade or more. Hoary sunray can withstand moderate to heavy grazing pressure and some top-dressing with fertilisers but it disappears with the establishment of improved pasture. *Fig 59*

LOCATIONS: Ross, Tunbridge, The Nut, Middlesex Plains near Cradle Mountain and Liawenee Moor.

***Levenhookia dubia* - hairy stylewort - presumed extinct**

Hairy stylewort is a tiny, annual plant up to 5 cm in height. It is a member of the trigger plant family. One of its five petals is attached on short hinges enclosing a column that is sensitive to touch and which springs back when touched. The oval-shaped leaves are alternately arranged. The flowers are pink with a yellow throat.

LOCATIONS: Hairy stylewort was recorded around 1900 at Mt Field, Pontville and the Bass Strait islands.

***Lobelia pratioides* - poison lobelia - vulnerable**

Poison lobelia is a slender perennial herb with small lilac, blue or white flowers that grows in loose mats of weak stems. The dull green leaves have wavy or toothed edges. Little is known of its management requirements but it is poisonous to stock. It is found along the margins of rivers and wet areas in the Midlands and north of the state.

Fig 60

LOCATIONS: North and Midlands.

***Lycopus australis* - native gypsywort - presumed extinct**

Native gypsywort, a member of the mint family, has rigid stems up to 1 m in length. The lance-shaped leaves are coarsely toothed and occur in whorls. The white mint-like flowers occur in dense clusters at the bases of the leaves. It was widespread in Tasmania in moist shaded places but there have been no collections of this species since the start of the 20th century.

LOCATIONS: Historically state-wide.

***Lythrum salicaria* - purple loosestrife - vulnerable**

Purple loosestrife is a tough plant 60 cm high that has stalkless, lance-shaped leaves, and is sometimes hairy. The flowers are deep pink and are borne on a spike. Little is known of the management requirements for purple loosestrife. It grows in swamps and wet places along the Apsley River in the north east and in the Epping Forest area. *Fig 61*

LOCATIONS: North east and northern Midlands.

***Mitrasacme divergens* - wiry mitrewort - vulnerable**

Wiry mitrewort is a slender, wiry annual that grows up to 12 cm in height. The leaves are 2-6 cm long and they lie in opposite pairs and are joined at their bases across the stem. The flowers are white and bell-shaped.

LOCATIONS: Wiry mitrewort was recorded in the 19th century at Circular Head, Eaglehawk Neck, George Bay and Punchbowl in Launceston but the only recent records are on the cliff top at Bridport and at Wedgetail Peak in the north east.

***Myosurus minimus* - mouse-tail - presumed extinct**

Mouse-tail is a small inconspicuous plant with fleshy leaves that form a rosette. It is a member of the buttercup family. The flowers are a greenish colour. *Fig 62*

LOCATIONS: Mouse tail has only been recorded once in Tasmania at a soak near Jericho.

***Myriophyllum glomeratum* – water milfoil - presumed extinct**

Water milfoil is an annual plant found submerged in water. It is an erect plant with flowers and fruits that occur in bundles. *Fig 63*

LOCATIONS: There has only been one recording of this species in 1842 at Cressy.

***Myriophyllum integrifolium* - water milfoil - vulnerable**

The lowermost leaves of this water-milfoil are usually linear if submerged. The pale flowers and fruits are solitary and sit in the junction between the leaf and stem. *Fig 64*

LOCATIONS: This species occurs occasionally in rivers in the Midlands and the eastern Central Plateau.

***Ozothamnus selaginoides* - Table Mountain daisy bush - endemic - presumed extinct**

Table mountain daisy bush is 50-100 cm tall with slender branches. The tiny round leaves have no stem and are sticky to touch. The white daisy flowers are clustered at the ends of the branches. It is similar to another daisy bush, *Olearia hookeri*. Table Mountain daisy bush has only been recorded at Table Mountain, west of Oatlands, but it has not been seen recently despite searches of suitable habitat.

LOCATIONS: Previously recorded at Table Mountain.

***Persicaria decipiens* - slender knotweed - vulnerable**

Slender knotweed is a river plant that grows up to 60 cm in height and has slender stems. The leaves are lance-shaped and have a long tip, with hairs along the veins on the lower surface. The flowers are small, pale to deep pink, and look like a knot. Little is known of the management requirements but heavy stock grazing may eliminate it. It is found on the banks of rivers such as the Macquarie. There are old records of it having been found at Cressy, Westbury, Launceston and North Esk. *Fig 65*

LOCATIONS: North.

***Persicaria subsessilis* - hairy knotweed - endangered**

Hairy knotweed is a perennial herb that has few branches and erect stems. It grows up to 60-100 cm in height. The tiny flowers are pink and look like buds or knots. The leaves are lance-shaped and have stiff hairs. Hairy knotweed is found in damp open places and riverbanks. Little is known of its management requirements. It is recorded along rivers in northern Tasmania. *Fig 66*

LOCATIONS: North.

***Phebalium daviesii* - Davies wax-flower - endangered - endemic**

Davies wax-flower is a medium-sized shrub, usually 1-2 m tall. The leaves are slender, linear, 2-3 cm in length with a two-lobed apex. The lower leaf surface is silvery and the upper surface dark green with a row of glands along each side. Delicate pale yellow flowers occur in groups of 5-8 at the tips of the branches. The stamens are distinctive and are usually twice as long as the petals. Until 1990 the species was presumed extinct. It grows close to the riverbank where it undergoes occasional flooding. It occurs on private land where it is grazed by cattle and affected by trampling and soil compaction. It is also susceptible to the root rot fungus *Phytophthora cinnamomi*. Davies wax-flower is found only in north east Tasmania in the George River and Constable Creek areas, both near St Helens. *Fig 67*

LOCATIONS: North east.

***Plantago gaudichaudii* - Gaudichauds plantain - vulnerable**

Gaudichauds plantain has long thin leaves with soft hairs and a long spreading taproot. The species was recorded in 1928 at Blackmans Bay and more recently in dry sclerophyll forest at Rosny.

LOCATIONS: South.

***Pneumatopteris pennigera* - lime fern - vulnerable**

Lime fern is a tufted ground fern with fronds forming a spreading tussock up to 110 cm in height. It is often found in small isolated populations growing on exposed limestone outcrops in sheltered sections of stream channels in the north west. *Fig 68*

LOCATIONS: North west.

***Podotheca angustifolia* - sticky long-heads - presumed extinct**

Sticky long-heads is an annual daisy with a slender woody tap root. It has many branches that arise from the base with stems 5-25 cm long growing along the ground or upwards. The flower heads lie at the ends of the branches. It was previously recorded on the north west coast and on several Bass Strait islands but it has not been collected in the 20th century. *Fig 69*

LOCATIONS: Previously recorded in the Bass Strait islands.

***Pomaderris elachophylla* - small-leaf pomaderris - vulnerable**

Small-leaf pomaderris is a slender shrub 1-3 m tall with cream flowers. The leaves are always wider than long and the tip is often indented. The flowers look like five-pointed stars with tiny dark hairs outside occurring singly or a few together along the spreading, short branchlets. It seems to withstand grazing and can resprout after mechanical disturbance and possibly after fire.

LOCATIONS: North east, Upper Derwent Valley and Leslie Vale.

***Prasophyllum apoxychilum* - tapered leek orchid - proposed to be listed as endangered - endemic**

Tapered leek orchid grows to 30-40 cm in height. Like other leek orchids the flowers are clustered in a flower spike at the end of a stem that emerges halfway up from the ground from the side which holds a round hollow leaf. The spike is about 10 cm long and contains about 12 flowers. The central lip of each flower is bright white and wavy, bending back on itself with the long tapered tip protruding through the upper flower parts. A few plants have been found on Mt Knocklofty near Hobart but its main distribution is confined to the Tasman Peninsula where it is found on moist, sandy to loamy soils in scrubby heath and also on rocky ground. The peak flowering time is November. *Fig 70*

LOCATIONS: Mt Knocklofty and Tasman Peninsula.

***Prasophyllum correctum* - gaping leek orchid - proposed to be listed as endangered**

Gaping leek orchid has a dull-looking flower with all its flower parts a similar greenish or brownish to reddish colour. The whole plant is relatively small, about 20-30 cm tall, with an open flower spike containing up to 15-20 flowers. It flowers in late October-early November. The characteristic feature of this species is the pair of widely opening petals that gives the species its common name. The central lip tapers gradually and is bent backwards from the middle. This orchid was only known from a single and highly endangered colony in Victoria until many hundreds of plants were discovered in 1995 in the rough areas of Campbell Town Golf Course. It may possibly be found in other native pasture remnants in the district although searches so far have failed to locate other colonies. The main threats to this species are fertilisers and ploughing. *Fig 71*

LOCATIONS: Campbell Town Golf Course.

***Prasophyllum olidum* - pungent leek orchid - proposed to be listed as endangered**

Pungent leek orchid is an unassuming and dullish-looking leek orchid about 40-50 cm tall. All the flower parts are a similar light greenish to brownish colour. The flowers do not open as widely as in *Prasophyllum correctum* and the central lip is suddenly contracted from about the middle into a narrow tail-like portion which is bent backwards. It has a sweet pungent scent that can be almost overpowering on hot days. It only occurs on the Campbell Town Golf Course but could possibly be found in other native pasture remnants in the district that have not been ploughed or fertilised. Pungent leek orchid flowers in late November when *Prasophyllum correctum* has all but disappeared. *Fig 72*

LOCATIONS: Campbell Town Golf Course.

***Prasophyllum robustum* - robust leek orchid - proposed to be listed as endangered**

Robust leek orchid is a robust and tall (up to 1 m) white-lipped leek orchid from northern lowland forests. The flower spike is up to 25 cm long and contains about 20 well-spaced flowers that are dominated by a white wavy central lip. The species was originally described from the Smithton area in 1940. It was thought to be extinct due to agricultural development until a small population was rediscovered in 1995 in the Latrobe area where it grows on brown loam in grassy/shrubby brown-topped stringybark (*Eucalyptus obliqua*) forest. Although there are other white-lipped leek orchids found in forests, any tall and robust ones found in northern forests are worth investigating. *Fig 73*

LOCATIONS: Latrobe area.

***Prasophyllum tunbridgense* - Tunbridge leek orchid - proposed to be listed as endangered - endemic**

Tunbridge leek orchid is a white-lipped but otherwise light green to greenish-brown leek orchid found on unimproved pasture in the Midlands. The wavy white lip is relatively wide and robust and dominates the flowers (up to 20) that are placed on a dense spike about 10 cm long. The whole plant is 30-40 cm tall. The stronghold of this species is the Township Lagoon Nature Reserve at Tunbridge which holds an estimated 50 plants. However, one plant was found in a paddock north of Campbell Town. Both localities are native grassland remnants with basalt bedrock close to the surface. *Fig 74*

LOCATIONS: Township Lagoon Nature Reserve at Tunbridge.

***Prostanthera cuneata* - alpine mintbush - presumed extinct**

Alpine mintbush is a spreading strong-smelling shrub 60-100 cm high. The branches have a soft velvet feel. The small leaves are almost orb-shaped with wavy margins. The white flowers are spotted with purple on the lower parts and occur singly towards the ends of the branches. In Tasmania alpine mintbush has only been recorded at Cataract Gorge in Launceston and is now thought to be extinct. *Fig 75*

LOCATIONS: Alpine mintbush was previously recorded at Cataract Gorge, Launceston.

***Prostanthera rotundifolia* - round-leaf mintbush - vulnerable**

Round-leaf mintbush is a tall shrub up to 2 m in height. It has a strong mint smell when crushed. The tough lance-shaped leaves have toothed margins and are dark green on the upper surface and pale beneath. The mauve flowers form dense clusters at the ends of the branches. It is currently only known at Avenue River north of St Marys. *Fig 76*

LOCATIONS: North east.

***Pterostylis commutata* - Midland greenhood - proposed to be listed as endangered - endemic**

Midland greenhood is a summer-flowering grassland greenhood about 15 cm tall. It has one or two large translucent flowers, light green or brownish with white in colour and is hard to spot in the dry surrounding vegetation. The hood and lower flower parts are characterised by long drawn-out tips. The lip is designed to capture insects by flicking up and into the flower at the slightest touch. In the down position stiff bristles can be seen on the margins of the lip. The species is only known from three very small populations on private land near Ross and at Township Lagoon Nature Reserve at Tunbridge. If it occurs elsewhere, remnant grassland or grassy woodland on dry sand or basalt-related soils are its most likely environments. *Fig 77*

LOCATIONS: Midlands.

***Pterostylis wapstreorum* - fleshy greenhood - proposed to be listed as endangered - endemic**

Superficially this multi-flowered grassland fleshy greenhood is very similar to *Pterostylis cycnocephala* and can grow together with it. It is larger (20 cm tall) even in dry years and the flowers are a darker green without the white stripes. The appendage of the lip does not protrude from the flower but is almost hidden under the hood and is a dark green short knob rather than a stalked pointy beak. In recent years the species has only been found in native pasture at Pontville although there are historical records from other areas in the south east and the Central Highlands. Suburban encroachment, pasture improvement, and conversion of native grasslands to crop lands are believed to be responsible for its reduced distribution. *Fig 78*

LOCATIONS: Pontville.

***Pultenaea hibbertioides* - bush pea - vulnerable**

This bush pea is a tall erect shrub that reaches 2 m or more in height. It can grow in dense stands and in flower can make an impressive golden display. The crowded leaves are 10-15 mm long, hairy, linear and are curled inwards towards the stem. The large showy flowers form dense clusters from September-November. *Fig 79*

LOCATIONS: Pipers River region.

***Pultenaea humilis* - dwarf bush pea - vulnerable**

Dwarf bush pea is a small, dark green spreading shrub. It is identified by its orange pea-flowers in dense leafy clusters at the ends of the branchlets and the shape of its leaves which are about 10 mm long, 2 mm wide, linear, hairless above and hairy below. It has thick woody branches 15-30 cm long and the stems are covered with dense hairs. It survives the occasional fire and light spelled grazing. The development of a very dense understorey might lead to its local extinction. Dwarf bush-pea occurs in black peppermint forest in the Epping Forest district. *Fig 80*

LOCATIONS: Northern Midlands.

***Pultenaea paleacea* var. *sericea* - bush pea - vulnerable**

This bush pea is a slender spreading shrub that reaches up to 1 m in height and has branchlets that become hairy with age. The wiry branches spread from the base. The leaves are 7-20 mm long, linear to narrow, flat with an acute tip, hairless on the upper surface and silky-haired beneath. The flowers are arranged in small clusters and are pale and papery. This bush pea flowers August-November. It is susceptible to the root rot fungus *Phytophthora cinnamomi* and is found in the north east in sandy heaths near the coast. *Fig 81*

LOCATIONS: North east.

***Pultenaea prostrata* - bush pea - vulnerable**

This bush pea is a spreading, dark green shrub. It is identified by its growth habit, orange pea-flowers, leaf shape and degree of hairiness. Hairy branchlets grow to 60 cm in height. The leaves are 3-7 mm long and hairy but become hairless with age. It is superficially similar to the more widespread *Pultenaea pedunculata*, which differs from *Pultenaea prostrata* in its lighter green colour and yellow, rather than orange, flowers. Unlike *Pultenaea pedunculata*, which is found in woodland and forest on non-clayey soils, *Pultenaea prostrata* is found in kangaroo grass tussock grassland, usually in rocky places on clay-rich soils. It resprouts after burning and light grazing. It may become locally extinct where a lack of disturbance by grazing or fire leads to the development of a dense tussock grassland. It regenerates well after mechanical disturbance. Flowers appear in early spring. The species is susceptible to the root rot fungus *Phytophthora cinnamomi*. It is found in the Township Lagoon Nature Reserve and nearby paddocks on basalt soils, at Pontville, and at the Campbell Town Golf Course. *Fig 82*

LOCATIONS: Midlands.

***Pultenaea selaginoides* - bush pea - vulnerable - endemic**

This bush pea is a slender, erect, hairless shrub, 1-2 m in height with brittle ascending branches. The leaves are thick, oblong to heart-shaped, and are clustered at the ends of branches. The branches grow out beyond dense, small terminal clusters of yellow and brown flowers. It is threatened by weeds and inappropriate fire regimes. It is found on the central east coast on the banks of the Apsley and Swan Rivers, and at Lilla Villa bridge.

LOCATIONS: Central east coast.

***Ranunculus prasinus* - Tunbridge buttercup - endangered - endemic**

Tunbridge buttercup is a small perennial herb with a rosette of leaves arising from a stout root. The leaves are grass green and erect and the yellow flowers are 10-12 mm in diameter. The achenes (dry fruits) form globular heads 4-5 mm in diameter. Tunbridge buttercup has a very restricted distribution, being limited to four damp grassy sites on the margins of wetlands on private land in the central Midlands. Current management at all four wild populations is currently favourable to its continued existence at these sites. It has been introduced to the edges of Township Lagoon Nature Reserve, a natural salt lake, with plants collected from two populations within a 10 km radius of the reserve. *Fig 83*

LOCATIONS: Midlands.

***Rhytidosporum alpinum* - alpine apple-berry - endangered**

Alpine apple berry is a dense, prostrate shrub up to 10 cm high that produces underground stems (rhizomes). The leaves are ellipse-shaped, wider towards the ends, 4-12 mm long, 2-5 mm wide and hairless. Single flowers are produced with hairy stalks at the ends of the branches. It is found in alpine heath. *Fig 84*

LOCATIONS: Central Plateau.

***Scaevola aemula* - fairy fan-flower - endangered**

Fairy fan-flower is a perennial herb 30-50 cm high with stout, ascending stems. The lower leaves are spade-shaped and up to 9 cm long with coarsely toothed margins. The upper leaves are smaller and stemless with a smooth margin. The fan-shaped flowers are deep purplish-blue and covered with a soft down. Fairy fan-flower is found in dry sclerophyll forest on the east coast from the Apsley River to the Prosser River, and in the Central Highlands. *Fig 85*

LOCATIONS: East coast, Central Highlands.

***Schoenus latelaminatus* - Medusa bog-rush - endangered**

Medusa bog-rush is a small grass-like plant 10-25 cm in size with flattened narrow, pale green leaves. Little is known of its management needs but it is likely to tolerate stock grazing and withstand fire. It has occasionally been found in a few wetlands in the Midlands but has not been recorded recently. *Fig 86*

LOCATIONS: Midlands.

***Scleranthus diander* - knawel - vulnerable**

Knawel is a light green, trailing plant that forms a loose cushion. It is distinguished from the more common knawel (*Scleranthus biflorus*) by the arrangement of its flowers. The flowers of *Scleranthus diander* occur in groups of three or four in branches of cupped leaves whereas those of *Scleranthus biflorus* occur in pairs. It appears to need gaps between the tussocks for its survival. It regenerates quickly after fire and also tolerates heavy grazing. It has been recorded in grasslands and native pasture in the central Midlands. *Fig 87*

LOCATIONS: Midlands.

***Scleranthus fasciculatus* - knawel - vulnerable**

Knawel is small perennial herb with a much-branched stem that forms a loose, open cushion. It resembles a sprawling, overgrown version of the more widespread common knawel (*Scleranthus biflorus*) which is a tight green cushion plant sold in nurseries. The vegetation at most of the sites is silver tussock grassland. It appears to need gaps between the tussocks for its survival and both fire and stock grazing maintain the openness it requires. It is only known at a few locations in the Midlands and south east.

LOCATIONS: Midlands and south east.

***Senecio macrocarpus* - fluffy groundsel - presumed extinct**

Fluffy groundsel is a large, yellow, daisy-flowered groundsel or fireweed. It was recorded in the 19th century on the grassy banks of the South Esk River. *Fig 88*

LOCATIONS: Fluffy groundsel was previously recorded along the South Esk River.

***Spyridium microphyllum* - small-leaf spyridium - vulnerable - endemic**

Small-leaf spyridium is a small shrub generally less than 1.5 m in height with small, convex, soft, thick leaves. The veins are indented on the upper leaf surface and the lower surface is densely covered in short hairs. The flowers form tight clusters at the ends of branches and are surrounded by whitish leaves that resemble petals. *Spyridium microphyllum* is similar in appearance to two other species, *Spyridium obcordatum* and *Stenanthemum pimeleoides*. *Spyridium microphyllum* can be distinguished from these species by its growth habit and distribution. It is an erect or climbing shrub while the other two species are ground-hugging. *Fig 89*

LOCATIONS: Central east coast and eastern Midlands.

***Spyridium obcordatum* - obcordate spyridium - vulnerable - endemic**

Obcordate spyridium is a delicate, prostrate shrub with brittle, wiry branches. Its delicate, bright green leaves are inversely heart-shaped with an indentation at the tip. The flowers are small and white, arranged in tight clusters and surrounded by brown bracts and white floral leaves (leaves which look like petals). *Spyridium obcordatum* is superficially similar to *Spyridium microphyllum* and *Stenanthemum pimeleoides* but it does not occur within the range of these eastern species. It has been recorded on rocky hilltops in the north of the state. *Fig 90*

LOCATIONS: North.

***Stackhousia gunnii* - Gunns mignonette - endangered**

Gunns mignonette is a small annual herb with fleshy green leaves. The creamy white to pale yellow strong-scented flowers attract night-flying moths. The flowers appear in late winter and early spring. Few seeds are produced and they are difficult to germinate. Gunns mignonette is fire resistant and needs bare inter-tussock spaces for its long-term survival. It tolerates moderate grazing but its brittle stems are often trampled by stock and humans. Gunns mignonette is found only in the central Midlands between Tunbridge and Campbell Town. It is believed to be more extensive on the mainland on heavy black clays in inland, semi-arid regions of South Australia and New South Wales where it is grouped with the common candles *Stackhousia monogyne*. *Fig 91*

LOCATIONS: Midlands.

***Stenanthemum pimeleoides* - prostrate stenanthemum - vulnerable - endemic**

Prostrate stenanthemum has white flowers that form dense clusters at the ends of the branches. It is a spreading shrub with almost square, dark green leaves. The distinct white leaves form around the tiny flower heads. It can be eliminated by heavy grazing from both stock and marsupials and is capable of recovery after fire. It does not compete strongly with taller grasses and shrubs so prefers bare ground. Prostrate stenanthemum occurs on some of the poorest gravelly soils associated with dry sclerophyll forest in eastern Tasmania, mainly from Swansea to Coles Bay, and in the Midlands near Epping Forest. *Fig 92*

LOCATIONS: East coast and Midlands.

***Stenopetalum lineare* - threadcress - endangered**

Threadcress is a slender, annual herb 20-50 cm in height with narrow linear leaves.

The brownish coloured flowers have thin thread-like petals that become clawed after flowering. Being a member of the cress family it is likely to be highly palatable to stock. It occurs in sandy heaths on the east coast near St Helens and was once found at Bellerive and Risdon. *Fig 93*

LOCATIONS: East coast.

***Tetradthea gunnii* - Gunns pink-bells - endangered - endemic**

Gunns pink-bells is a small, straggling herb with between one and five (sometimes more) slender branches 15-50 cm long that tend to trail through associated plants. It closely resembles other *Tetradthea* species. The foliage and flowers of *Tetradthea gunnii* are generally smaller than those of the other species. The leaves are less than 5.5 mm long and the petals are pale lilac to deep pink, generally less than 5 mm in length. The fruit is a compressed capsule with two to three sections and a sparse cover of gland-tipped hairs. Gunns pink-bells is susceptible to the root rot fungus *Phytophthora cinnamomi*. It is restricted to a small area in the foothills of the Dazzler Range near Beaconsfield where it occurs on serpentine outcrops. *Fig 94*

LOCATIONS: Beaconsfield.

***Thesium australe* - austral toadflax - presumed extinct**

Austral toadflax is a perennial, spindly herb with only a few yellowy-green wiry stems that radiate from a central rootstock. It is a root parasite. Small five-lobed flowers and distinctive deep plum-coloured fruit are produced. Austral toadflax is a member of the native cherry family and is probably palatable to stock and native animals. Fire that maintains the openness of its grassy habitat is probably favourable to this species. The seed can remain dormant for at least a year and may be stimulated to mass germination after fire. It was recorded in the Derwent Valley at the beginning of the 19th century but has not been found since. *Fig 95*

LOCATIONS: Austral toadflax was previously recorded in the Derwent Valley.

***Tricoryne elatior* - yellow rush lily - vulnerable**

The wiry yellow rush lily grows up to 40 cm tall with bright yellow, star-shaped flowers clustered in groups of two to six. It is distinguished from other yellow lilies (*Bulbine* species) which are stout, rigid and almost fleshy. The yellow rush lily is found in grassy vegetation at Perth in the northern Midlands and at Scamander on the east coast. *Fig 96*

LOCATIONS: Midlands and east coast.

***Triptilodiscus pygmaeus* - sunray - vulnerable**

Sunray is a tiny spreading to erect moss-like annual daisy that grows up to 10 cm tall. It has bright green, linear leaves and small, yellow, open flower heads surrounded by leaves. Soil disturbance is essential for its regeneration. Fire may also be favourable to this species by maintaining the gaps between the tussocks in grassy bush and reducing competition from other species. The narrow seeds are topped with several short-plumed bristles. Sunray is found on rock plates and outcrops in grassland and grassy woodland at Epping Forest, Pontville and Bridgewater.

LOCATIONS: Midlands.

***Velleia paradoxa* - spur velleia - vulnerable**

Spur velleia is an erect, perennial herb with showy yellow flowers. The oval-shaped seed capsules contain several brown, winged seeds that are easy to germinate. It is highly palatable to stock so it is now restricted to road verges or cemeteries that are inaccessible to stock. These areas were originally white gum or cabbage gum woodland. Excluding stock appears necessary for the survival of this species. It can resprout after fire, which also helps it survive by maintaining the inter-tussock spaces. Spur velleia is found on very dry grassy sites on fertile soils in the eastern half of the state. Known localities include the Waverley Flora Park at Bellerive, Pontville, Hamilton and several sites at Tunbridge. *Fig 97*

LOCATIONS: Midlands.

Veronica notabilis - forest speedwell - presumed extinct

Forest speedwell is a perennial herb that has creeping stems and erect flowering hairy branches 20-60 cm tall. The round leaves have stalked margins, are coarsely toothed, and both surfaces have a few short hairs. The lobed flowers are lilac with raised dark purple stripes that are arranged along a 6-20 cm long branch which extends from the base of the upper leaves. Forest speedwell has previously been recorded at St Patricks River but has not been seen in recent times. *Fig 98*

LOCATIONS: Forest speedwell was previously recorded at St Patricks River.

Viminaria juncea - native broom - endangered

Native broom is a tall, willowy, single-stemmed shrub or low tree that grows up to 6 m in height. It has slender, smooth, erect stems and graceful drooping branchlets. The leaves are reduced to slender stalks. In spring or early summer the whole plant is an elegant shower of yellow pea-flowers 7-10 mm long. The young seedlings are palatable to stock so periods of excluding stock are required to allow regeneration. Cattle and goats will also browse taller plants. The species respouts after fire, which also stimulates seed germination. *Fig 99*

LOCATIONS: Moulting Lagoon, east coast.

Vittadinia australasica var. oricola - New Holland daisy - presumed extinct

New Holland daisy is a perennial purple-flowered herb that can become woody with age. It has hairy stems and leaves. Little is known about this species in Tasmania but mainland New Holland daisies tolerate grazing, fire, and germinate where there is soil disturbance. It was recorded in Tasmania in the early days of settlement but has not been seen since. *Fig 100*

LOCATIONS: None known.

Vittadinia megacephala - Giant New Holland daisy - presumed extinct

Giant New Holland daisy bears large purple solitary flowers on unbranched leafy stems. It was collected in the early 19th century from Tasmania and lodged at Kew Gardens in London. *Fig 101*

LOCATIONS: Not known.

Xanthorrhoea arenaria - sand grasstree - vulnerable - endemic

Sand grasstree occurs in sandy heaths. Like many heath species it is susceptible to the root rot fungus *Phytophthora cinnamomi*. It is well adapted to fire and is found from Bridport to Coles Bay.

LOCATIONS: East coast.

Xanthorrhoea bracteata - grasstree - vulnerable - endemic

This trunkless grasstree is usually characterised by the presence of several leafy crowns, each an erect tuft. The flowers extend half way down the stem which enables it to be distinguished from the more common *Xanthorrhoea australis* which has flowers for most of its length. It occurs in heaths. *Fig 102*

LOCATIONS: North east and east Tasmania.

Alphabetic index of common names

Alpine apple-berry	<i>Rhytidosporum alpinum</i>
Alpine mintbush	<i>Prostanthera cuneata</i>
Apsley heath	<i>Epacris apsleyensis</i>
Austral moonwort, parsley fern	<i>Botrychium australe</i>
Austral thorn	<i>Discaria pubescens</i>
Austral toadflax	<i>Thesium australe</i>
Bearded heath	<i>Epacris barbata</i>
Bearded midge orchid	<i>Genoplesium morrisii</i>
Bertya	<i>Bertya rosmarinifolia</i>
Bitter cryptandra	<i>Cryptandra amara</i>
Black bristle-rush	<i>Chorizandra enodis</i>
Black-tipped spider orchid	<i>Caladenia anthracina</i>
Black-tongue caladenia	<i>Caladenia congesta</i>
Blue devil	<i>Eryngium ovinum</i>
Blue pincushion or native cornflower	<i>Brunonia australis</i>
Border heath	<i>Epacris limbata</i>
Brown guinea flower	<i>Hibbertia rufa</i>
Buftons eyebright	<i>Euphrasia phragmostoma</i>
Bush pea	<i>Pultenaea hibbertioides</i>
Bush pea	<i>Pultenaea paleacea</i> var. <i>sericea</i>
Bush pea	<i>Pultenaea prostrata</i>
Bush pea	<i>Pultenaea selaginoides</i>
Clasping goodenia	<i>Goodenia amplexans</i>
Cloak fern	<i>Cheilanthes distans</i>
Coral heath	<i>Epacris acuminata</i>
Dans Hill heath	<i>Epacris virgata</i>
Davies wax-flower	<i>Phebalium daviesii</i>
Dwarf bush-pea	<i>Pultenaea humilis</i>
Dwarf wedge-pea	<i>Gompholobium ecostatum</i>
Fairy fan-flower	<i>Scaevola aemula</i>
False sarsparilla	<i>Hardenbergia violacea</i>
Fleshy greenhood	<i>Pterostylis wapstreorum</i>
Fluffy groundsel	<i>Senecio macrocarpus</i>
Forest speedwell	<i>Veronica notabilis</i>
Furze hakea	<i>Hakea ulicina</i>
Gaping leek orchid	<i>Prasophyllum correctum</i>
Gaudichauds plantain	<i>Plantago gaudichaudii</i>
Giant New Holland daisy	<i>Vittadinia megacephala</i>
Grass cushions	<i>Isoetopsis graminifolia</i>
Grasstree	<i>Xanthorrhoea bracteata</i>
Great bindweed	<i>Calystegia sepium</i>
Great heath	<i>Epacris grandis</i>

Gristle fern	<i>Blechnum cartilagineum</i>
Gunns mignonette	<i>Stackhousia gunnii</i>
Gunns pink-bells	<i>Tetratheca gunnii</i>
Hairy cutleaf daisy	<i>Brachyscome rigidula</i>
Hairy knotweed	<i>Persicaria subsessilis</i>
Hairy mountain daisy	<i>Brachyscome tenuiscapa</i> var. <i>pubescens</i>
Hairy stylewort	<i>Levenhookia dubia</i>
Heart-lip spider orchid	<i>Caladenia cardiochila</i>
Hoary guinea flower	<i>Hibbertia obtusifolia</i>
Hoary sunray	<i>Leucochrysum albicans</i> var. <i>tricolor</i>
Hookers spleenwort	<i>Asplenium hookerianum</i>
Horny cone-bush	<i>Isopogon ceratophyllus</i>
Knawel	<i>Scleranthus diander</i>
Knawel	<i>Scleranthus fasciculatus</i>
Lanky buttons	<i>Leptorhynchos elongatus</i>
Lemon beauty heads	<i>Calocephalus citreus</i>
Lesser joyweed	<i>Alternanthera denticulata</i>
Lime fern	<i>Pneumatopteris pennigera</i>
Lindleys spider orchid	<i>Caladenia lindleyana</i>
Medusa bog-rush	<i>Schoenus latelaminatus</i>
Midland greenhood	<i>Pterostylis commutata</i>
Midlands mimosa	<i>Acacia axillaris</i>
Morrisbys gum	<i>Eucalyptus morrisbyi</i>
Moss sunray	<i>Hyalosperma demissum</i>
Mouse-tail	<i>Myosurus minimus</i>
Native broom	<i>Viminaria juncea</i>
Native gypsywort	<i>Lycopus australis</i>
Native soybean	<i>Glycine latrobeana</i>
Native wintercress	<i>Barbarea australis</i>
New Holland daisy	<i>Vittadinia australasica</i> var. <i>oricola</i>
Obcordate spyridium	<i>Spyridium obcordatum</i>
Patersons spider orchid	<i>Caladenia patersonii</i>
Peppergrass	<i>Lepidium hyssopifolium</i>
Poison lobelia	<i>Lobelia pratioides</i>
Port Arthur eyebright	<i>Euphrasia semipicta</i>
Prostrate stananthemum	<i>Stenanthemum pimeleoides</i>
Pungent leek orchid	<i>Prasophyllum olidum</i>
Purple goodenia	<i>Cooperookia barbata</i>
Purple loosestrife	<i>Lythrum salicaria</i>
Roadside wallaby grass	<i>Danthonia popinensis</i>
Robust leek orchid	<i>Prasophyllum robustum</i>
Rosy spider orchid	<i>Caladenia pallida</i>
Rough raspwort	<i>Haloragis aspera</i>
Round-leaf mintbush	<i>Prostanthera rotundifolia</i>
Saltbush	<i>Atriplex suberecta</i>

Sand brome	<i>Bromus arenarius</i>
Sand grasstree	<i>Xanthorrhoea arenaria</i>
Scrambling ground fern	<i>Hypolepis distans</i>
Shiny cliff eyebright	<i>Euphrasia amphisysepala</i>
Skirted tree fern	<i>Cyathea X marcescens</i>
Slender knotweed	<i>Persicaria decipiens</i>
Slender tick trefoil	<i>Desmodium gunnii</i>
Small rasp-fern	<i>Doodia caudata</i>
Small-leaf pomaderris	<i>Pomaderris elachophylla</i>
Small-leaf spyridium	<i>Spyridium microphyllum</i>
South Esk heath	<i>Epacris exserta</i>
South Esk pine	<i>Callitris oblonga</i>
Southern ballantine	<i>Ballantinia antipoda</i>
Spicers everlasting	<i>Argentipalium spiceri</i>
Spur velleia	<i>Velleia paradoxa</i>
Sticky long-heads	<i>Podotheca angustifolia</i>
Stinking pennywort	<i>Hydrocotyle laxiflora</i>
Strap leaf asperula	<i>Asperula charophyton</i>
Stuarts heath	<i>Epacris stuartii</i>
Sunray	<i>Triptilodiscus pygmaeus</i>
Swamp wallaby grass	<i>Amphibromus macrorrhinus</i>
Table Mountain daisy bush	<i>Ozothamnus selaginoides</i>
Tapered leek orchid	<i>Prasophyllum apoxychilum</i>
Tasmanian velvet bush	<i>Lasiopetalum micranthum</i>
Thick-stem caladenia	<i>Caladenia campbellii</i>
Threadress	<i>Stenopetalum lineare</i>
Three awned spear grass	<i>Aristida benthamii</i>
Tunbridge buttercup	<i>Ranunculus prasinus</i>
Tunbridge leek orchid	<i>Prasophyllum tunbridgense</i>
Water milfoil	<i>Myriophyllum glomeratum</i>
Water milfoil	<i>Myriophyllum integrifolium</i>
Wiry mitrewort	<i>Mitrasacme divergens</i>
Yellow eyebright	<i>Euphrasia scabra</i>
Yellow rush lily	<i>Tricoryne elatior</i>



Figure 1 *Acacia axillaris*



Figure 2 *Amphibromus macrorhinus* (seeds)



Figure 3 *Argemone spicera*

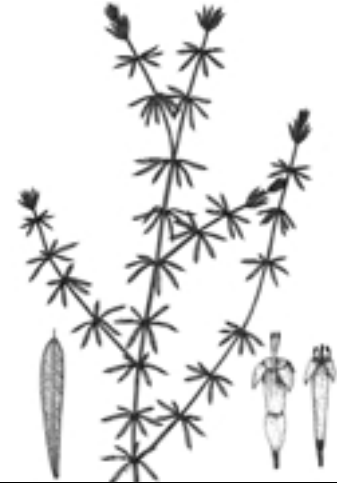


Figure 4 *Asperula charophyton*



Figure 5 *Asplenium hookerianum*



Figure 6 *Atriplex suberecta*



Figure 7 *Ballantinia antipoda*



Figure 8 *Barbarea australis*



Figure 9 *Blechnum cartilagineum*



Figure 10 *Botrychium australe*



Figure 11 *Brachyscome rigidula*

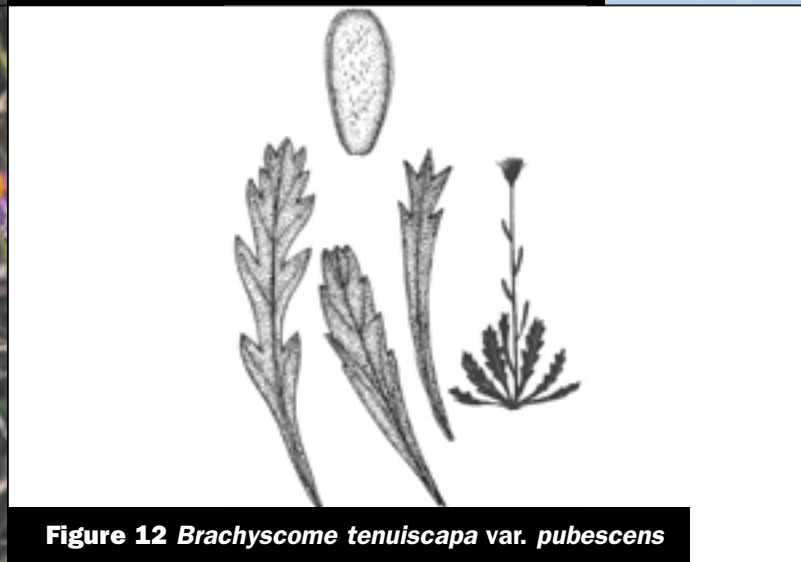


Figure 12 *Brachyscome tenuiscapea* var. *pubescens*

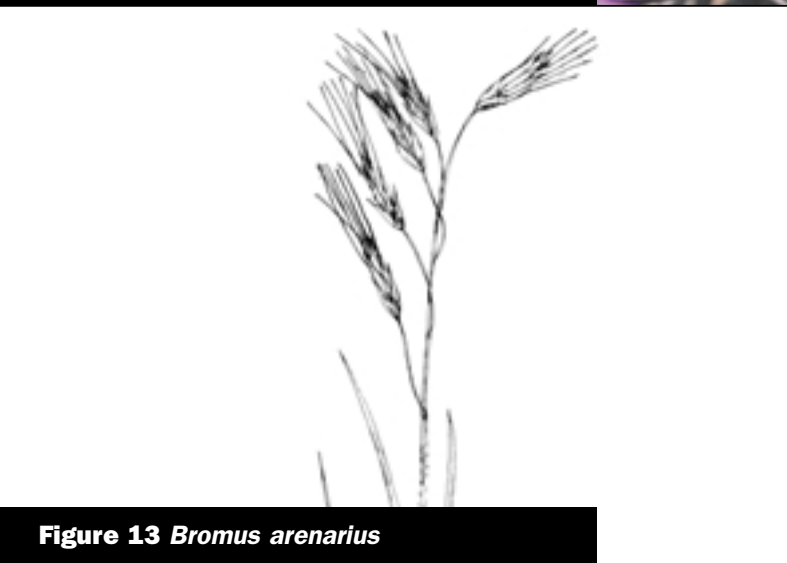


Figure 13 *Bromus arenarius*



Figure 14 *Brunonia australis*



Figure 15 *Caladenia anthracina*



Figure 16 *Caladenia campbellii*



Figure 17 *Caladenia cardiochila*



Figure 18 *Caladenia congesta*



Figure 19 *Caladenia lindleyana*



Figure 20 *Caladenia pallida*



Figure 21 *Caladenia patersonii*



Figure 22 *Callitris oblonga*

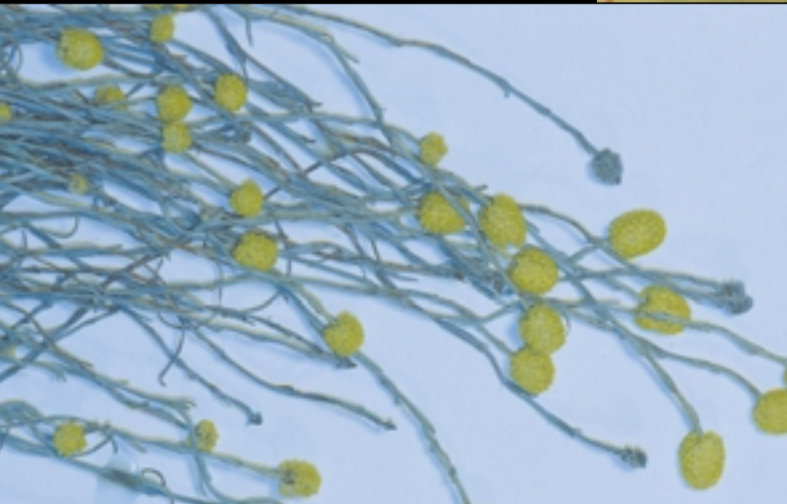


Figure 23 *Calocephalus citreus*



Figure 24 *Calystegia sepium*



Figure 25 *Cheilanthes distans*



Figure 26 *Chorizandra enodis*



Figure 27 *Cryptandra amara*



Figure 28 *Cyathea X marcescens*



Figure 29 *Danthonia popinensis*



Figure 30 *Desmodium gunnii*



Figure 31 *Discaria pubescens*



Figure 32 *Doodia caudata*



Figure 33 *Epacris acuminata*



Figure 34 *Epacris apsleyensis*



Figure 35 *Epacris exserta*



Figure 36 *Epacris grandis*



Figure 37 *Epacris limbata*



Figure 38 *Epacris stuartii*



Figure 39 *Eryngium ovinum*



Figure 40 *Euphrasia amphisysepala*



Figure 41 *Euphrasia scabra*



Figure 42 *Euphrasia semipicta*



Figure 43 *Genoplesium morrisii*



Figure 44 *Glycine latrobeana*



Figure 45 *Gompholobium ecostatum*

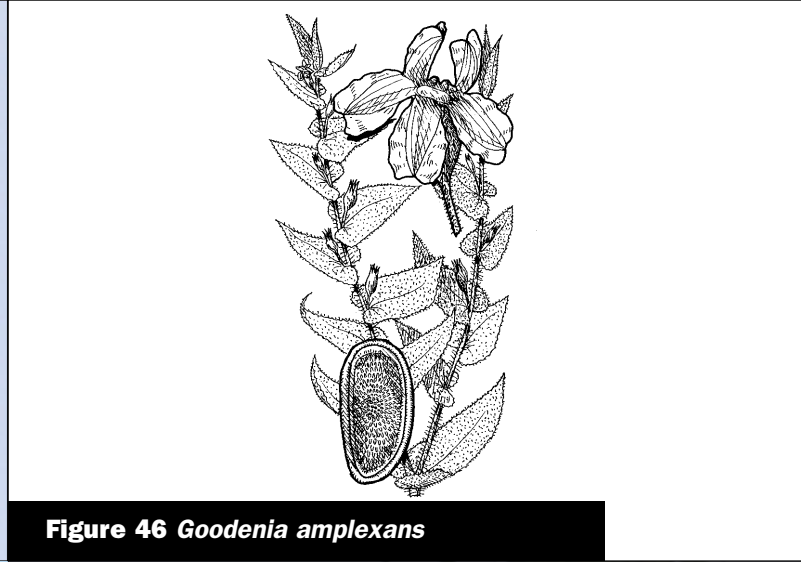


Figure 46 *Goodenia amplexans*



Figure 47 *Hakea ulicina*



Figure 48 *Haloragis aspera*



Figure 49 *Hardenbergia violacea*



Figure 50 *Hibbertia obtusifolia*



Figure 51 *Hyalosperma demissum*



Figure 52 *Hydrocotyle laxiflora*

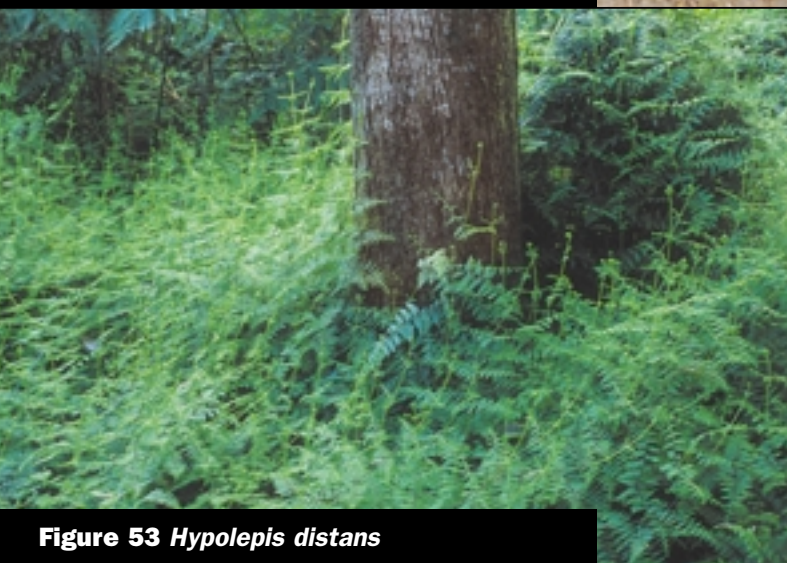


Figure 53 *Hypolepis distans*



Figure 54 *Isoetopsis graminifolia*



Figure 55 *Isopogon ceratophyllus*



Figure 56 *Lasiopetalum micranthum*



Figure 57 *Lepidium hyssopifolium*



Figure 58 *Leptorhynchos elongatus*



Figure 59 *Leucochrysum albicans* var. *tricolor*

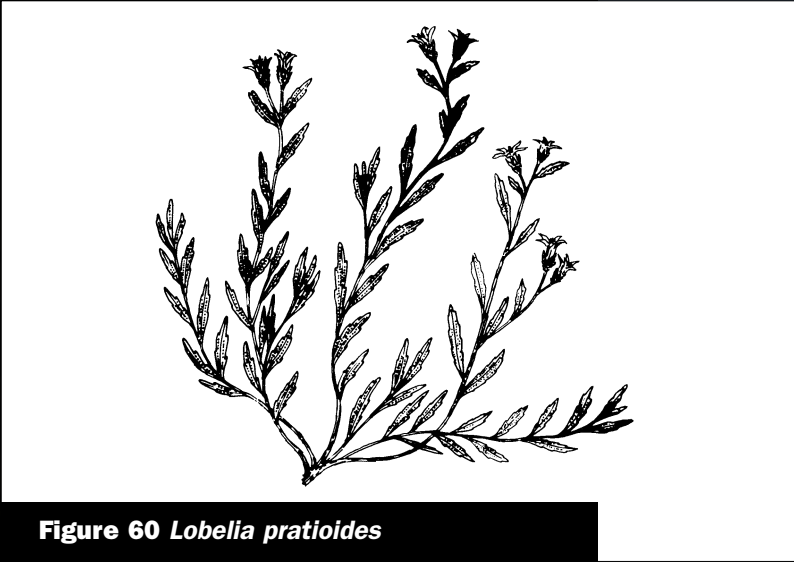


Figure 60 *Lobelia pratioides*



Figure 61 *Lythrum salicaria*

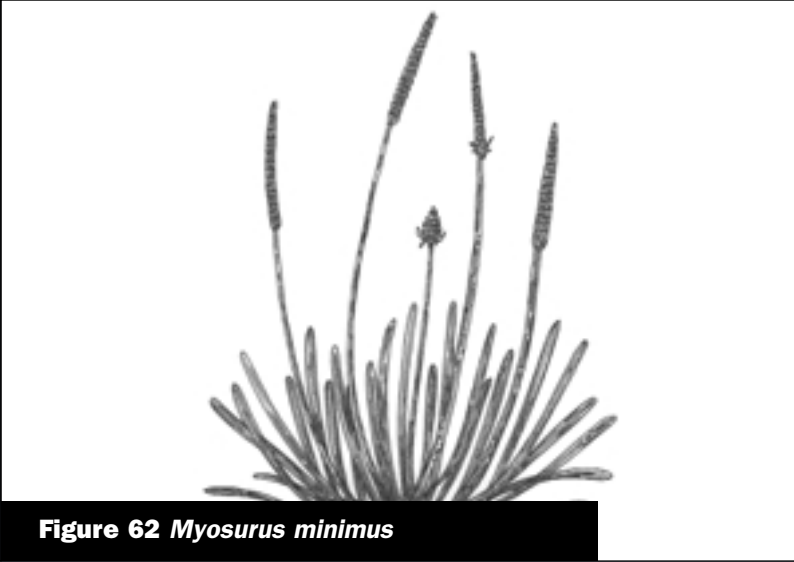


Figure 62 *Myosurus minimus*



Figure 63 *Myriophyllum glomeratum*



Figure 64 *Myriophyllum integrifolium*



Figure 65 *Persicaria decipiens*



Figure 66 *Persicaria subsessilis*



Figure 67 *Phebalium daviesii*



Figure 68 *Pneumatopteris pennigera*



Figure 69 *Podotheca angustifolia*

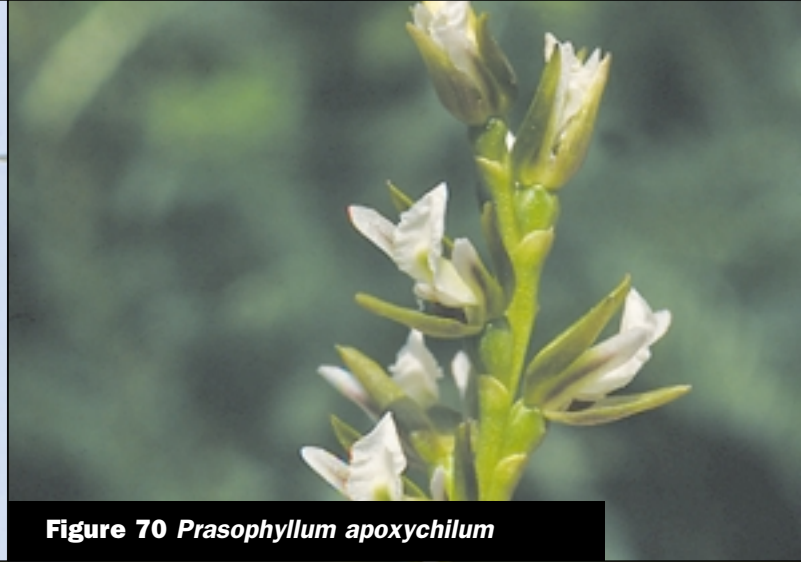


Figure 70 *Prasophyllum apoxychilum*



Figure 71 *Prasophyllum correctum*

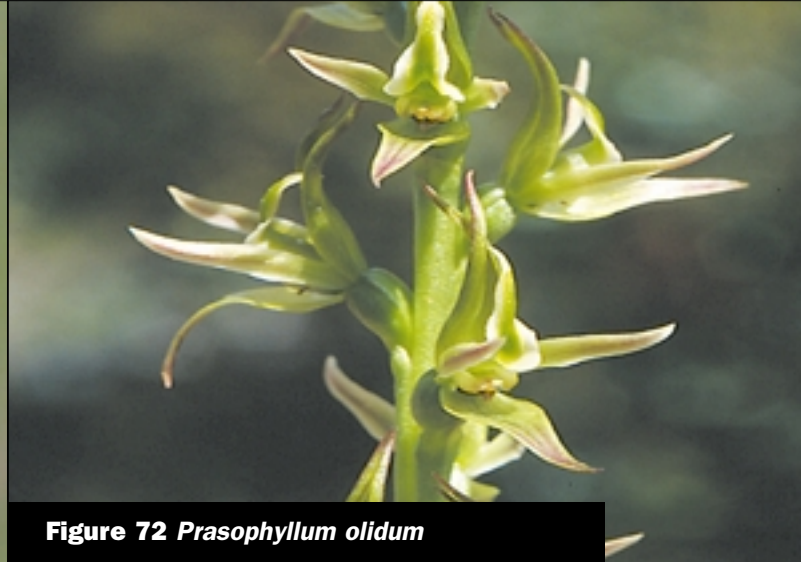


Figure 72 *Prasophyllum olidum*



Figure 73 *Prasophyllum robustum*



Figure 74 *Prasophyllum tunbridgense*



Figure 75 *Prostanthera cuneata*



Figure 76 *Prostanthera rotundifolia*



Figure 77 *Pterostylis commutata*



Figure 78 *Pterostylis wapstreorum*



Figure 79 *Pultenaea hibbertioides*



Figure 80 *Pultenaea humilis*



Figure 81 *Pultenaea paleacea* var. *sericea*



Figure 82 *Pultenaea prostrata*



Figure 83 *Ranunculus prasinus*



Figure 84 *Rhytidosporum alpinum*



Figure 85 *Scaevola aemula*



Figure 86 *Schoenus latelaminatus*



Figure 87 *Scleranthus diander*

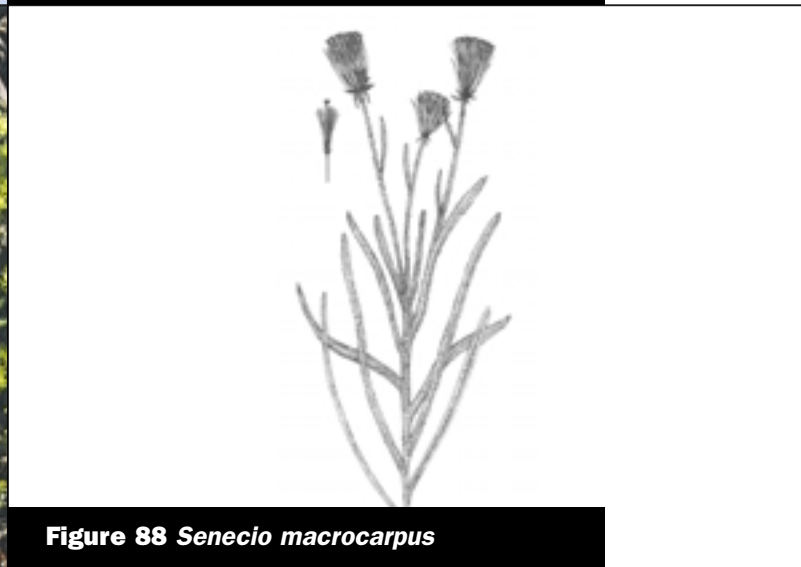


Figure 88 *Senecio macrocarpus*



Figure 89 *Spyridium microphyllum*



Figure 90 *Spyridium obcordatum*



Figure 91 *Stackhousia gunnii*



Figure 92 *Stenanthemum pimeleoides*



Figure 93 *Stenopetalum lineare*



Figure 94 *Tetratheca gunnii*



Figure 95 *Thesium australe*



Figure 96 *Tricoryne elatior*



Figure 97 *Velleia paradoxa*



Figure 98 *Veronica notabilis*



Figure 99 *Viminaria juncea*



Figure 100 *Vittadinia australasica* var. *oricola*



Figure 101 *Vittadinia megacephala*



Figure 102 *Xanthorrhoea bracteata*

6

Kit 6

Riparian bush



About this kit

This kit discusses riparian bush and gives specific guidelines for managing it. However, as with all the recommendations in the **Tasmanian Bushcare Toolkit**, the guidelines are not meant to be followed rigidly. Rather, they are intended to give you some principles for managing remnant bush. You can then modify the guidelines to suit your particular situation and needs.

The specific management of riparian vegetation depends on the bush type present. Therefore, this kit should be read in conjunction with the kit that discusses the particular bush type that makes up your riparian vegetation. For example, if the bush along the river is lowland grassland you should read this kit and **Kit 7 Grassy Bush**. You will then need to combine the guidelines given in Kit 7 with those in this kit.

If you are unsure what bush type makes up your riparian bush read the “Tasmanian Bush Types” section of **Kit 1 Bush on Your Farm** and use the key provided to identify the bush type and the relevant kit to use.

This kit includes:

- A description of riparian bush and where it tends to be found.
- Places where you can see good examples of riparian bush.
- The significance of riparian bush and some of the threatened species that may be found in it.
- The management issues relevant to riparian bush. The management guidelines included are those that are specific to riparian bush. As said before, these recommendations need to be considered in conjunction with those given for the specific bush type that makes up your riparian bush. Where no specific guidelines are given in either kit use the general principles outlined in **Kit 2 Managing Your Bush**.



Looking after riparian bush

Riparian bush is vegetation found along streams, creeks, rivers and wetlands. A variety of bush types make up riparian vegetation, including rainforest, wet forest, dry forest and scrub. Riparian bush may have a grassy, heathy, sedgey or shrubby understorey. Some riparian vegetation may be treeless and many rivers in Tasmania have extensive river flats of silver tussock grass as riparian vegetation. Alongside the stream there is often a strip of vegetation containing moisture-loving herbs, sedges, rushes and reeds that are periodically inundated. Within the stream are aquatic plants that are often referred to as macrophytes, which may float on the surface or emerge through it.

Much of the remnant riparian vegetation found in Tasmania is confined to the less productive parts of the rivers. The banks of many of the rivers flowing through the fertile floodplains of lowland Tasmania have been cleared and replaced with pasture or willow. This has been detrimental to the health and ecology of the state's river systems.

Good examples

The upper parts of river catchments often contain native riparian vegetation in good condition. These areas usually have all the attributes that make streams such interesting environments: diverse flora and fauna, healthy aquatic environments and many different habitats. Native riparian vegetation can also be found in natural refuges, such as narrow valleys or gorges. The Prosser River, on the east coast, is a good example of a river that still has reasonable native riparian vegetation, almost to its mouth at Orford.

Values

Riparian land is important from both the economic and environmental perspectives. It provides habitat, food and shelter for animals and is vital for maintaining good water quality. Riparian vegetation plays an important role in:

- **Stabilisation of river banks.** Riparian vegetation can protect banks from scour and collapse. Generally, a bank covered with vegetation will erode at a lower rate than a bare bank.
- **Maintenance of water quality.** Vegetation is an important filter that helps to reduce the speed of water runoff from surrounding areas, thereby allowing sediments and nutrients to be trapped.
- **Provision of habitat for aquatic species.** Riparian vegetation is an important source of food for both fish and aquatic insects. The mottled shade of riparian vegetation creates cover for both predator and prey, habitat for threatened plants, and habitat and feeding areas for fish.
- **Maintenance of habitat conditions.** The shade provided by riparian vegetation helps to regulate water temperature and light levels, thereby maintaining suitable water quality for aquatic plants and animals. Reducing the temperature leads to higher oxygen levels for aquatic fauna. Limiting the available light reduces weed and algal growth.

THREATENED ANIMALS OF RIVERS INCLUDE:

Swan galaxias (*Galaxias fontanus*)

Clarence galaxias (*Galaxias johnstoni*)

Saddled galaxias (*Galaxias tanycephalus*)

Dwarf galaxias (*Galaxias pusilla*)

Australian grayling (*Prototroctes maraena*)

Giant freshwater crayfish (*Astacopsis gouldii*)

Mt Arthur burrowing crayfish (*Engaeus orramakunna*)

Burnie burrowing crayfish (*Engaeus yabbimunna*)

THREATENED PLANTS OF RIVERS INCLUDE:

River dogwood (*Pomaderris phyllicifolia*)

Small-leaf sphyridium (*Spyridium microphylla*)

Midlands mimosa (*Acacia axillaris*)

Oyster Bay pine (*Callitris oblonga*)

Native wintercress (*Barbarea australis*)

Clubmoss bush pea (*Pultenaea selaginoides*)

Water milfoil (*Myriophyllum integrifolium*)

Refer to **Kit 5 Threatened Plant Species in Your Bush** for more information and an illustration of each species.



Management issues

Riparian land is often highly productive making it vulnerable to overuse. Poorly managed access to streambanks by stock can lead to erosion, soil compaction and weed invasion as well as a loss of native vegetation. Healthy streambank vegetation and instream habitat, such as woody debris, increases habitat for fauna and improves water quality by reducing runoff. The management of riparian land becomes problematic where there are infestations of weeds such as willows or where the area is devoid of vegetation. The areas of a catchment with remnant native vegetation are a high priority for the protection of biodiversity.

Grazing

Stock are one of the most serious management problems along rivers. The problems they cause include:

- Loss of vegetation through trampling and grazing, leaving bare banks that are more vulnerable to erosion.
- Breakdown of soil structure, increasing erosion of the banks.
- Decreased water quality through contamination by urine and faeces. This will result in an increase in nutrient levels which in turn favours weed and algal growth.

Stock management is about controlling access – excluding them when they are most likely to cause damage. Some landowners prefer to keep stock out permanently while others limit access to times when the native plants are not flowering and the streambanks are stable. There is a range of fencing options suitable for use along rivers. These are described in detail in the book *A Guide to Riparian Vegetation and its Management* by Sarah Munks which is available from good bookstores.

Alternative watering supplies may be needed for stock. There is a range of innovative pumps, troughs, and stream access design systems that have been developed for use along rivers. For information on alternative watering systems contact your local Bushcare officer.

Weeds

Weed infestations occur in disturbed environments. Rivers are naturally prone to soil disturbance through flooding. Seeds are transported by flowing water. In many riparian areas natural disturbance is compounded by unrestricted stock access. Weeds will compete with native species for light and nutrients, often growing faster than their native counterparts. The severity of weed infestations in riparian vegetation increases as the stream or river flows downstream, particularly as it flows through the highly developed alluvial soil flats.

Willows, gorse, hawthorn and blackberry are the major weeds along rivers. In many situations these species have transformed riparian vegetation from a native to an introduced flora. Information on weed management and control is contained in **Kit 3 Weeds in Your Bush**. For information on managing willows refer to the *Willow Management Guidelines* available from the Department of Primary Industries, Water and Environment (DPIWE). Additional information can be obtained from the regional weed officers, DPIWE.

Woody debris

Large woody debris is a term used to describe river snags. River snags include large limbs, branches and occasionally complete trees. They are significant because they provide habitat for a range of species, including fish, invertebrates and microscopic organisms. They also help to reduce the energy of the stream and are a source of organic matter for some animals to feed on. De-snagging rivers leads to loss of habitat and increases flow rate which results in channel erosion. This is more likely to occur when the removal of snags is combined with straightening of channels.

Riparian vegetation is an important source of woody debris for rivers and its removal or absence disrupts the ecological balance of the stream. If woody debris is causing a problem it can be realigned so that it lies at an angle of 20-40° to the bank to stop flooding or erosion. Advice should be sought before removing or realigning debris from the River Engineer, Department of Primary Industries, Water and Environment.

Revegetation

Retaining healthy riparian vegetation is the cheapest way of preventing degradation. If you have any intact riparian bush protect it. If you have only isolated plants or small patches left, ensure that these are not removed during rehabilitation works, such as willow removal.

Some guidelines for revegetating along rivers are:

- Survey river sections or tributaries that have riparian bush in good or excellent condition. Record the different species present and note which ones are dominant. This will be useful when deciding upon a seed or planting mix.
- The species mix should reflect the vegetation types that would typically occur along the river. This information will come from the surveys. Preferably a range of species should be used, including trees, shrubs and ground covers. The roots of the trees and shrubs will penetrate deep into the soil profile and help to bind the soil together. The ground cover plants will reduce the amount of bare ground and help to trap sediments and nutrients from the adjacent land.
- As part of the survey, note where particular species occur in relation to the river. For example, woolly tea-tree most commonly occurs on the edge of the stream while blackwood and dogwood occur further away. Tea-tree may find it too dry away from the river while blackwood and dogwood may find it too wet if planted on the river's edge. Herbs, small sedges, rushes and grasses occur along the edge of the stream and are very important for binding the soil. It is important to try and replicate this pattern when revegetating the banks.

Managing by condition

The best management regime for riparian bush will depend on the condition of the bush. Management guidelines based on the condition of the bush are given below. However, the specific needs of threatened plants may override these recommendations. If you are unsure what condition your bush is in refer to **Kit 1 Bush on Your Farm**.

Excellent condition

Riparian bush in excellent condition is characterised by:

- High levels of native species richness and a diverse range of life forms, including herbs, sedges, rushes, grasses, shrubs and trees. These species may form discrete zones parallel to the stream which change as conditions such as drainage and exposure vary.
- Virtually no weeds and those that are present are 'naturalised' species such as the flat weeds and *Prunella*.
- High aquatic and terrestrial habitat diversity.
- Natural woody debris.
- A channel that has not been straightened or altered in other ways.

Riparian vegetation in this condition is an asset, both to your own property and to the greater catchment. Do not change your management regime unless there is a good reason to do so.

Much of this bush is confined to areas that have been relatively free of human disturbance in the past. However, this land is increasingly coming under pressure. Typically, it occurs in the upper parts of catchments or along small tributaries so it has an important functional role within the catchment.

It is important to continue to exclude stock and ensure that fire does not burn into riparian areas. Flooding provides any disturbance that the plant community is likely to need for regeneration. Avoid changing the flow regime through irrigating or damming as this may eliminate the flooding that is necessary for regeneration. The stream channel should also be left untouched. Woody debris that has accumulated in the stream is likely to be occurring at natural rates and is important for providing habitat and for reducing flow rates.

While these areas are relatively weed free it will be necessary to monitor them for any invading weeds. These weeds may come from areas upstream or from adjacent areas, or may be carried in by birds. Serious weeds of riparian bush include willow, gorse, hawthorn and blackberry.



Good condition

Riparian bush in good condition is characterised by:

- Fragmentation of patches of native vegetation leaving small isolated remnants separated by pasture, or continuous riparian vegetation that is less than two metres wide.
- Moderate to low diversity of native plant and animal species.
- Relatively high levels of weed invasion which can include introduced grasses, flat weeds, blackberry, briar rose, and some gorse and hawthorn.
- Actively eroding streambanks, causing areas of bank instability and possibly leading to excessive accumulation of woody debris in the stream.
- Moderate to low diversity of habitats for native animals and plants.
- Stock access which is associated with soil compaction, structural damage to banks, and a reduction in water quality.

Riparian bush in good condition is usually found in bush run country where fire may occur at regular intervals, and grazing, while not heavy, is uncontrolled. It is also found adjacent to pasture in areas where cattle access is restricted but is still too frequent. Stock need to be excluded at least until the vegetation has recovered. This may take over 20 years in some vegetation types. If recovery occurs without significant weed invasion and there is a diverse range of species it would be beneficial to exclude stock. However, if weeds become a problem crash grazing may help to reduce their number. Crash grazing should take place when the weeds are flowering, the banks have low moisture levels, and there is no risk of erosion. However, this will only be a short-term solution and a more active weed control program will be needed. See **Kit 3 Weeds in Your Bush** for more detailed information on weed management.

Fire should be excluded. While fire may be a useful tool for encouraging shrub and tree regeneration it is likely to cause damage and may simply encourage weeds and erosion.

Poor condition

Riparian bush in poor condition is characterised by:

- Very little native vegetation with only the occasional tree or clump of shrubs present.
- A high proportion of pasture areas or weeds such as willow, gorse or hawthorn.
- Stock damage in the form of stock pathways, bank erosion, soil compaction, animal faeces in and around the water's edge, and sediment in the water.
- Little suitable habitat for native plant and animal species.
- Significant and active erosion which is not natural.

Riparian bush in poor condition commonly occurs in areas used for intensive agriculture. Many of the rivers flowing through the floodplains of the state are in poor condition and are dominated by willow. There has been much effort and money spent removing willows from these rivers in order to return them to a more natural state. Simply fencing off these areas and waiting for natural regeneration may not be enough because of poor seed availability and weed invasion. Rehabilitation of these sites will require an active strategy of direct seeding or planting. It is important that these areas are revegetated as soon as possible following any works. If rivers are not revegetated it is likely that they will become further degraded and water quality for both humans and native fauna will decline.

Stock control is essential. Rivers in poor condition appear to be highly prone to damage by stock, especially once willows and other weeds have been removed and there is free access. Fencing should accompany revegetation.

Further reading

There are a number of useful publications that provide more detailed information on managing riparian vegetation.

Riparian Management 1. Managing Riparian Land

Riparian Management 2. Stream Stability

Riparian Management 3. Water Quality

Riparian Management 4. River Ecosystems

Riparian Management 5. Land-based Ecosystems

Riparian Management 6. Managing Stock

Riparian Management 7. Managing Snags in Rivers

This series of seven fact sheets provides a good overview of some of the important management and ecological issues associated with rivers. They are available from the Resources Assessment Branch, Department of Primary Industries, Water and Environment or the Land and Water Resources Research and Development Corporation, GPO Box 2182, Canberra ACT 2601.

Willow Management Guidelines by Greg Parker and David Bower, 1996.

These guidelines are essential for anyone contemplating willow removal. The book is an excellent practical guide that provides a step-by-step method for removing willows. It is available from the Department of Primary Industries, Water and Environment, Hobart.

A Guide to Riparian Vegetation and its Management by Sarah Munks, 1996.

This publication gives a broad overview of river systems, including their ecology, geomorphology, management and rehabilitation. It is especially useful for topics such as planning rehabilitation, fencing, and different approaches to management and revegetation. It is available from the Department of Primary Industries, Water and Environment.

Waterplants in Australia: A Field Guide by G R Sainty and S W L Jacobs, CSIRO Division of Water Resources, Canberra, 1994.

This is a handy guide for people wanting to become familiar with aquatic and semi-aquatic plants in Australia. It is available from major bookstores.

7

Grassy bush

Lowland grassland

Highland grassland

Grassy woodland and forest



About this kit

This kit discusses a number of grassy bush types and provides guidelines for managing them. However, as with all the recommendations in the **Tasmanian Bushcare Toolkit**, the guidelines are not meant to be followed rigidly. Rather, they are intended to give you some guiding principles that can be modified to suit your particular circumstances and needs.

Grassy bush is bush with an understorey dominated by native grasses. The grassy bush types covered in this kit are:

Lowland grassland

Highland grassland

Grassy woodland and forest.

Included in this kit are:

- A description of each of the grassy bush types and where they tend to be found.
- Public places where you can see good examples of each of the grassy bush types.
- The significance of grassy bush in terms of conservation and biodiversity, and some of the threatened species that may be found in it.
- The management issues relevant to grassy bush. The management guidelines included are those that are specific to grassy bush. Where no specific guidelines are given use the general principles outlined in **Kit 2 Managing Your Bush**.
- The likely causes of rural tree decline and some ways of managing it.

When you have read the guidelines for grassy bush you will probably need to reread **Kit 2 Managing Your Bush**. This kit contains more detailed information on the principles and practices of managing remnant native vegetation. You may also need to refer to parts of the following kits for specific information on weeds, revegetation and threatened species:

- **Kit 3 Weeds in Your Bush**
- **Kit 4 Revegetating Your Farm**
- **Kit 5 Threatened Plant Species in Your Bush.**

Looking after grassy bush types

This kit refers to a number of grassy bush types: lowland grassland, highland grassland, and grassy woodland and forest. The most important characteristic of these bush types is an understorey dominated by native grasses such as silver tussock grass, kangaroo grass, wallaby grass or spear grass. Sags and sedges may also be common.

Lowland grassland

Native grasslands have few or no trees. Before European settlement native tussock grasslands occurred on many of the fertile plains between Launceston and Hobart. A superficial resemblance to European pasture made both the northern and southern Midlands and the lower Derwent Valley attractive to early settlers. The lowland tussock grasslands have been heavily cleared and today only small patches remain in places like country cemeteries and road reserves. Some larger areas of lowland native pastures are still found on grazing properties where they are valued for the high quality wool produced by sheep grazing on them.

Lowland grasslands are of two types: lowland silver tussock grassland or kangaroo grass tussock grassland, both of which are endangered.

LOWLAND SILVER TUSSOCK GRASSLAND is generally found on alluvial river flats less than 600 m above sea level. It also occurs in coastal areas on sand ridges or next to wetlands, where it is usually the result of excessive burning of shrubby coastal vegetation. The dominant grass is silver tussock (*Poa labillardierei*) which is a narrow-leaved species that forms dense tussocks up to 1 m in height. Lowland silver tussock grassland usually occurs in association with black gum (*Eucalyptus ovata*) grassy woodland.

Many farmers value these river flat grasslands for the shelter they provide newly shorn sheep or lambs. They are also important for erosion control during floods. Lowland grassland is probably the Tasmanian vegetation type that has undergone the most destruction since European settlement. The remnants of this community in the Midlands are of particularly high conservation significance as they have concentrations of rare and threatened species. Every remnant – no matter how degraded – is important.

KANGAROO GRASS TUSSOCK GRASSLAND is found on well-drained, fertile valley floors in low rainfall, low altitude areas. It is also found on shallow soils on well-drained hill tops and ridges on basalt, dolerite and deep sands. It is dominated by kangaroo grass (*Themeda triandra*) which is a deep-rooted, summer-growing, perennial grass. It has a distinctly-shaped flowering head and its foliage is red-green during the non-growing season. Other common grasses of kangaroo grass tussock grassland include wallaby grass, weeping grass and tussock grass. Kangaroo grass tussock grasslands are often characterised by a rich variety of lilies, orchids, daisies and other herbs in the patches between the tussocks. They are rich in rare or threatened species. Kangaroo grass tussock grassland is one of Tasmania's most endangered vegetation types.

Highland grassland

Highland grasslands are found in fertile valleys and plains between 600 m above sea level and the lower limit of alpine vegetation (approximately 1000 m above sea level). Many of the original upland tussock grasslands survive though often in a degraded state. The dominant grass is silver tussock (*Poa labillardierei*) which is a narrow-leaved species that forms dense tussocks up to 1 m in height. In some cases, such as at Paradise Plains in the north east highlands, the grassland has replaced rainforest after fire. In most cases it seems that it has occupied the plains for thousands of years.

All of these highland grasslands have been used for stock grazing and most are still used for this purpose. The lower altitude plains on the Central Plateau have been partly converted to

improved pasture, a conversion that is still continuing. Only a small proportion of highland grassland is managed to maintain biodiversity. While introduced grasses and herbs are found in most areas of highland grassland, the number of different species is still high and spectacular wildflower displays can be seen at places such as the Vale of Belvoir and Middlesex Plains.

Grassy woodland and forest

Grassy woodland and forest is one of the most characteristic bush types of the Midlands and central east coast. It occurs naturally on fertile soils, usually in low rainfall areas. The trees in woodland are spaced such that the gaps between their crowns are wider than the crowns. The crowns are closer together in forest. The terms grassy woodland and forest are used interchangeably and the management guidelines apply to both. The understorey of grassy woodland and forest is dominated by a diversity of grasses, saggos, sedges, lilies, daisies, orchids, peas and other wildflowers. The canopy can be dominated by white gum (*Eucalyptus viminalis*), cabbage gum (*Eucalyptus pauciflora*), black gum (*Eucalyptus ovata*), black peppermint (*Eucalyptus amygdalina*), silver peppermint (*Eucalyptus tenuiramis*), swamp peppermint (*Eucalyptus rodwayi*), blue gum (*Eucalyptus globulus*), or gum-topped stringybark (*Eucalyptus delegatensis*). In montane regions grassy forests often occur adjacent to grassy plains. Areas of sedgely forest may occur on poorly drained sites within grassy woodland and forest. They are generally managed in the same way as the surrounding grassy bush.

Grassy woodland and forest can intergrade with heathy woodland and forest. If there is a dominant heathy component in the understorey then the management is different to that of grassy bush and you should refer to **Kit 8 Eucalypt Bush**.

Grassy bush is used for rough grazing and is an important part of farming enterprises. Much of this bush has been cleared for crops, pasture and housing.

Good examples

Township Lagoon Nature Reserve at Tunbridge has good examples of both types of LOWLAND GRASSLAND. The adjacent paddocks are cabbage gum (*Eucalyptus pauciflora*) grassy woodland. The best time to visit is in spring when there is a profusion of wildflowers. The Tunbridge area has one of the highest concentrations of threatened plant species anywhere in Tasmania. Lowland silver tussock grassland is found on many river flats, including the Macquarie, South Esk, St Pauls and North Esk Rivers.

HIGHLAND GRASSLAND can be seen at Middlesex Plains and the Vale of Belvoir near Cradle Mountain, and at Paradise Plains in the north east. Montane grassy forests can be seen in the vicinity of these plains.

GRASSY WOODLAND AND FOREST can be seen on the Domain in Hobart and in the Trevallyn State Recreation Area in Launceston. They are also widespread on north Bruny Island. The rest area on the Midland Highway near St Peters Pass is an excellent and typical example of grassy forest, with white gums, cabbage gums and a diverse understorey. This area has not been burned frequently and it has a dense understorey of small trees such as prickly box.

Biodiversity values

Grasslands and grassy woodland and forest are some of the bush types that have been most extensively cleared and modified. They are an extremely high priority for conservation, especially for threatened animal and plant species. A number of Tasmanian grassland plant species are extinct, and so is the Tasmanian emu that once lived in grassland habitat.

EXTINCT OR THREATENED ANIMALS OF GRASSY BUSH TYPES INCLUDE:

Thylacine (<i>Thylacinus cynocephalus</i>)	EXTINCT
Tasmanian emu (<i>Dromaius novaehollandiae diemensis</i>)	EXTINCT
Ptunnara brown butterfly (<i>Oreixenica ptunnara</i>)	
Eastern-barred bandicoot (<i>Perameles gunnii</i>)	
Swift parrot (<i>Lathamus discolor</i>)	
Forty-spotted pardalote (<i>Pardalotus quadragintus</i>)	
Green and gold carabid (<i>Catadromus lacordairei</i>)	
Geometrid moth (<i>Chrysolarentia decisaria</i>)	

THREATENED PLANT SPECIES OF GRASSY BUSH TYPES INCLUDE:

Austral thorn bush (<i>Discaria pubescens</i>)
Bitter cryptandra (<i>Cryptandra amara</i>)
Black-tipped spider orchid (<i>Caladenia anthracina</i>)
Bush pea (<i>Pultenaea prostrata</i>)
Gaping leek orchid (<i>Prasophyllum correctum</i>)
Graceful leek orchid (<i>Prasophyllum pyriforme</i>)
Grass cushions (<i>Isoetopsis graminifolia</i>)
Gunns mignonette (<i>Stackhousia gunnii</i>)
Hairy cutleaf daisy (<i>Brachyscome rigidula</i>)
Hoary sunray (<i>Leucochrysum albicans</i> var. <i>tricolor</i>)
Knawel (<i>Scleranthus diander</i>)
Knawel (<i>Scleranthus fasciculatus</i>)
Lanky buttons (<i>Leptorhynchos elongatus</i>)
Native soybean (<i>Glycine latrobeana</i>)
Roadside wallaby grass (<i>Danthonia popinensis</i>)
Rough raspwort (<i>Haloragis aspera</i>)
Slender leek-orchid (<i>Prasophyllum pyriforme</i>)
Slender tick trefoil (<i>Desmodium gunnii</i>)
Spur velleia (<i>Velleia paradoxa</i>)
Swamp wallaby grass (<i>Amphibromus macrorhinus</i>)
Tunbridge buttercup (<i>Ranunculus prasinus</i>)
Tunbridge leek-orchid (<i>Prasophyllum tunbridgense</i>)
Yellow eyebright (<i>Euphrasia scabra</i>)

Refer to **Kit 5 Threatened Plant Species in Your Bush** for more information and an illustration of each plant.

Management issues

Fire and grazing are the main tools used to maintain the health of native grassy bush. In many cases fire is not essential as grazing by stock or native animals performs a similar role of reducing the competition from dense grasses. One of the main aims of managing grassy bush is to retain a rich and diverse flora by maintaining the gaps between the tussocks. Once the grass becomes rank and dense, the gaps between the tussocks disappear. As a result wildflowers, trees and shrubs fail to flower and set seed, and eventually they become sparse or disappear. Grassy bush may have over 50 different species in an area of 10 square metres but once the inter-tussock gaps close up this may drop to as low as 10-15 species. Both fire and grazing can be used to maintain the gaps between the tussocks.

Weed invasion is also a critical issue in grassy bush, particularly for woody weeds such as broom and gorse. Some native woody species such as prickly box and silver wattle can also become dense in native pastures and may be considered weeds by landowners. The invasion of native pastures by both native and introduced woody shrubs leads to changes in the structure of the vegetation. It can be a serious management issue because the quality of the pasture is reduced and wool can be contaminated by twigs, seeds and other woody material. In some districts gorse is tolerated by landowners because of the valuable shelter it provides for stock in the absence of native shrubs. It can also provide an important habitat for bandicoots by providing protection from cats and dogs.

Rural tree decline is one of the most pressing management issues of grassy bush. Vegetation types with grassy understories are the most affected by dieback or rural tree decline and white gums are the most affected of all the eucalypts.

Grazing

Grazing management will depend on the management aims and the condition of the bush. Some general guidelines are outlined below.

- Do not set stock or stock heavily for extended periods. Native grasslands and grassy woodlands and forests tolerate moderate levels of grazing but their condition deteriorates at high stocking levels. The highly palatable kangaroo grass is eliminated from native pasture at high stocking levels and heavy cattle grazing can eliminate silver tussock grass. Do not stock at levels that cause a loss of tussocks and an increase in the amount of bare soil.
- Reduce the rank growth of grasses by crash grazing or burning. Crash grazing is a technique where a mob of sheep is put into an area to graze it heavily for a short period of time.
- If annual grasses and broad-leaved weeds are a problem stock heavily during early spring to reduce the seed set of weeds. Late winter and early spring is the main growing and flowering period for annual grasses and broad-leaved weeds. Burning in spring can achieve the same effect.
- Spell grassy bush over late spring and summer. Some of the healthiest and most diverse areas of grassy bush are those that are spelled in late spring and summer. This allows grasses, herbs and shrubs to flower and set seed.
- Stock grassy bush after the autumn break. Use your native pastures and bush runs for autumn and winter grazing.
- Do not graze too soon after burning. Grazing stock too soon after a fire will eliminate the regenerating seedlings. Do not graze until the new plants are out of the reach of stock.
- Limit access to sensitive areas through strategic fencing. This includes areas with grazing-sensitive threatened species, north-facing slopes where soil erosion is a major problem, and where the regeneration of trees and shrubs is needed. Grazing-sensitive threatened species include austral thornbush (*Discaria pubescens*), Gunns mignonette

(*Stackhousia gunnii*), young seedlings of Midlands wattle (*Acacia axillaris*), and peppergrass (*Lepidium hyssopifolium*). See **Kit 5 Threatened Plant Species in Your Bush** for more details on these species.

Fire

Fire is often used in grassy bush to produce green-pick for stock. Fire can also be used to control silver wattle and prickly box if they become too dense. It is also an important method of managing woody weeds.

- Autumn is the best season to burn for most species. Most of the plants and animals have completed their life cycle in autumn and conditions are more likely to be suitable for a controlled burn. Burning in spring and summer will stop flowering and seed set for that season. Spring burning could be useful for the control of weeds, particularly annual grasses.
- Burn grassy bush when the gaps between the tussocks start to close up. Intervals of 2-5 years between fires are recommended in ungrazed native grasslands to maintain the inter-tussock gaps. Highland silver tussock grasslands need less frequent fires than the lowland communities because of their slower growth rates. The recommended interval for highland grassland is 5-20 years. Grassy woodlands and forests also need less frequent fires than grasslands. Recommended fire intervals are 4-10 years for grassy woodlands and 6-18 years for grassy forests. However, this is only a guide and the appropriate interval will vary from situation to situation.
- Fairly hot burns are better than cool burns in most situations. The fire should at least remove all the ground litter.
- Don't burn if fire-sensitive threatened species are present. If you have Midlands wattle (*Acacia axillaris*) on your property it can be eliminated by fire, unlike most wattles. The role of fire in the regeneration of austral thornbush (*Discaria pubescens*) is not clear. It resprouts after some fires but the young shoots are highly palatable and the resprouting stems and leaves are heavily browsed. It is best to seek expert advice from the Threatened Species Unit of the Department of Primary Industries, Water and Environment if you wish to burn the riparian (i.e. riverside) grassy forests where austral thornbush is found.

Weeds

White gum woodlands are used extensively as bush run country in the Midlands. They are occasionally top-dressed with superphosphate and aurally seeded with pasture species. As a result these sites are often weedy and gorse can be a major problem. Annual weedy grasses and herbs are present even in remnants that are in excellent condition but they are only a problem when they are at high levels.

The weeds listed below are the common weeds found in grassy forest that threaten biodiversity. **Kit 3 Weeds in Your Bush** provides information on the control of these weeds.

Woody shrubs such as gorse, broom and Spanish heath are the most serious weeds. Gorse is widespread in much of the grassy bush run country.

Introduced grasses such as browntop bent, Yorkshire fog-grass and cocksfoot are widespread in native grassy understories. A number of farmers have commented that hairs-tail grass has been invading aggressively in the past few years.

Horehound has become invasive in the past decade and is a serious problem for wool growers. It tends to establish where sheep camp. Other common herbaceous weeds include yellow daisies such as flatweed, hawkbit and dandelion.

Managing by condition

The best management regime for grassy bush will depend on the condition of the bush. Management guidelines based on the condition of the bush are given below. However, the specific needs of threatened plants may override these recommendations. If you are unsure what condition your bush is in refer to **Kit 1 Bush on Your Farm**.

Excellent condition

Grassy bush in excellent condition is characterised by:

- A rich diversity of species and a mixture of dominant grasses, including kangaroo grass, wallaby grass, weeping grass, tussock grasses and wheat grass. There is a rich variety of wildflowers.
- Inter-tussock spaces (gaps between the grass tussocks) that are important areas for the germination of trees, shrubs and wildflowers.
- A cryptogamic mat (a mat of lichens and mosses) on the soil surface. This protects the soil from erosion, helps the infiltration of water, helps nutrient recycling, and plays a role in seed germination.
- Low levels of weed invasion.
- Young trees of different ages.

Bush in excellent condition is an asset. Maintain your current management. There is no need to change your farming practices unless there is an obvious reason to do so. Recommendations for grazing and fire management are given below. However, other aspects of your farm may affect what is practical and the particular requirements of threatened plants may override these recommendations.

Ungrazed native grasslands and grassy woodland and forest will need some form of regular management to reduce the growth of grasses and maintain the gaps between the tussocks. This can be achieved by occasional crash grazing so that the rank grasses are reduced to a short sward. Burning can also result in a healthy grassland. A hot burn in autumn is preferable. It will probably be needed about every three years to maintain the gaps. Mowing or slashing is an option in the short term but unless the grass clippings or hay are removed they will cover the inter-tussock gaps and suppress germination of the native species and favour the invasion of weeds.

An active weed control program, particularly of gorse and broom, is vital for maintaining the integrity of grassy bush.

Tree planting is undesirable and is not needed in grassy bush in excellent condition.

Good condition

Grassy bush in good condition is characterised by:

- A lack of inter-tussock spaces.
- Weed invasion. Native pastures and bush runs are occasionally top-dressed with superphosphate and aerially seeded with pasture grasses and clovers. As a result these sites are often weedy. Gorse can be a major problem, as can annual grasses and herbs.
- Many areas of bare soil, especially on the warm north-facing slopes preferred by stock.

Management will need to focus on reducing the stocking levels so that the bush can recover. Destocking may be the best option in some situations. This will also reduce the risk of soil erosion by restoring a perennial grass cover. You may decide to limit access to sensitive areas through strategic fencing. Sensitive areas include areas with highly palatable threatened species and north-facing slopes where soil erosion is a major problem.

Poor condition

Grassy bush in poor condition is characterised by:

- Little diversity in the ground cover.
- Many patches of bare ground.
- No cryptogamic mat to protect the soil.
- Severe weed problems.
- Soil compaction with poor water infiltration.
- No regeneration of trees and shrubs in the forests and woodlands.

Threatened species are often found in grassy bush in poor condition. The species found tend to be those that need disturbance as part of their life cycle. For example, curly sedge (*Carex tasmanica*) is often found where there has been digging or other soil disturbance and where there is only a handful of native species. Peppergrass (*Lepidium hyssopifolium*) is another threatened plant that thrives on disturbed soils with very low levels of stock grazing. If your bush has threatened species it is best not to change your management regime without advice from the Threatened Species Unit of the Department of Primary Industries, Water and Environment.

If your poor quality grassy bush does not contain threatened species, you will probably need to change the pattern and intensity of stocking by spelling it over spring and summer. Weed control is a major management issue in degraded native pastures and grassy woodlands and forests. In many cases it may be a matter of learning to live with most of the weeds and directing your management to favour the native species so that they eventually dominate.

Consider rehabilitating the area, including treating the eroded areas, direct seeding of trees and shrubs, and controlling weeds. **Kit 3 Weeds in Your Bush** and **Kit 4 Revegetating Your Farm** provide information on managing weeds and revegetation.

Rural tree decline

Over the past 20 years many isolated paddock trees and eucalypts in the bush remnants of the Midlands have died. In some areas almost every tree is dead. As no regeneration is taking place in these areas, they will remain treeless unless action is taken.

White gum is the tree most affected by dieback. However, black gum, candlebark, black peppermint, swamp peppermint, silver peppermint, cabbage gum, blue gum and gum-top stringybark are also affected. These forest types generally have grassy understories.

Many theories exist on the cause of rural tree decline. However, the most likely causes are given below.

- **LOW RAINFALL** over the last two decades is a major factor, especially in areas where the average annual rainfall is below 625 mm (25 inches). Low rainfall areas of the state have often experienced dry conditions in summer and autumn without compensating winter and spring rain. During the last 20 years it has been common to see little rainfall for two successive months during summer and autumn. This is unprecedented in the meteorological records.
- **CHANGES IN THE ENVIRONMENT AROUND TREES** due to clearing, fertilising and grazing. The stress of drought on trees is greatly increased if the area around them is cleared and grazed. Lone trees or trees near the edges of patches of remnant native vegetation experience higher winds at ground level and more sunshine, especially if they are on the upwind and sunny side of the bush. Therefore, evaporation is higher and the trees transpire more. Frost effects are also greater. Larger bush remnants are much less affected by tree decline than smaller remnants.
- **STOCK GRAZING** increases the evaporation from soil by removing the ground cover. This leads to higher soil temperatures and greater soil moisture loss. Stock compact the soil, especially under shade trees, causing reduced water infiltration (seepage into the soil) and more runoff. The loss of soil micro-organisms and damage to the fine feeder roots further stresses the trees. As soil nutrient levels increase so do leaf nutrient levels. This makes the leaves more palatable and nutritious to possums and insects.
- **THE END OF THE POSSUM FUR TRADE** and the increased availability of food through improved pastures and stock water supplies have allowed populations of brushtail possums to explode. The browsing of foliage can be the final blow for severely drought-stressed trees.
- **INSECT ATTACK** tends to be local and sporadic but when it happens it is usually severe. Possums and insects are most attracted to new growth at the ends of branches and the shoots on the trunk and branches (the epicormic growth). Epicormic shoots are a sign that the tree is trying to recover from stress, often using its last reserves of energy. Browsing of these shoots can be the last straw.
- **NOISY MINERS** are aggressive native birds that chase away other insectivorous birds. They dominate remnant stands where the understorey is sparse. Although they eat insects they do not eat as much as the usual bush birds. Noisy miners occupy a large proportion of woodlands and forests affected by dieback.
- **SELF-THINNING** can occur as stands age. Much of the dry bush in Tasmania has a greater density of trees than when the land was taken up for pasture because of changed fire and grazing practices. There is not enough water, nutrients or space to allow all the trees to reach their full size so the weaker ones die out as the stand ages. These weaker trees are generally the smaller ones.
- **THERE IS NO EVIDENCE THAT A PLANT DISEASE IS THE CAUSE** of rural tree decline.

Best bet management for rural tree decline

A serious problem in many bush remnants is the lack of tree regeneration. Drought is natural but in the past regeneration during good years made up for the loss of mature trees. Normally regeneration does not occur where the bush is set stocked. However, it does occur where the bush is only lightly grazed in late autumn and winter and spelled over spring and summer.

VERY SICK TREES

It seems almost impossible to stop sick trees dying. Many farmers say that once the bark of an affected tree splits and starts 'weeping' gum or sap the tree will be dead within a year.

PADDOCK TREES

Isolated paddock trees give character to the landscape and are important shelter for stock and habitat for wildlife. Most of the paddock trees are now old and are not being replaced. Fencing followed by scarification of the soil can encourage natural regeneration if the trees remain healthy enough to have seed stocks. If not, direct seeding or planting can be used.

Possum banding (placing a band of tin around the trunks of selected paddock trees) helps to protect the trees from possum browsing and allows flowering and seed set.

FENCING

Fencing off a patch of bush or fencing around paddock trees may promote regeneration by allowing seed to germinate. It will also prevent stock grazing the regenerating seedlings. When the young trees are tall enough to survive grazing the fence can be removed. For further information about fencing off bush see **Kit 2 Managing Your Bush**.

RE-ESTABLISH AN UNDERSTOREY

If you can re-establish a diverse understorey with many shrubs and a ground layer you will encourage the return of the insect-eating birds that have been scared away by the noisy miners. This can sometimes be achieved simply by fencing off the area. In other cases you might need to fence and then plant understorey species.

CONTROL POSSUM BROWSING

Controlling possum populations in bush runs by shooting is only a temporary measure. Banding isolated trees is time consuming and expensive and it may not be a solution where the trees may die of other causes. Long-term control of possum populations, if possible, can only be organised on a regional basis. Many farmers have found that the Property-Based Game Management Program run by the Department of Primary Industries, Water and Environment is an effective way of managing possum numbers.

PROMOTE CONDITIONS FOR TREE ESTABLISHMENT

Natural regeneration of trees is essential for the long-term survival of native vegetation remnants. There are many requirements for new eucalypts to establish, including a viable seed supply dropped by trees, seed in the soil or suppressed seedlings in the understorey, and light or no grazing. See **Kit 2 Managing Your Bush** for more information on encouraging natural regeneration in the bush on your property.

BURN TO REDUCE TRANSPIRATION

If you have severe rural tree decline it may be worth experimenting with using fire to reduce the number of tree deaths. Research in Hobart in the drought period of the 1980s showed that grassy woodland and forest burned immediately before the drought did not suffer the same levels of dieback. Perhaps the fire reduced the competition for water from shrubs and grasses and therefore the drought had less impact on the trees. Use long-term weather forecasts to burn your grassy bush prior to the start of a dry period. Compare the results with a similar patch of bush you did not burn.

CASE STUDY

Trying to stop dieback in forest stands

Three landowners and researchers from the School of Geography and Environmental Studies at the University of Tasmania have recently co-operated to try to work out ways of stopping dieback in remnant bush in the Midlands of Tasmania.

Three stands with trees of mixed health were selected. At St Peters Pass near Oatlands a stand of mountain gum (*Eucalyptus dalrympleana*) was chosen. At Rose Hill near Jericho a stand dominated by candlebark (*Eucalyptus rubida*) was used. At Birralee a stand dominated by white gum (*Eucalyptus viminalis*) was selected. At each stand three treatments were tried, singly, and in all possible combinations. The treatments used were possum proofing using metal girdles, fencing to exclude stock, and watering.

At Rose Hill and St Peters Pass possum proofing proved effective in slowing or reversing the dieback, which continued in the unprotected trees. At Birralee dieback was concentrated in the smaller trees but there was no effect from possum proofing.

While fencing did not affect the dieback at any of the sites the soils became less compacted and new eucalypt seedlings were found within the fences but not outside them.

Watering did not have any effect on the dieback at any site.

The results of this experiment show that the causes of dieback and the most effective treatments vary between sites. At Birralee the dieback appears to be the result of self thinning, with the bigger trees growing healthily. Nothing needs to be done here. At Rose Hill and St Peters Pass possums were major contributors to dieback. On some of the metal-girdled trees new growth below the girdle was heavily chewed whereas that above was healthy.

The lessons from this experiment are: do not worry about dieback if it only affects the smaller trees, control possum populations where larger trees are affected, and fence to enable regeneration if needed in all situations.



8

Eucalypt bush

Grassy/heathy woodland and forest

Heathy woodland and forest

Shrubby forest

Wet forest



About this kit

This kit discusses a number of bush types associated with eucalypt woodland and forest and gives specific guidelines for managing them. However, as with all the recommendations in the **Tasmanian Bushcare Toolkit**, the guidelines are not meant to be followed rigidly. Rather, they are intended to give you some principles for managing each bush type. You can then modify the guidelines to suit your particular situation and needs.

All four bush types discussed in this kit have a canopy of eucalypt trees. However, each of them has a characteristic understorey with its own typical appearance and mix of plant species. The characteristics of the different understoreys are described in the introductions to the bush types. Eucalypt bush with a grassy understorey is discussed in **Kit 7 Grassy bush**.

The bush types covered are:

Grassy/heathy woodland and forest

Heathy woodland and forest

Shrubby forest

Wet forest.

Each section in this kit discusses one bush type. This includes:

- A description of the bush type and where it tends to be found.
- Public places where you can see good examples of the bush type.
- The significance of the bush type in terms of conservation and biodiversity, and some of the threatened species that may be found in it.
- The management issues relevant to the particular bush type. The management guidelines included are those that are specific to the bush type in question. Where no specific guidelines are given use the general principles outlined in **Kit 2 Managing Your Bush**.

When you have read the specific guidelines for your bush type you will probably need to reread **Kit 2 Managing Your Bush**. This kit contains more detailed information on the principles and practices of managing remnant native vegetation. You may also need to refer to parts of the following kits for specific information on weeds, revegetation and threatened species:

- **Kit 3 Weeds in Your Bush**
- **Kit 4 Revegetating Your Farm**
- **Kit 5 Threatened Plant Species in Your Bush**

Looking after grassy/heathy woodland and forest

Grassy/heathy woodland and forest has an understorey in which small-leaved shrubs and grasses make up more than 30% of the cover in the layer that is less than 2 m tall. Typical shrubs include heaths (Epacridaceae family), acacias and legumes (Fabaceae family). Typical grasses include wallaby, plume, spear and tussock grasses. There may be a taller subsidiary layer in which wattles and she-oaks are prominent. However, this layer is sparser than the lower one. The canopy may be dominated by a range of eucalypts. The trees in woodland are spaced such that the gaps between their crowns are wider than the crowns. The crowns are closer together in forest. The terms woodland and forest are used interchangeably and the management guidelines apply to both.

The outstanding example of grassy/heathy forest is grassy/heathy black peppermint (*Eucalyptus amygdalina*) forest. This occurs on sandy soils derived from Tertiary laterite, which are known locally as buckshot or ironstone gravels. It is found in the northern Midlands and near Swansea on the east coast. Some areas of grassy/heathy woodland and forest also occur within black peppermint forest on dolerite, highland cabbage gum (*Eucalyptus pauciflora*) woodland and forest, and gum-topped stringybark (*Eucalyptus delegatensis*) forest.

Good examples

Some of the best examples of grassy/heathy woodland and forest lie within the Tom Gibson Nature Reserve on Barton Road, Epping Forest. The majority of the reserve is grassy/heathy black peppermint forest. Good examples can also be seen at Diprose Lagoon Nature Reserve. The Tom Gibson Nature Reserve also contains grassy white gum woodland and forest, sedgey black gum forest, and cabbage gum open forest on sand. Be sure to visit the reserve in early spring to see the prolific wildflowers, especially the orchids.

Biodiversity values

At least half of the original black peppermint forests in Tasmania have been cleared, largely for pasture. Considerable areas have been mined for gravel for roadworks. Grassy/heathy black peppermint forest contains threatened plants and is important habitat for the Tasmanian bettong. Grassy/heathy forests dominated by cabbage gum are poorly reserved. Grassy/heathy forests dominated by gum-topped stringybark are well reserved.

EXTINCT OR THREATENED ANIMALS AND PLANTS OF GRASSY/HEATHY WOODLAND AND FOREST INCLUDE:

Thylacine (*Thylacinus cynocephalus*) (extinct)

Blue pincushion or native cornflower (*Brunonia australis*)

Spreading stananthemum (*Stenanthemum pimeleoides*)

Rubble pepperpress (*Lepidium hyssopifolium*)

Lindleys spider orchid (*Caladenia lindleyana*)

Black-tipped spider orchid (*Caladenia anthracina*)

Midland greenhood (*Pterostylis commutata*)

Refer to **Kit 5 Threatened Plant Species in Your Bush** for more information and an illustration of each plant.

Management issues

Grassy/heathy woodland and forest is often marginal country for grazing in terms of its nutritional value. However, it is valuable country for shelter for lambing and off-shears. The carrying capacity is low. Many landowners use this type of bush only over the winter months. Light grazing by sheep does not appear to harm woodlands and forests with grassy/heathy understories. Remnants that are lightly grazed over the winter months and spelled during spring and summer are largely in good condition, with a diversity of native species and few weeds. However, some of the best remnants are those that have had stock excluded for more than 30 years. They have a greater diversity of species, a denser cover of grasses and wildflowers, and fewer weeds. Overgrazing can lead to the elimination of the shrub and ground layers. If your remnant is in excellent or good condition there is no reason to change its current management.

Grazing

- Exclude stock if possible.
- Light grazing is preferable if the bush is to remain stocked. If bush with a grassy/heathy understory is an important part of your grazing enterprise then grazing at low stocking rates is not damaging.
- If the area is grazed it should be grazed over winter, after the autumn break and before flowering of the native herbs and shrubs.
- Destock in spring and summer.
- If the autumn break has failed, consider destocking or lowering the stocking rate. It could be tempting or even necessary to graze the bush but this is the time when seedlings, especially those of trees, are most vulnerable.
- Do not graze soon after burning. Stocking too soon after fire will impede the regeneration of trees and understory shrubs and herbs.
- If annual grasses and broad-leaf weeds are a problem, stocking heavily during early spring can help to reduce the growth and seed set of weeds.

Fire

- Patch burn to favour target species. Fire should favour the persistence of rare and threatened plants and animals. In some cases the regimes needed by different species will conflict. For example, the fire frequency required to maintain the subterranean fungi that are the food source for bettongs may conflict with the fire regime required to maintain some plant species.
- Choose a fire regime to suit the desired outcome. For example, shrubs will become dominant with infrequent fires so if you want to reduce the shrub layer burn frequently enough to suppress the growth of shrubs.
- A diversity of fire regimes is preferable. The maintenance of biodiversity is best served by having a mix of fire ages and intensities across the landscape. This is partly because the needs of many plants and animals are not known and having a range of fire ages lessens the risk of long-term damage. If you have an area of bush that has not been burnt for many years it may be best to continue to avoid fire.
- Use fire to manage weed species. After a fire most native species resprout or regenerate from seed stored in the soil. Research on the germination of both native and introduced species has shown that weeds do not germinate after relatively hot fires, thereby allowing better regeneration of the native species. If many annual weeds such as shivery grass or brome grass are present, spring burning before they set seed, for at least two

years, may help to eliminate them by reducing their soil seedbanks. Fire can also be used to stimulate the germination of hard-coated weed seeds that persist in the soil, such as broom and gorse. This can then be followed by a chemical spraying program. A second burn 18-24 months later will germinate much of the remaining seed. The subsequent seedlings can be eliminated by follow-up chemical spraying.

- Use fire to stimulate the germination of trees and shrubs.
- Use fire in combination with herbicides to control woody weeds.

WHEN AND HOW TO BURN

- The timing of burns will vary according to circumstances. However, autumn burns are usually preferable as most plants and animals will have completed their life cycle. In autumn the vegetation is likely to be fairly dry giving a good burn while the humidity at night will help to control the fire.
- An interval of 8-20 years between fires is thought to be appropriate for grassy/heathy woodland and forest.
- Moderately hot burns are better than cool burns. Burns should be hot enough to at least remove all the ground litter. However, burns that are too hot will scorch the tree crowns and should be avoided.
- Burn small to medium patches, for example 1-5 ha.

WHEN NOT TO BURN

- Don't burn during spring and summer.
- Don't burn if there is a gorse problem, unless you are able to apply herbicide following the burn.
- Don't burn when large amounts of seed have germinated recently. Mass germination is relatively rare and could be important for the growth of a new generation of trees, shrubs and understorey species.

Looking after heathy woodland and forest

Heathy woodland and forest has an understorey that is less than 2 m tall and dominated by small-leaved shrubs and/or bracken. Typical shrubs include acacias, heaths and legumes. The canopy may be dominated by a range of eucalypts. Most heathy black peppermint (*Eucalyptus amygdalina*) woodlands and forests and silver peppermint (*Eucalyptus tenuiramis*)-candlebark (*Eucalyptus rubida*) forests are classed as heathy woodland and forest. A number of other eucalypt woodland and forest types may also be classed as heathy woodland and forest, including Smithton peppermint (*Eucalyptus nitida*), Tasmanian ironbark (*Eucalyptus sieberi*), stringybark (*Eucalyptus obliqua*), white peppermint (*Eucalyptus pulchella*), white gum (*Eucalyptus viminalis*), and lowland cabbage gum (*Eucalyptus pauciflora*). The trees in woodland are spaced such that the gaps between their crowns are wider than the crowns. The crowns are closer together in forest. The terms woodland and forest are used interchangeably and the management guidelines apply to both. Heathy woodland and forest is usually associated with nutrient-poor sandy soils that form on sandstone, quartzite and sand sheets. However, heathy understories can also be found on shallow soils on dolerite where the rainfall is moderate to high.

Heathy woodland and forest grades into grassy woodland and forest at one end of its spectrum and shrubby forest at the other. Where these intergrades occur the forest type is often described as grassy/heathy woodland and forest and heathy/shrubby forest.

Good examples

Heathy woodland and forest is most extensive in the north east and in the Furneaux Group of islands. It can be seen near the Pub With No Beer just south of Bothwell, Huntingfield just south of Hobart, Asbestos Range National Park, Rocky Cape National Park, Freycinet National Park and Mt William National Park.

Biodiversity values

Heathy woodland and forest has been heavily cleared over the last 20 years and many of its vegetation communities are threatened. Heathy silver peppermint and heathy black peppermint forests are poorly reserved. Heathy candlebark forests are not protected in any state reserve. Only a few remnants of heathy cabbage gum woodland and forest survive.

THREATENED PLANTS OF HEATHY WOODLAND AND FOREST INCLUDE:

Guinea-flower bush pea (*Pultenaea hibbertioides*)

Thick-stem caladenia (*Caladenia campbellii*)

Grass tree (*Xanthorrhoea bracteata*)

Apsley heath (*Epacris apsleyensis*)

Creeping spyridium (*Spyridium obcordatum*)

Small-leaf spyridium (*Spyridium microphyllum*)

Lesser guinea-flower (*Hibbertia calycina*)

Refer to **Kit 5 Threatened Plant Species in Your Bush** for more information and an illustration of each species.

Management issues

The key management issues in heathy woodland and forest are:

- Degradation of the understorey over time as a result of fire or fire followed by grazing.
- Weed invasion in bush in good or poor condition. It is also something to watch for in bush in excellent condition in order to prevent future weed invasion and subsequent degradation. In particular, woody weeds such as gorse and broom are a serious problem in heathy woodland and forest.
- Rural tree decline is becoming widespread in heathy woodland and forest. Refer to **Kit 7 Grassy Bush** for more information.

If threatened species are present in your heathy woodland or forest you should consider their needs first. These needs may conflict with other aspects of management. Some threatened species are found in remnants that are in poor condition. This is because the past management regime has favoured their survival. If the management is changed these species may be lost.

Grazing

There will be little economic return from grazing heathy bush. It has a low nutritional value, a low stock carrying capacity, and the soils have low fertility. Heathy bush can provide shelter for off-shears and some winter grazing, but excluding stock is the best option. However, light grazing by sheep does not appear to harm heathy bush.

Fire

The recommended average interval between fires for heathy woodland and forest is 15-30 years. However, a range of fire intervals is best if biodiversity is to be maintained. Look at your patch of bush to determine the appropriate fire interval, keeping in mind the past fire regime. For example, too frequent fires will increase the risk of bracken dominating and increase soil erosion causing bare ground. Grazing too soon after fire will impede regeneration of the new plants. Keep stock out for at least five years after a fire if you are managing the area to maintain biodiversity or for tree regeneration.

Weeds

Woody weeds such as gorse and broom are the most serious weeds in heathy woodland and forest. Refer to **Kit 3 Weeds in Your Bush** for details of weed control measures.

Managing by condition

The best management regime for heathy woodland and forest will depend on the condition of the bush. Management guidelines based on the condition of the bush are given below. However, the specific needs of threatened plants may override these recommendations. If you are unsure what condition your bush is in refer to **Kit 1 Bush on Your Farm**.

Excellent condition

Heathy woodland and forest in excellent condition is characterised by:

- A healthy and diverse shrub layer. This bush is a profusion of colour in spring and it may be rich in orchids.
- Low levels of weed invasion.

This bush is an asset. Maintain your current management. There is no need to change your management practices unless there is an obvious reason to do so. However, if there are signs of weed invasion an active weed control program, particularly for gorse and broom, may be needed to maintain the integrity of the bush.

Good condition

Heathy woodland and forest in good condition is characterised by:

- A limited number of species. There may be only a few native shrub species and the wildflower component will have almost disappeared.
- Weed invasion. Gorse can be a major problem in heathy woodland and forest. Broom is invading heathy bush on mudstone in the Oatlands district.
- Extensive areas of bare soil and erosion.

Management will need to focus on reducing stock levels so that the bush can recover. Destocking may be the best option in some situations. This will also reduce the risk of soil erosion by restoring a perennial ground cover. You may decide to limit access to sensitive areas through strategic fencing. These include areas with highly palatable species and areas where soil erosion is a problem.

Poor condition

Heathy woodland and forest in poor condition is characterised by:

- Little diversity in the ground cover.
- Extensive areas of bare ground.
- No regeneration of trees and shrubs.
- Severe weed problems, particularly gorse and broom.

Heathy woodland and forest in poor condition usually recovers well through natural regeneration. You will probably need to destock for a number of years to allow the bush to recover. Once stock are excluded the results can be dramatic. Small wildflowers and orchids appear in areas where they have never been seen before. Shrubs and small trees may need two good seasons in succession to become established.

Management should aim to maximise regeneration in areas with poor understories or areas affected by rural tree decline. Where natural regeneration does occur, it is important to exclude stock and fire from the area until the saplings are tall enough to survive. Dense bracken can act as a nursery for young trees and shrubs by protecting them from grazing. Consider rehabilitation in bush that is severely degraded, particularly if there is extensive erosion.

Looking after shrubby forest

The understorey of shrubby forest is dominated by small-leaved shrubs more than 2 m tall, such as tea-trees (*Leptospermum*) and wattles (*Acacia*). The canopy can be dominated by most types of eucalypt forest, including black gum (*Eucalyptus ovata*), white gum (*Eucalyptus viminalis*), black peppermint (*Eucalyptus amygdalina*), highland cabbage gum (*Eucalyptus pauciflora*), blue gum (*Eucalyptus globulus*), ironbark (*Eucalyptus sieberi*), stringybark (*Eucalyptus obliqua*), gum-topped stringybark (*Eucalyptus delegatensis*), snow gum (*Eucalyptus coccifera*), Smithton peppermint (*Eucalyptus nitida*), and white peppermint (*Eucalyptus pulchella*). Shrubby forest is usually found in moisture conditions that are intermediate between those of wet forest and either heathy forest or grassy woodland and forest.

Good examples

Shrubby forest is common and widespread in Tasmania. A large proportion of the forest on the south-facing slopes of the foothills of Mt Wellington and much of the forest around Launceston is shrubby forest.

Biodiversity values

Most types of shrubby forest are well reserved, and most have escaped significant clearing for agriculture and development. However, little remains of the shrubby forests dominated by black gum, and those dominated by blue gum have been heavily cleared. Blue gum forests are extremely important for the survival of the swift parrot, a species considered vulnerable to extinction. Much of the unreserved forest is used for timber production. Relatively little shrubby forest is used for stock grazing, and when used it is mainly for shelter. Shrubby forests are generally rich in Tasmanian endemic birds and marsupials. Shrubby forests that are particularly important for biodiversity survive in a few small remnants on lowland basalt in the north east and north west of the state.

THREATENED ANIMALS OF SHRUBBY FORESTS INCLUDE:

Wedge-tailed eagle (*Aquila audax fleayi*)

Swift parrot (*Lathamus discolor*)

Grey goshawk (*Accipiter novaehollandiae*)

Broad-toothed stag beetle (*Lissotes latidens*)

Blind velvet worm (*Tasmanipatus anophthalmus*)

Simons stag beetle (*Hoplogonus simsoni*)

Mt Mangana stag beetle (*Lissotes menalcas*)

THREATENED PLANTS OF SHRUBBY FORESTS INCLUDE:

Spicers everlasting (*Argentipallium spiceri*)

Midlands wattle (*Acacia axillaris*)

Golden bertya (*Bertya rosmarinifolia*)

Small-leaf pomaderris (*Pomaderris elachophylla*)

Round-leaf mint bush (*Prostanthera rotundifolia*)

Gristle fern (*Blechnum cartilagineum*)

Skirted tree fern (*Cyathea X marcescens*)

Scrambling ground fern (*Hypolepis distans*)

Small rasp fern (*Doodia caudata*)

Refer to **Kit 5 Threatened Plant Species in Your Bush** for more information and an illustration of each species.

Management issues

The best management regime for shrubby forests will depend on the condition of the bush. Refer to **Kit 1 Bush on Your Farm** for details on assessing the health of your bush.

The key management issues in shrubby forests are:

- Fire management. Inappropriate fire regimes can lead to the conversion of shrubby forest to other vegetation types. In some situations this may be seen as desirable (e.g. conversion to grassy forest which generally has a greater diversity of plant species than shrubby forest). However, a shrubby understorey has been shown to support a diversity of native birds.
- Weed invasion. This will be a problem in bush in good or poor condition. However, it is something to watch for in bush in excellent condition in order to prevent future weed invasion and subsequent degradation. In particular, woody weeds such as boneseed, cotoneaster, hawthorn, gorse and broom are a serious problem in shrubby forest.

If threatened species are present you should consider their needs. These needs may conflict with other aspects of management. Some threatened species are found in remnants that are in poor condition because the past management regime has favoured their survival. If the management regime is changed these species may be lost.

Grazing

- There will be little economic return from grazing shrubby forest. Most of the vegetation is unpalatable and too tall for stock to reach.
- If the remnant is in good condition maintain your current management regime unless there is an obvious reason to do so.
- Shrubby bush can provide shelter for stock. Nevertheless, exclude stock if possible.
- Do not allow stock access to the bush soon after burning. Stocking too soon after fire will impede the regeneration of new plants.

Fire

- Do not burn shrubby forest that is higher than 900 m above sea level.
- Patch burn to favour target species. The fire pattern should favour the persistence of threatened plant and animal species.
- Burn every 20-40 years. More frequent fires will often prevent a shrubby layer forming. Less frequent fires may convert the bush to wet forest.
- Moderately hot burns are better than cool burns. Burns should at least remove all the ground litter.
- Only burn gorse or broom if you are able to apply herbicide following the burn.

Weeds

Woody weeds such as cotoneaster, hawthorn, boneseed, blackberry, gorse and broom are the most serious weeds in shrubby forests. See **Kit 3 Weeds in Your Bush** for details of control measures.

Managing by condition

The best management regime for shrubby forest will depend on the condition of the bush. Management guidelines based on the condition of the bush are given below. However, the specific needs of threatened plants may override these recommendations. If you are unsure what condition your bush is in refer to **Kit 1 Bush on Your Farm**.

Excellent condition

Shrubby forest in excellent condition is characterised by:

- A healthy shrub layer.
- Low levels of weed invasion.

Bush in excellent condition is an asset. Maintain your current management regime. There is no need to change your management practices unless there is an obvious reason to do so.

If there are any signs of weed invasion, an active weed control program, particularly of gorse and broom, may be needed to maintain the integrity of shrubby bush in excellent condition. Only burn gorse if you are able to apply herbicide following the burn. Shrubby forest may become wet forest in the natural process of succession following fire. If you do not want this to occur, burn at least once every 40 years. However, do not burn any shrubby forests that are higher than 900 m above sea level.

You may wish to limit access to sensitive areas through strategic fencing. This includes areas with grazing-sensitive threatened species, areas where there is a high risk of erosion such as in gullies, and where the regeneration of trees and shrubs is needed.

Good condition

Shrubby forest in good condition is characterised by:

- Some old and dying small-leaved shrubs.
- Weed invasion. Gorse can be a major problem in shrubby forests. Only burn gorse and broom if you are able to apply herbicide following the burn.

If the small-leaved shrubs are dying through old age, burning the understorey will generally result in their regeneration. However, do not burn any shrubby forests higher than 900 m above sea level. Burning can also be useful for killing some woody weeds such as cotoneaster and hawthorn. Other woody weeds will require follow-up work after fire, using hand pulling where possible (e.g. South African boneseed) or an application of herbicide.

Poor condition

Shrubby forest in poor condition is characterised by:

- Extensive areas of bare ground.
- No regeneration of trees and shrubs.
- Severe weed problems.

Burning the understorey of shrubby forest in poor condition will result in the regeneration of trees and shrubs. However, do not burn shrubby forests if they are higher than 900 m above sea level. Burning will also kill the woody weeds such as cotoneaster and hawthorn. Some woody weeds will need follow-up work after burning. For example, some weeds will need to be pulled by hand (e.g. South African boneseed) or given an application of herbicide.

Consider rehabilitating bush that is severely degraded, particularly if there is extensive erosion.

Looking after wet forest

Wet forest has an understorey in which broad-leaved tall shrubs and small trees such as dogwood (*Pomaderris apetala*), musk (*Olearia argophylla*), and blanket leaf (*Bedfordia salicina*) form a prominent layer. The shrub understorey is often dense, preventing continuous regeneration of shade-intolerant species such as eucalypts. Alternatively, wet forest can have a ground layer in which ferns, excluding bracken, are dominant, or an understorey dominated by temperate rainforest trees, such as myrtle beech (*Nothofagus cunninghamii*), sassafras (*Atherosperma moschatum*), and celerytop pine (*Phyllocladus asplenifolius*). This forest type is often called mixed forest. The canopy of wet forest may be dominated by a range of eucalypts. Most swamp gum (*Eucalyptus regnans*), yellow gum (*Eucalyptus johnstonii*), and yellow alpine gum (*Eucalyptus subcrenulata*) forests are wet forests. A number of other eucalypt forests may also be wet forest, including white gum (*Eucalyptus viminalis*), blue gum (*Eucalyptus globulus*), stringybark (*Eucalyptus obliqua*), gum-topped stringybark (*Eucalyptus delegatensis*), Smithton peppermint (*Eucalyptus nitida*), and snow gum (*Eucalyptus coccifera*). Wet forests occur on moderately fertile to fertile well-drained soils in high rainfall areas.

Good examples

Wet forest can be seen in all parts of Tasmania. Near Hobart it is found on the middle slopes of Mt Wellington. Near Launceston it is found on the mountains to the east and north west of the city.

Biodiversity values

Relatively little wet forest has been cleared. However, large areas have been modified by logging and considerable areas will be lost to plantations in the future. The most heavily cleared and modified wet forest communities are swamp gum forest and blue gum forest. The latter community has lost a substantial part of its range in Tasmania and is poorly reserved.

Most wet forest types are well reserved. Wet forest contains few threatened plant species but it is an important habitat for rare and threatened fauna. Significant fauna include the little pygmy possum (*Cercartetus lepidus*), eastern quoll (*Dasyurus viverrinus*), long-nose potoroo (*Potorous tridactylus*), and the scrubtit (*Sericornis magnus*), which is an endemic bird restricted to the ground and leaf litter layer of wet gullies. Wet forests are also important for invertebrates, including landsnails such as the *Tasmaphena lamproides* and *Helicarion rubicundus* which have restricted distributions. Wet forests provide habitat for 15 species of primitive moth in the family Hepialidae, many of which are endemic. Wet forests dominated by blue gum mostly occur on private land. They form important habitat for the vulnerable swift parrot.

THREATENED ANIMALS OF WET FORESTS INCLUDE:

Wedge-tailed eagle (<i>Aquila audax fleayi</i>)
Swift parrot (<i>Lathamus discolor</i>)
Grey goshawk (<i>Accipiter novaehollandiae</i>)
Spotted-tail quoll (<i>Dasyurus maculatus</i>) (nationally vulnerable)
Broad-toothed stag beetle (<i>Lissotes latidens</i>)
Blind velvet worm (<i>Tasmanipatus anophthalmus</i>)
Mt Arthur burrowing crayfish (<i>Engaeus orramakunna</i>)
Burnie burrowing crayfish (<i>Engaeus yabbimunna</i>)
Simsons stag beetle (<i>Hoplogonus simsoni</i>)
Mt Mangana stag beetle (<i>Lissotes menalcas</i>)
Bornemissas stag beetle (<i>Hoplogonus bornemissza</i>)
Vanderschooris stag beetle (<i>Hoplogonus vanderschoori</i>)
North east forest snail (<i>Anoglypta launcestonensis</i>)

THREATENED PLANTS OF WET FORESTS INCLUDE:

Small-leaf pomaderris (<i>Pomaderris elachophylla</i>)
Round-leaf mint bush (<i>Prostanthera rotundifolia</i>)
Gristle fern (<i>Blechnum cartilagineum</i>)
Skirted tree fern (<i>Cyathea X marcescens</i>)
Scrambling ground fern (<i>Hypolepis distans</i>)
Small rasp fern (<i>Doodia caudata</i>)

Refer to **Kit 5 Threatened Plant Species in Your Bush** for more information and an illustration of each species.

Management issues

Wet forest needs a fire every few hundred years to enable regeneration of the eucalypts. However, frequent fire will eliminate the ferny and broad-leaved understories, converting them to dry forest. Planned fire in wet forest is extremely dangerous because the fuel levels are high and it can only be burnt in the most extreme weather conditions. Wet forest is of little use to graziers because it has little fodder, although it may be valuable for shelter in some situations. Heavy grazing or logging can open up the understorey and allow the invasion of weeds, especially blackberry (*Rubus fruticosus*).

The critical management recommendations for wet forest are:

- Exclude fire. The only exception to this recommendation is where it may be necessary to burn wet forest after logging in order to promote the regeneration of eucalypts. In this situation the Forestry Code of Practice should be followed.
- Control weeds. Weeds are not usually a problem in wet forests. However, blackberries can become a problem after logging, fire or grazing. **Kit 3 Weeds in Your Bush** provides detailed information on weeds and their management.

9

Other bush types

Saltmarsh

Dry coastal vegetation

Wetland

Buttongrass moorland

Heath

Alpine vegetation

Banksia scrub and woodland

She-oak woodland and forest

Oyster Bay pine and South Esk pine woodland and forest

Tea-tree and paperbark wet scrub and forest

Blackwood forest

Dry rainforest

Temperate rainforest



About this kit

This kit discusses a number of native bush types and gives specific guidelines for managing them. However, as with all the recommendations in the **Tasmanian Bushcare Toolkit**, the guidelines are not meant to be followed rigidly. Rather, they are intended to give you some principles for managing each bush type. You can then modify the guidelines to suit your particular situation and needs.

The bush types covered in this kit are:

Saltmarsh
Dry coastal vegetation
Wetland
Buttongrass moorland
Heath
Alpine vegetation
Banksia scrub and woodland
She-oak woodland and forest
Oyster Bay pine and South Esk pine woodland and forest
Tea-tree and paperbark wet scrub and forest
Blackwood forest
Dry rainforest
Temperate rainforest.

Each section in this kit discusses a single bush type or a group of related bush types. This includes:

- A description of the bush type and where it tends to be found.
- Public places where you can see good examples of the bush type.
- The significance of the bush type in terms of conservation and biodiversity, and some of the threatened species that may be found in it.
- The management issues relevant to the particular bush type. The management guidelines included are those that are specific to the bush type in question. Where no specific guidelines are given use the general principles outlined in **Kit 2 Managing Your Bush**.

When you have read the specific guidelines for your bush type you will probably need to reread **Kit 2 Managing Your Bush**. This kit contains more detailed information on the principles and practices of managing remnant native vegetation. You may also need to refer to parts of the following kits for specific information on weeds, revegetation and threatened species:

- **Kit 3 Weeds in Your Bush**
- **Kit 4 Revegetating Your Farm**
- **Kit 5 Threatened Plant Species in Your Bush.**

Looking after saltmarsh

Saltmarsh occurs in areas that are periodically inundated by the sea, where the wave action is subdued and sediments are able to accumulate. It is therefore largely confined to estuaries and inlets. Near the mouths of estuaries and inlets, where the inundating water is highly saline, saltmarshes are dominated by succulent herbs and shrubs. The most common succulent herb is the beaded glasswort (*Sarcocornia quinqueflora*), and a common succulent shrub is shrub glasswort (*Sclerostegia arbuscula*). Where inflowing rivers and streams make the water less saline, tussock rushes, tussock sedges, tussock grasses and non-succulent herbs are more prominent. The saltmarsh rush (*Juncus kraussii*) is a common saltmarsh species.

Good examples

The most accessible areas of saltmarsh in south east Tasmania are at Lauderdale, Old Beach on the Derwent River, and on the spit at Marion Bay. In the north excellent saltmarshes can be seen near Port Sorell and Bakers Beach, and near Smithton. However, saltmarshes can be seen in any part of the state in estuaries and sheltered bays.

Biodiversity values

Saltmarsh is poorly reserved in Tasmania. It contains several rare and threatened plants including the blue wilsonia (*Wilsonia humilis*) and the saltmarsh statice (*Limonium australe*). Saltmarsh and its adjacent mudflats are used by many migratory birds, some of which are rare or threatened. Saltmarsh stabilises the coast and contributes significant amounts of organic material to estuaries. This is important for the food chain which contains the breeding stock of many commercial and non-commercial fish species. Saltmarshes in the north west and on King Island are important food sources for the endangered orange-bellied parrot (*Neophema chrysogaster*).

Management issues

Some owners of saltmarshes have attempted to drain them for agricultural use. This usually results in salt-scalded bare ground. Saltmarshes have also been used for rubbish dumping although this practice has largely stopped. Some saltmarshes are used for stock grazing. This can result in a loss of species, soil compaction, and promotion of the few weeds that can invade saltmarsh, such as buckshorn plantain (*Plantago coronopus*). While saltmarshes generally recover well after fire (except when the fire is followed by stock grazing), fire is not necessary for their regeneration. Several estuaries in the state, most notably the Tamar estuary, have been invaded by the introduced ricegrass (*Spartina anglica*).

Ricegrass occupies the intertidal mud flats and reduces bird habitat. As it is difficult to remove once well established, it is important to destroy any colonising plants in estuaries that are largely free of the species.

The major recommendation for saltmarsh is to leave it alone. This means excluding fire and grazing. Ricegrass invasion should be monitored closely. Remove any ricegrass plants that colonise in areas that have not been infested previously. However, care should be taken when removing them because when a plant is broken up each of the fragments can form a new plant. **Kit 3 Weeds in Your Bush** provides more information on weeds and their management.

Looking after dry coastal vegetation

Dry coastal vegetation occurs on well-drained soils along the coast. It can occur on sand dunes, cliffs and rocky shores. It is dominated by plants that are confined to the coastal zone. The most common dominant species in Tasmania are sea rockets (*Cakile* species), marram grass (*Ammophila arenaria*), coast fescue (*Austrofestuca littoralis*), coast spinifex (*Spinifex sericeus*), blue daisy-bush (*Leucophyta brownii*), boobyalla (*Myoporum insulare*), coast wattle (*Acacia sophorae*), coast beard-heath (*Leucopogon parviflorus*), and coastal tea-tree (*Leptospermum laevigatum*). Sea rockets are weeds that occupy the high tide line, while the introduced marram grass occupies foredunes where it competes with native vegetation.

Good examples

Dry coastal vegetation exists around much of Tasmania's coastline with varying degrees of invasion by weeds. In many areas clearing, grazing and shack building have led to a loss of coastal vegetation. The cliff and rocky shore vegetation in most national parks is still in good condition. However, sand dunes free from invasion by marram grass are relatively rare. The best accessible example of sand dune vegetation free of marram grass is at Friendly Beaches in Freycinet National Park.

Biodiversity values

Dry coastal vegetation is well reserved in Tasmania. Several rare or threatened plants are found in dry coastal vegetation, which is also important for providing nesting sites for threatened birds. Birds such as the hooded plover (*Thinornis rubricollis*) and red-capped plover (*Charadrius ruficapillus*) nest just beyond the high tide mark among natural debris and sometimes in pigface (*Carpobrotus rossii*). However, they do not nest in taller vegetation, including areas infested with marram grass. The dune stabilising effect of marram grass changes the natural landscape of the beach, creating ledges of vegetation that are unsuitable nesting habitat for beach birds and sometimes making it impossible for little penguins (*Eudyptula minor*) to reach their burrows. Little penguins nest in coastal scrub and many colonies are threatened through habitat loss. Mutton bird or short-tailed shearwater (*Puffinus tenuirostris*) rookeries are also found in coastal scrub and the burrows are vulnerable to damage by stock.

All fauna listed under the Japan Australia Migratory Bird Agreement (JAMBA) and the China Australia Migratory Bird Agreement (CAMBA) are significant and include most international migratory birds and nationally listed threatened fauna. A number of rare migratory species roost and forage in coastal areas during the northern winter, including the bar-tailed godwit (*Limosa lapponica*), red knot (*Calidris canutus*), lesser golden plover (*Pluvialis dominica*), and grey-tailed tattler (*Tringa brevipes*).

THREATENED ANIMALS OF DRY COASTAL VEGETATION INCLUDE:

Hooded plover (*Thinornis rubricollis*)

New Holland mouse (*Pseudomys novaehollandiae*)

Little tern (*Sterna albifrons sinensis*)

Fairy tern (*Sterna nereis*)

Geometrid moths (*Amelora acontistica* and *Dasybela achroa*)

EXTINCT AND THREATENED PLANTS OF DRY COASTAL VEGETATION INCLUDE:

Coast banksia (*Banksia integrifolia*) EXTINCT IN TASMANIA

Green berry nightshade (*Solanum opacum*)

Saltbush (*Atriplex suberecta*)

Wiry mitrewort (*Mitrasacme paradoxa*)

Refer to **Kit 5 Threatened Plant Species in Your Bush** for more information and an illustration of each species.



Management issues

The major management issue for dry coastal vegetation is weed invasion. It is particularly susceptible to weed invasion because of the high degree of natural disturbance, its relatively high fertility, and the large number of potentially invasive weeds that occur in adjacent gardens and farmlands. One of the most threatening invasive weeds, marram grass, is still planted to stabilise dunes. Like many other invasive weeds in the coastal zone it can disperse in sea currents and is currently spreading down the west coast of Tasmania. Another weed, the sea spurge (*Euphorbia paralias*), is spreading by currents southward in Tasmania and is one of the most serious threats to coastal biodiversity. It spreads rapidly and vigorously colonises a variety of habitats such as herbfields, dry slopes and rocky shores. Invasive woody plants found in dry coastal vegetation include South African boneseed (*Chrysanthemoides monilifera*), New Zealand mirror bush (*Coprosma repens*), and South African boxthorn (*Lycium ferocissimum*). Trampling by stock and humans can destabilise coastal soils leading to increased rates of weed invasion. Stock can also introduce weeds in their faeces and on their coats.

Fire is not necessary to maintain dry coastal vegetation. Certain fire regimes can eliminate some coastal species. For example, on King Island coastal tea-tree has disappeared because the area has been burnt twice in quick succession. Fires can also lead to cliff destabilisation and the development of unnatural sand dunes. Dunes are active landforms that are regularly mobilised by natural processes. Any increase in access by people, stock or vehicles is likely to cause greater sand mobility than would occur naturally.

If your dry coastal vegetation is in excellent condition maintain your current management regime. However, be aware of the first signs of invasion by the most threatening weeds such as sea spurge, marram grass and South African boneseed. If these weeds appear eliminate them using the advice given in **Kit 3 Weeds in Your Bush**.

The condition of your dry coastal vegetation can be improved by:

- reducing or excluding stock;
- excluding fire or reducing its frequency;
- hardening and restricting access roads and pathways;
- reducing the abundance of threatening weeds by using the techniques outlined in **Kit 3 Weeds in Your Bush**;
- strategic planting of local native shrubs and grasses in degraded areas.

Looking after wetland

Wetlands are areas of shallow water that are usually flooded for at least part of the year. They are distributed from the coast to inland areas and may occur at low and high altitudes. They include areas of marsh, fen and peatland, and may be found in streams and around lakes. They may be natural or artificial, permanent or temporary, static or flowing, and be fresh, brackish or salty. On some farms a small wetland may simply be a swampy area that has reeds and rushes. Plants and animals that live in wetlands are adapted to wet conditions for at least part of their life cycle. Many wetlands have dried out during the drought periods of the last 15 years. However, they may refill in the future.

Wetlands are among the world's most productive environments and their continuing loss and degradation is a major global problem. They are vital habitats and breeding grounds for many species, especially fish and waterbirds, some of which are in danger of extinction. They support wildlife that help to control insect pests on farms and provide important refuges for wildlife during drought. Wetlands help to purify water by acting as filters that trap sediment and nutrients. They reduce erosion and provide protection from floods by absorbing and slowly releasing water.

Good examples

Wetlands with many birds can be seen at Orielton Lagoon, Pittwater and Moulting Lagoon, and on the mudflats at Robbins Passage. Coastal wetlands can be seen at Waterhouse Point, Asbestos Range National Park and Jocks Lagoon near St Helens. Lake Dulverton near Oatlands and Lake Crescent in the Central Highlands are also excellent examples of wetlands.

Biodiversity values

Many wetlands have been drained or dammed. In the drier parts of the state almost one-third of the wetlands have been drained and another one-third have been flooded as dams. Many of the dry country wetlands are of national or international significance, with many listed on the Directory of Important Wetlands in Australia and several listed under the Ramsar Treaty, which is an international treaty dedicated to protecting the world's wetlands.

Wetlands are important habitats for many species, including some migratory species such as Latham's snipe (*Gallinago hardwickii*). A number of wetland bird species such as the Australasian shoveller (*Anas rhynchos rhynchos*) and the hard head (*Aythya australis*) are thought to be declining in numbers.

THREATENED ANIMALS OF WETLAND INCLUDE:

Green and gold bell frog (*Litoria raniformis*)

Great-crested grebe (*Podiceps cristatus australis*)

THREATENED PLANTS OF WETLAND INCLUDE:

Tunbridge buttercup (*Ranunculus prasinus*)

Purple loosestrife (*Lythrum salicaria*)

Water milfoil (*Myriophyllum integrifolium*)

Refer to **Kit 5 Threatened Plant Species in Your Bush** for more information and an illustration of each species.

Management issues

- Protect remaining wetlands from permanent inundation or drainage.
- Excluding stock is the best option, if possible. It is possible to graze a wetland with minimal damage when it is completely dry. However, stock should be excluded while the wetland is drying out. Stock trampling the boggy ground will destroy the vegetation mat that is important for a healthy wetland.
- Alternative watering points may be needed. If that is not possible it may be necessary to fence off most of the wetland while still providing access to the most suitable watering point.
- Exclude fire from wetlands.

There are numerous plants that grow in wetlands and around their edges. Once a wetland has been established it is likely that a range of rushes (*Juncus* species) and bog rushes (*Schoenus* species) will appear.



Looking after buttongrass moorland and heath

Buttongrass moorland is found on poorly-drained and infertile soils. It is the most common vegetation type in lowland western Tasmania. It also occurs on poorly-drained, infertile flats elsewhere in the state. Buttongrass moorland is less than 2 m tall and is dominated by buttongrass hummocks (*Gymnoschoenus sphaerocephalus*) with a rich mixture of shrubs, sedges and rushes in the gaps between the hummocks. Sphagnum peatland is a type of moorland that is generally found in areas between 600 m and 1350 m in altitude.

Heath is usually found close to the coast on highly infertile sandy plains. The most extensive areas of heath in the state are found in the Furneaux Group of islands and in the north east. Small areas of heath are occasionally found on poorly-drained inland sites and rock-plate hill tops. Heath is dominated by shrubs less than 2 m tall in the tallest layer. The most common dominant species are tea-tree (*Leptospermum* species), paperbark (*Melaleuca*), banksia (*Banksia marginata*), casuarina (*Allocasuarina*), and grass-tree (*Xanthorrhoea*).

Good examples

Buttongrass moorland can be seen from all the main roads in western Tasmania. The Peter Murrell Nature Reserve at Huntingfield, south of Hobart, contains small areas of buttongrass and sphagnum peatland.

Heath can be seen alongside roads in Rocky Cape National Park, Waterhouse Point Protected Area, Mount William National Park, the Friendly Beaches section of Freycinet National Park, and at Remarkable Cave on the Tasman Peninsula.

Biodiversity values

Buttongrass moorland is extremely well represented in Tasmania's reserve system and is relatively rare on private land. Most rare or threatened plant species that occur in buttongrass moorland are also well reserved. One of the most threatened species that uses buttongrass moorland is the orange-bellied parrot (*Neophema chrysogaster*). Species such as the emu wren (*Stipiturus malachuru*), striated field wren (*Calamanthus fuliginosus*), tawny crowned honeyeater (*Phylidonyris melanops*), broad-toothed rat (*Mastacomys fuscus*), and ground parrot (*Pezoporus wallicus*) are all buttongrass species.

Heaths are generally well reserved in the state. However, the few surviving heaths in the driest parts of the state are significant because of their local rarity. The inland heaths of the north east coastal plains and the Furneaux Group include some vegetation communities that are unreserved or poorly reserved. Many rare or threatened plant species occur in heath.

THREATENED SPECIES OF BUTTONGRASS MOORLAND INCLUDE:

Orange-bellied parrot (*Neophema chrysogaster*)

New Holland mouse (*Pseudomys novaehollandiae*)

Hickmans pygmy mountain shrimp (*Allanaspides hickmani*)

Scottsdale burrowing crayfish (*Engaeus spinicaudatus*)

THREATENED SPECIES OF HEATH INCLUDE:

Southport heath (*Epacris stuartii*)

Conebush (*Isopogon ceratophyllus*)

Heath (*Epacris barbata*)

Chaffy bushpea (*Pultenaea paleacea* var. *sericea*)

Refer to **Kit 5 Threatened Plant Species in Your Bush** for more information and an illustration of each plant.

Management issues

Both buttongrass moorland and heath are relatively resistant to invasion by weeds, provided that the nutrient levels of the soils are not raised. However, these vegetation types are particularly susceptible to shrub dieback caused by the cinnamon fungus (*Phytophthora cinnamomi*) which has the potential to eliminate some heath species, such as the cone-bush (*Isopogon ceratophyllus*), from Tasmania.

Both vegetation types would be replaced by taller vegetation over almost all of their range in the long-term absence of fire. However, frequent fire will lead to a loss of peat beneath the buttongrass moorland, and convert heath to sedgeland or bracken fernland.

Buttongrass moorland is useless for domestic stock grazing. Some of the more fertile heaths, particularly those in the north east, are used for grazing, especially after burning. However, fire followed by stock grazing appears to degrade these heathlands and encourage the invasion of weeds.

Unsustainable moss harvesting and peat mining leads to degradation of sphagnum peatlands.

Grazing

Stock grazing is not appropriate in heath managed to maintain biodiversity. However, if you wish to continue using such areas for stock consider leaving the areas ungrazed for a couple of years following a fire as this will give the palatable species a chance to re-establish. Trampling of sphagnum peatlands by stock results in their degradation.

Fire

The general recommended fire frequency for buttongrass moorland is 5-20 years, and for heaths 10-30 years. However, the appropriate frequency for particular areas is best judged from the growth rates of the shrubs and the rate of decline in the number of plant species. If there appears to be no danger of buttongrass moorland or heath converting to scrub and there is no loss of the smaller plant species, there is no biodiversity reason to burn. Conversely, if the growth rate of the shrubs looks set to convert the heath into scrub, or if the smaller plant species are disappearing, burning will be beneficial. Autumn burns are preferable to spring burns as they avoid harming ground-nesting birds such as the ground parrot. Ideally, fires should be intense enough to kill all the foliage but not so intense that they burn into the peat.

Weeds and diseases

Where there are no weeds in buttongrass moorland or heath take care not to increase the fertility of the site through drift from aerial top-dressing, dumping of material, or diversion of drainage from higher nutrient areas. Increasing the fertility of the area will encourage weeds to colonise.

If there is some penetration of weeds into your heath, there is little you can do apart from counteracting the possible causes such as nutrient drift or stock grazing. In some extreme cases it may be possible to restore heath by scraping off the nutrient-rich upper few centimetres of soil. If your heath is badly invaded by woody weeds eliminate the invading shrubs using the recommendations given in **Kit 3 Weeds in Your Bush**.

If the cinnamon fungus has invaded your area of buttongrass moorland or heath make sure that you do not transfer any soil from infected areas to uninfected areas. If your buttongrass moorland or heath is free of the fungus, clean all your boots, vehicles and machinery before entering the area as the fungus can be transported in mud and water (see **Kit 2 Managing Your Bush**).



Looking after alpine vegetation

Alpine vegetation is found above the tree line, in treeless areas and among subalpine forests. It is less than 2 m tall. The alpine vegetation of Tasmania is extremely unusual globally in that most of it is dominated by small-leaved shrubs or hard cushion plants. However, there are also substantial areas of Tasmanian alpine vegetation that are dominated by grasses, herbs or sedges.

Good examples

There are several places where alpine vegetation can be seen from the road, including Mt Barrow, Ben Lomond, Mt Wellington, Mt Field (Wombat Moor), Hartz Mountains, and the Central Plateau (Lake Ada Road, Lake Mackenzie Road, Lake Highway and Poatina Road).

Biodiversity values

The international biodiversity significance of Tasmanian alpine vegetation has been recognised by its almost complete reservation within the World Heritage Area and other reserves. However, there is some alpine vegetation that is significant for its rare or threatened species that occurs on private land. This is alpine vegetation that occurs below the climatic tree line on basaltic soils.

EXTINCT AND THREATENED SPECIES OF ALPINE VEGETATION INCLUDE:

Alpine apple berry (<i>Rhytidosporum alpinum</i>)	
Jewel beetle (<i>Stigmodera insculpta</i>)	EXTINCT
Alpine spider (<i>Plesiothele fentoni</i>)	
Pencil pine moth (<i>Dirce aesiodora</i>)	

Refer to **Kit 5 Threatened Plant Species in Your Bush** for more information and an illustration of each plant.

Management issues

The two issues for the management of alpine vegetation on private land are fire and stock grazing. A combination of burning and stock grazing lead to severe erosion, a loss of some native species, and the long-term promotion of unpalatable species. Unfortunately, stock grazing without fire also leads to increased areas of bare ground in alpine vegetation that does not have a complete cover. The removal of stock from such areas has increased the vegetation cover at a rate of 1% per year.

Research has shown that both fire and grazing, and especially a combination of the two, should be excluded from alpine vegetation managed for biodiversity. Even if your alpine vegetation is not being managed for biodiversity you will need to exclude stock from already eroded areas if you do not wish to destroy the soils on which your stock ultimately depend.



Looking after banksia scrub and woodland

Banksia or honeysuckle (*Banksia marginata*) varies in appearance, forming a shrub or small tree. It is widespread in Tasmania and forms scrub and woodland on coastal sand dunes where the fire frequency is low. Banksias also form groves in the Midlands, usually on sandy soils. Some of these groves are extensive, up to 2 km in length with magnificent old trees, although the majority occur in small copses. Inland stands of banksia were probably once extensive in the grassy lowlands throughout south east Australia. Today, few remain and those that do are mostly in poor condition with weedy understories and little regeneration. Coastal stands of banksia generally survive in better condition.

Good examples

A small grove of banksia woodland can be seen on the eastern side of the Midlands Highway a few kilometres south of the rest area between Oatlands and Tunbridge. A coastal stand exists on the northern end of Kingston Beach near Hobart. At Sisters Beach in northern Tasmania an unusual stand of saw-toothed banksia (*Banksia serrata*) can be seen.

Biodiversity values

Coastal banksia woodlands are well reserved and in good condition. However, there are few good stands of the inland banksia woodland which makes this vegetation type valuable for conservation.

Management issues

Fire and grazing are the major management tools in banksia scrub and woodland.

Fire

Banksias have a hard seed that is stored in a cone and released after fire. However, fire is not essential for regeneration and in some areas banksias regenerate in the absence of fire. Drought and high temperatures also lead to seed release.

- Intense fire will probably kill many of the old trees so take care!
- If you want to experiment, burn a small patch of your banksia grove and see if any regeneration occurs.
- Autumn is probably the best time of the year to burn but experiment with burning in other seasons.

Grazing

- Fencing a banksia grove allows for better stock control.
- If regeneration has occurred exclude stock until the young trees are out of their reach. Electric fencing is effective for a small area.
- Leave dead branches on the ground as they act as a cage protecting the young banksias and other species from browsing animals.
- If there is a dense grassy sward and no regeneration, crash grazing a large mob of sheep for a short time may help regeneration by reducing competition.

Weeds

Rank grasses such as Yorkshire fog, cocksfoot and brown-top bent often form a dense sward in banksia groves. Crash grazing for a short period of time may help to reduce these grasses but seedlings may also be lost.

Revegetation

Banksia woodlands are often difficult areas in which to establish trees, including banksias, because of the competition from grasses and the poor sandy soils. These soils often have large numbers of ants that feed on the seed. Experiments with hand-sowing seed, including banksia seed, have not led to the establishment of young plants.



Looking after she-oak woodland and forest

She-oak (*Allocasuarina verticillata*) is a small, drooping tree. It is the most drought-resistant tree in Tasmania. Because it reaches a lower maximum height and has a slower growth rate than eucalypts, it usually only dominates native vegetation in places where eucalypts find it hard to grow. These are generally north-facing slopes with shallow and rocky soils in areas receiving less than 700 mm of rainfall per year. Therefore, she-oak woodland and forest is widespread in dry eastern Tasmania and on the eastern Bass Strait islands, most commonly near the coast. She-oak can be found as the dominant tree in woodland and forest.

However, it can also form a major understorey component of eucalypt forest. The recent dieback of white gum (*Eucalyptus viminalis*) in the lowlands has extended the areas occupied by she-oak woodland to include areas where she-oaks previously formed the understorey. The presence of a dense she-oak understorey increases the rate of dieback amongst emergent eucalypts during drought.

She-oaks do not respond to fire and grazing in the same way as eucalypts. Frequent fires will eliminate she-oaks while allowing eucalypts to survive. She-oak seedlings are more palatable to stock than eucalypt seedlings so under light grazing regimes eucalypts may re-establish successfully but not she-oaks.

She-oak woodland and forest varies from an almost closed forest that has little else beneath the trees but needles, to a woodland in which umbrella-shaped trees are interspersed in a species-rich sward dominated by tussock grasses. Little of this community has been cleared since European settlement. In fact, it may occupy a greater area now than it did under Aboriginal occupation because of changed fire regimes.

Good examples

A fine example of she-oak forest can be seen on the hill to the east of the Midlands Highway between the rest stop north of Oatlands and the ruin of Antill Ponds. Here, the emergent white gums have recently died leaving the she-oak to dominate. Excellent examples of she-oak woodland and forest can also be seen on the northern slopes of the Domain in Hobart and in Cataract Gorge in Launceston.

Biodiversity values

She-oak woodland and forest is not a high conservation priority in Tasmania as it is well reserved, has suffered no reduction in area, and contains few threatened species.

Management issues

She-oak is a preferred firewood as it burns slowly and intensely and produces little ash. She-oak forest is of little value for grazing as the tree litter suppresses the growth of grass beneath the canopy. However, she-oak woodlands are widely used as rough grazing country. Because they occur on some of the least productive sites for pasture, and often exist within paddocks that contain more productive pasture, it is common to see bare red ground between the trees in summer and signs of erosion. There is usually no regeneration of she-oak in these grazed woodlands and many of the trees are beginning to die. She-oak woodlands are more valuable for nature conservation than she-oak forests, which are less rich in native species. The main conservation management goals with she-oak vegetation are to maintain the woodland structure and the health of the understorey. In urban remnants there is also a problem with woody weed invasion, the most threatening being boneseed (*Chrysanthemoides monilifera*), gorse (*Ulex europaeus*), and briar rose (*Rosa rubiginosa*). Refer to **Kit 3 Weeds in Your Bush** for more information on weeds and how to manage them.

Maintaining the health of the dominant layer of she-oak woodland and forest is relatively simple:

- Exclude stock until the regenerated shrubs and trees are out of the reach of stock, assuming that seed is held on the trees and that no young trees are already present.



Looking after Oyster Bay pine and South Esk pine woodland and forest

Tasmania has two native cypress pine species. **Oyster Bay pine** (*Callitris rhomboidea*) woodlands and forests occur along the east coast from Cape Pillar to the Douglas-Apsley National Park and in the Furneaux Group. The threatened Tasmanian endemic, **South Esk pine** (*Callitris oblonga*), is found near a few rivers in the east of the state, including the Apsley, Swan, St Pauls and South Esk Rivers, where it forms a low woodland or forest community. Native cypress pines can be found as the dominant trees in woodland and forest. However, they can also form a major understorey component of eucalypt forest, and they occasionally occur in heath.

Both species are very hardy. The Oyster Bay pine is drought resistant and establishes readily in moderately shaded, undisturbed areas. The South Esk pine can survive flood damage and is highly frost resistant. Both species hold seed in woody cones that release the seed after the branches die, enabling them to regenerate after fire. However, individual trees are easily killed by fire. They take up to a decade to set new seed after germination so they can disappear from a site if fires occur in close succession.

Good examples

The best places to see **South Esk pine** are in the riparian forest at Royal George on the Old Coach Road and from the Apsley River Bridge on the Coles Bay Road. **Oyster Bay pine** is common around Orford. Paradise Gorge, just below the dam on the Prosser River, houses a magnificent stand of Oyster Bay pine, which is currently replacing the local eucalypts. There are also accessible stands just south of Swansea and at the southern entrance of the Douglas-Apsley National Park.



Oyster Bay pine

Biodiversity values

The South Esk pine and vegetation containing it are threatened. It largely occurs on private land and is reserved only in the Douglas-Apsley National Park. Many other threatened plants occur with South Esk pine. Vegetation containing Oyster Bay pine is more widespread and is present in many reserves, although the level of protection is inadequate.

Many rare or threatened plant species occur in Oyster Bay pine and South Esk pine woodlands and forests, including Midlands mimosa (*Acacia axillaris*) and small-leaf sphyridium (*Spyridium microphyllum*). Refer to **Kit 5 Threatened Plant Species in Your Bush** for more information and an illustration of each plant.

Management issues

The two key issues for maintaining Oyster Bay pine and South Esk pine woodland and forest are:

- avoiding their elimination by using an appropriate fire regime;
- woody weed invasion, particularly gorse and willow.

Excluding fire is the best management option for native cypress pine (*Callitris*) woodland and forest. If a stand is accidentally burnt and the trees killed, exclude all stock until the new plants are out of their reach. Then try to ensure that fire does not recur until the regenerating trees have ample mature cones. If your stand of Oyster Bay pine contains mature trees with most of their foliage well above ground level, low intensity fire or grazing may help to prevent fires that will kill the trees. However, this will also prevent any regeneration.

Woody weed invasion is rarely a problem in Oyster Bay pine stands. However, South Esk pine stands are usually badly invaded by gorse and occasionally willow. Dense understories of gorse can prevent regeneration of the pines. They are also highly flammable which increases the probability of fire destroying the stand. See **Kit 3 Weeds in Your Bush** for advice on gorse and willow removal.



South Esk pine

Looking after tea-tree and paperbark wet scrub and forest, blackwood forest, dry rainforest and temperate rainforest

These four vegetation types are grouped together because they share relatively simple management requirements. Dry rainforest and temperate rainforest regenerate without any large scale disturbance such as fire. The same goes for blackwood forest and tea-tree and paperbark wet scrub and forest over some of their range. However, over most of their range they form a stage in the development of rainforest.

Tea-tree and paperbark wet scrub and forest are dominated by manuka (*Leptospermum scoparium*), soft-fruited tea-tree (*Leptospermum glaucescens*), shiny tea-tree (*Leptospermum nitidum*), woolly tea-tree (*Leptospermum lanigerum*), swamp paperbark (*Melaleuca ericifolia*), and scented paperbark (*Melaleuca squarrosa*). This vegetation type usually has an understorey of rainforest species. In northern Tasmania and on the Bass Strait islands dense forests dominated by swamp paperbark are widespread.

Blackwood forest (*Acacia melanoxylon*) is widespread in lowland Tasmania, except on the most infertile soils. It dominates forests in well-drained areas where temperate rainforest has been burnt. In these situations it represents a stage in the regeneration of temperate rainforest. In swampy areas on fertile soils blackwood may persist as the dominant species in the absence of fire.

Dry rainforest is rare. It is confined to deep, south-facing rocky gullies in the driest parts of the state. It has a dense, closed upper canopy of small trees, most notably native olive (*Notelaea ligustrina*), pinkwood (*Beyeria viscosa*), and dogwood (*Pomaderris apetala*), with occasional emergent blackwoods (*Acacia melanoxylon*).

Temperate rainforest is most extensive in western Tasmania and in the north east highlands. It also occurs sporadically in most mountain ranges in eastern Tasmania. The canopy is dominated, either singly or in combination, by myrtle beech (*Nothofagus cunninghamii*), deciduous beech (*Nothofagus gunnii*), sassafras (*Atherosperma moschatum*), King Billy pine (*Athrotaxis selaginoides*), pencil pine (*Athrotaxis cupressoides*), leatherwood (*Eucryphia* species), horizontal (*Anodopetalum biglandulosum*), Huon pine (*Lagarostrobos franklinii*), celerytop pine (*Phyllocladus aspleniifolius*), and Cheshunt pine (*Diselma archeri*).

Good examples

There are large areas of **tea-tree and paperbark wet scrub and forest** on the west coast, particularly where mining settlements have been associated with the burning of rainforest. They can also be seen in the north west of the state in some of the swampy flats between Smithton and Marrawah. On King Island magnificent swamp paperbark forests can be seen in the Lavinia Nature Reserve and at The Nook. The nature trail at Bakers Beach in the Asbestos Range National Park is also a good place to see paperbark wet scrub.

The best **blackwood forests** in Tasmania occur in the swampy flats between Smithton and Marrawah, and they can be seen from a nature trail at Dismal Swamp. Blackwood forest that represents a stage of rainforest regeneration can be seen along the main roads to the south, east and west of Queenstown.

The walking track that passes along the northern bank of the dam in the Trevallyn State Recreation Area passes through a stand of **dry rainforest**, as does the track in the Truganini Reserve, south of Hobart.

All the main roads in western Tasmania pass through stands of **temperate rainforest**. Temperate rainforest can also be seen along many of the roads in the north east highlands, at Mt Field, and at locations on the east coast such as the Sandspit Forest Reserve.

Biodiversity values

Tea-tree and paperbark wet scrub and forest is extremely well reserved. Swamp forest dominated by blackwood has been heavily cleared and drained for dairying and is inadequately protected in Tasmania's reserve system. The other type of forest dominated by blackwood is adequately reserved and is in no danger of extinction. Dry rainforest is rare and carries a high conservation value. Although there has been some clearing of temperate rainforest for forest plantations on private land in recent years the vegetation type is well reserved.

THREATENED ANIMALS OF THESE VEGETATION TYPES INCLUDE:

Grey goshawk (*Accipiter novaehollandiae*)

North east forest snail (*Anoglypta launcestonensis*)



Management issues

The main management issue for all four vegetation types is the exclusion of fire. While tea-tree, paperbark and blackwood may, in some situations, require an occasional fire to maintain their dominance, unplanned frequent fires are likely to prevent them becoming an extensive feature of the landscape. None of these vegetation types are suitable for planned burning because of their fuel loads. Fire can lead to the destruction of temperate and dry rainforests, especially when repeated. Extreme stock disturbance or logging can open up the understorey of these vegetation types sufficiently to allow the invasion of some weeds, notably blackberry (*Rubus fruticosus*). Myrtle beech, the major dominant of temperate rainforest, suffers from a natural dieback called myrtle wilt. This dieback accelerates when the forest is disturbed. The opening up of the temperate rainforest canopy on infertile soils less than 800 m above sea level has also been associated with dieback caused by the cinnamon fungus (*Phytophthora cinnamomi*). While tea-tree and paperbark wet scrub and forest often appear over-mature or in need of a good 'clean out' their dense nature is just a stage in their development. Over time these forests will thin out, the eucalypts will become more dominant, and the understorey will become more diverse. Burning or clearing to encourage regeneration will merely start the developmental cycle all over again.

The management recommendations for these vegetation types are:

- exclude fire;
- control woody weeds (see **Kit 3 Weeds in Your Bush**).

If you manage rainforest with myrtle beech do not disturb the area around the tree roots or expose the trees by removing adjacent vegetation. If you manage temperate rainforest on infertile soils below 800 m avoid breaking the canopy and introducing soil to the area on machinery.

