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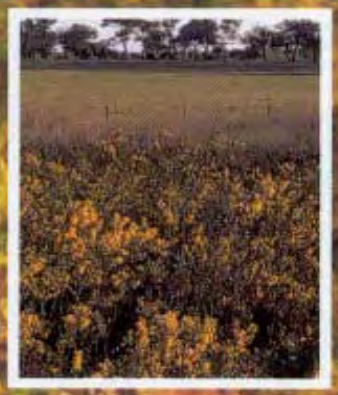
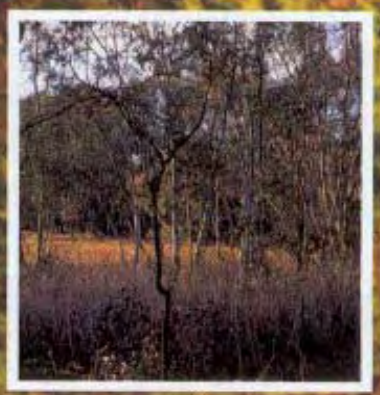
Indigenous plants for North Central Victoria

a revegetation guide





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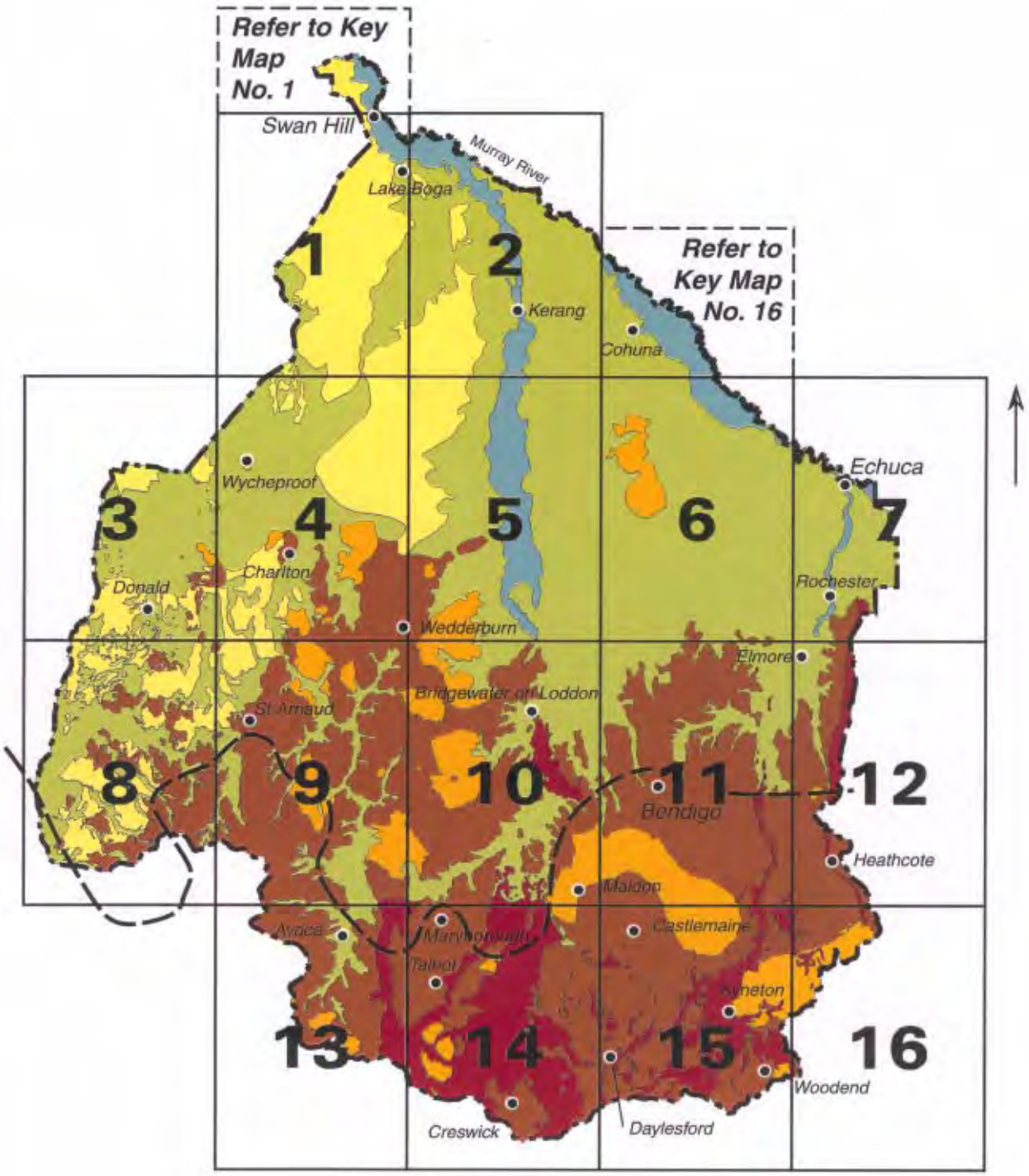
Victoria ON THE MOVE

Key map

Planting zones of North Central Victoria



Riverine Plain
Riverine Plain subject to flooding
Marine Plain
Sedimentary
Granite
Volcanic
Water bodies

Approximate 500mm rainfall band

Indigenous plants for North Central Victoria

A REVEGETATION GUIDE

Greening Australia™

COMPILED BY GREENING AUSTRALIA VICTORIA

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Foreword

The natural landscape in the North Central Region has been severely modified since European settlement. These changes have often been rapid, and almost irreversible in many areas. We are now left with 40,485 hectares of protected native vegetation in conservation and biological reserves (with more remaining as unprotected remnants), from a total Regional area of around 3 million hectares.

This loss of biodiversity is one of the main problems in the region. For millions of years, complex ecological and biophysical relationships have shaped unique flora and fauna in the North Central Region. White settlement has disrupted many of these relationships; as a result, salinity, declining soil health, poor water quality, erosion, exotic species and many other problems have emerged.

The Regional Catchment Strategy addresses these issues and other priority issues throughout the North Central Region. The Strategy provides an outline for the integration of land and water management in the region, where the North Central Catchment Management Authority is charged with overseeing its implementation. However the Regional Catchment Strategy is not a stand alone document and is underpinned by further strategies and action plans.

This guide will be a valuable resource in addressing and complementing the many programs and priorities in the North Central Region. Revegetation assists in addressing many of the issues in the catchment. However, some of the planting programs in the past have had low survival rates. This guide will help to ensure more effective revegetation schemes and increased survival rates of plants. The valuable technical guidance provided for planting indigenous trees, shrubs, grasses and herbs native to North Central Victoria will be utilised by a wide sample of the catchment community, from the landholder, to Landcare Groups, Local Government and many other land managers in the North Central Region.

I am confident that *Indigenous plants for North Central Victoria – a revegetation Guide* will be a valuable contributor in aiding natural resource management and enhancing the natural environment of the North Central Region. The Department of Natural Resources and Environment and Greening Australia should be commended for the preparation of this important document.

Drew English
Chairman
North Central Catchment Management Authority

North Central Catchment Management Authority

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How this book works

This revegetation guide is divided into three sections:

- The first section covers issues related to remnant vegetation and replanting native vegetation. It also contains a list of further reading at the end of each topic. This section will help you with basic questions about native vegetation management.

- The second section contains maps together with planting lists. A key map on the inside front cover shows the arrangement of the 16 pages of maps which cover all of the North Central Victorian Catchment Management area. The maps show six different planting zones, which are broad summaries of more complex land systems. The zones are used to give a basic guide to planting throughout the region. Planting lists for each planting zone show a typical cross section of the landscape found in that zone. The plant lists for each zone are split into above and below 500 mm annual rainfall. The approximate line of 500 mm rainfall can be found on the keymap. It should be noted that the planting zones show very general and much simplified information to help you get started in choosing plants. Where possible, local remnant vegetation found in similar conditions to your planting site should be used as a guide for your species selection.

- The final section of the book provides detailed information for all of the plants mentioned in the planting zones. These descriptions give information relevant to the North Central Victorian area and are based on published work as well as comments from experts in the region. The species chosen for this book are those most likely to be practical for revegetation for a range of situations, as well as several plants from other ecologically important plant groups.

Section 1
Introduction

The Value of Indigenous Plants

Introduction

Indigenous plants can be simply defined as members of the original flora: plants that occur naturally in a given locality. An increased awareness of the value of indigenous vegetation has created much interest in the re-establishment of local native trees and shrubs where they have been lost. Some of the benefits of using indigenous plants are discussed below.

Conservation

The planting of rare or endangered species contributes to the conservation of local flora. Using indigenous plants helps preserve the genetic heritage of plant and animal communities. Wild genetic resources are increasingly being recognised for their scientific value and contribution to biodiversity.

Indigenous plants will support local wildlife, thereby providing a 'richer' environment as compared to less diverse landscapes.

Local identity

Each area is unique because of its indigenous vegetation. Many areas are losing their local identity because of the destruction of indigenous plants and the introduction of plants from other areas of Australia or from other countries. By using indigenous plants we help to preserve our distinctive local landscape character.

Economic benefits

Local species are well adapted to local soils and climatic conditions. This means there is little need for watering, fertiliser application or specialised soil improvements, thereby saving considerable time and expense with revegetation projects.

When planted as windbreaks, indigenous plants can improve farm productivity through providing shelter for livestock, crops and pastures. Indigenous plants also help to maintain the natural balance in the local ecosystem. This can help to reduce pest outbreaks because habitat is provided for local wildlife that are useful in natural pest control on the farm.

Remnant vegetation, Boort area
Photo: Paul Haw

Some local trees are also valuable as timber crops, particularly those with good form. When managed correctly, trees selected from local provenances may have commercial potential.

There is minimal danger of indigenous plants becoming weeds that are costly to control.

Education resource

The growing of indigenous plants can provide formal and informal education in ecology, biology and environmental studies, allowing schools, community groups and individuals to benefit.

Potential establishment problems

Two potential problems associated with growing indigenous plants are discussed below.

1) Altered environmental conditions

Where the environment has been significantly altered, it may not be possible to immediately re-establish the local plants. Conditions may be unsuitable for some indigenous plants when:

- salinity, soil erosion, waterlogging, and or compaction have changed the properties of the soil;
- repeated application of fertilisers and manure have altered the soil nutrient levels;
- a site has become severely exposed; or
- the original soil microflora that may be important to the health of the plant have been lost.

2) Difficulty in obtaining indigenous plants

Seed or plant stocks may be difficult to obtain from nurseries. Collecting seed or cutting material from local plants may be necessary. Many non-indigenous nurseries will grow indigenous plants if they are supplied with local seed.

How local is local?

It is a sound policy to revegetate with local species, using seed collected from many parent plants growing as close to the intended planting site as possible. This is optimal for nature conservation as it preserves local genetic resources. Suitable parent plants for seed collection can usually be found in the locality, however, there can be significant differences in vegetation types over short distances. It is sometimes the case that the same species will occur in very different vegetation types, for example in wet gullies and on dry ridges. In this situation it is probably best to collect seed from the vegetation type that matches your site conditions.

The effects of introducing non-local provenances are not well understood nor are they yet well documented. Because of this gap in understanding, there is concern that local plant communities are being degraded by such introductions (see Environmental Weeds, p13).

Managing remnant vegetation

Introduction

The main focus of the revegetation effort in south-eastern Australia has been the planting of trees and shrubs, rather than protecting remnant (existing) vegetation, and allowing it to regenerate. This indicates that remnant vegetation is mis-perceived as something that will always exist, can easily be replaced, or is under-valued. In fact, remnant vegetation generally is far more complex and provides many more benefits than planted vegetation.

Remnant Buloke (Allocasuarina luehmannii)
Photo: Paul Foreman

Benefits of remnant vegetation

1) Shade and shelter

Remnant vegetation can provide shade and shelter for the farm, especially if it remains in clumps or strips (common along roadsides) with understorey plants (e.g. shrubs, grasses). The extent of shelter provided depends partly on the height of trees (hence mature trees are more beneficial than recently planted trees).

2) Wildlife habitat

Remnant vegetation provides important habitat for local native wildlife (including insects, birds, mammals, lizards and frogs). Tree hollows found mainly in older trees provide essential refuge and breeding sites for many different animals. These may take more than 100 years to form. Over one-third of Victoria's woodland birds and mammals need hollows for nesting. Due to their size, mature trees provide more food resources than younger trees. Litter (i.e. tree parts including branches, twigs and leaves) fallen to the ground provides essential habitat for insects, reptiles, frogs and birds. Litter also reduces erosion and maintains soil fertility as it decomposes.

3) Natural pest control

The role of native wildlife in natural pest control in farmland and in remnant vegetation is substantial, yet generally under-valued.

Many species of wildlife prey upon pasture and crop pests, thus providing an alternative to pesticide application (which often harm useful species). Wildlife also assist in keeping remnant vegetation healthy by preying on pests and by carrying predatory parasites and diseases that also reduce pest numbers. Many insects which are serious defoliators of eucalypts are eaten by native birds.

Natural pest control is enhanced if there is a diverse habitat (with understorey being particularly important), as the range and quality of wildlife increases with habitat diversity.

Wildlife active in controlling pests in south-eastern Australia include: bats (which require tree hollows and loose-barked trees for roosting); sugar gliders (which require hollow trees and access to wattles for an alternative food source to insect pests); a vast range of predatory spiders, lizards and snakes (which require ground debris e.g. rocks, logs, leaf litter and ground vegetation such as herbs and grasses for habitat); predatory wasps and many species of birds.

Useful species of birds include magpies, ibis, parrots, rosellas, cuckoos, kingfishers, honeyeaters, whistlers, shrike-thrushes, wattlebirds, currawongs, crows, ravens, friarbirds, shrike-tits, pardalotes, thornbills, robins, fairy-wrens, silvereyes, willie wagtails, grey fantails and woodswallows. These birds collectively consume enormous amounts of agricultural and native vegetation pests, including scarab grubs, caterpillars, bugs, beetles, lerps, aphids, flies, moths, christmas beetles and thrips. Magpies are among the most useful pest controlling species in pastures, consuming vast quantities of pests year-round. Also, ibis are particularly useful, with a single adult bird consuming about 200 grams of insects daily.

Owls (e.g. the Barn Owl) and snakes are useful in controlling mice. There are thousands of parasitic species of native wasps in Australia that are especially useful in controlling pasture grubs, provided they have access to the

Grey-crowned Babbler's nest
Photo: Paul Foreman

nectar of summer-flowering shrubs, such as Sweet Bursaria. Grubs are effectively controlled up to 200m from these shrubs by native wasps.

4) Aesthetic benefits

Remnant vegetation gives us an historical perspective of what the landscape was like before European settlement. Mature trees in particular are valued for their beauty in the landscape, and many of these are irreplaceable with an age of 200 to 800 years. Trees we plant today will take a few centuries to attain a similar dimension in the landscape.

5) Maintenance of genetic diversity

Remnant vegetation represents the vestiges of once-intact ecosystems, and is the best version that there will ever be in many areas of what existed. Once lost, such complex systems can never be recreated. Remnant vegetation (whether a lone paddock tree or a patch of bushland) provides a genetic plant and animal resource that can generally be protected and enhanced by encouraging regeneration. Unfortunately most remnant vegetation is diminishing yearly, or slowly degrading due to factors including unmanaged livestock grazing and weed invasion.

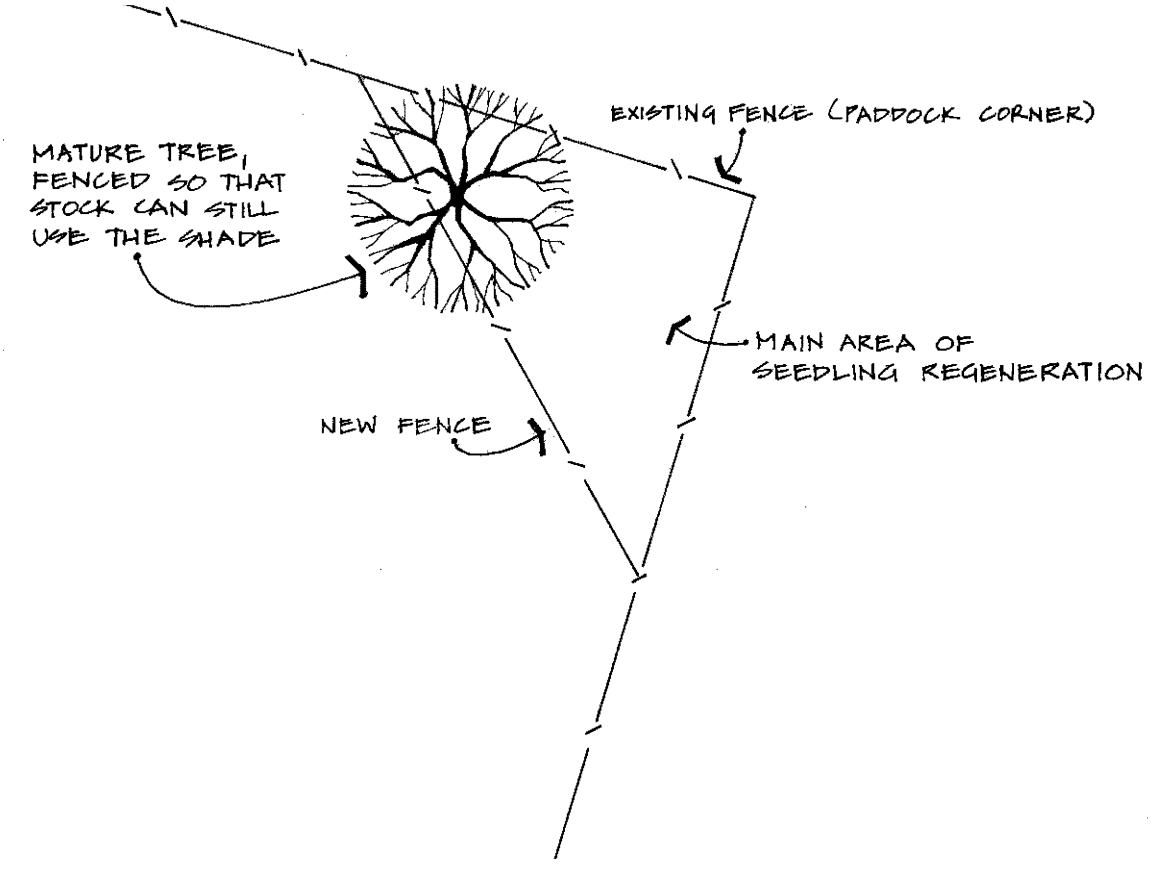
6) Regeneration – an opportunity for cheap revegetation

In areas where there is remnant vegetation, the option of protecting and regenerating areas is a sound practice. Natural regeneration is a cost effective option and produces vegetation that is naturally adapted to the site. Fencing to control livestock is an important part of starting the regeneration process.

Protecting remnant vegetation

To optimise the many benefits obtained from remnant vegetation, often the single most important action is to control livestock by fencing. The careful control of livestock can increase vegetation longevity by removing stresses associated with over-intense use of livestock, such as: soil compaction (e.g. from trampling, which damages tree roots), raised soil fertility (e.g. from stock camps which appear to make trees prone to insect predation), and ring barking (a particular problem for trees with stringy bark). The control of stock can make natural regeneration more likely, and will ensure shade and shelter for the future. While vegetation does not tolerate continual grazing

Fencing plays a crucial role in protecting vegetation. Photo: Paul Foreman



pressure, some fenced out areas can be managed with an annual short, hard, graze to remove weeds just before seeding. This grazing would also remove old foliage which would otherwise smother plants.

Most seedlings regenerate beyond the drip line of parent trees, within a distance of about one tree height downwind (usually to the south and south-east). Most regeneration occurs during periods when temperatures are warm and there is enough soil moisture for germination. This is often in spring and autumn.

Regeneration is inhibited where there are exotic grasses and weeds which compete for limited soil moisture, nutrients and light. At these sites weed control will be necessary to encourage regeneration (e.g. by knockdown herbicide application in winter-spring or possibly by scraping off a thin layer of topsoil containing the weeds and weed seeds). Where native grasses and other herbs dominate, competition is less severe and 'weed' control should be carefully considered as it may not be needed and it may damage the ground flora.

Patience is required when aiming to regenerate vegetation; it may not occur immediately after stock are excluded. Success depends on seed supply and seasonal climatic factors particularly spring and summer rainfall. It is advisable to wait for a few years before considering other methods of vegetation establishment. It is often surprising to observe what species appear (e.g. many wattle seeds can remain viable in the soil for over 60 years).

Regeneration may be assisted by careful use of controlled burning and various forms of cultivation such as ripping or harrowing. This can help to activate dormant seed within the soil or provide a seed bed onto which seed can fall naturally from existing vegetation.

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Environmental weeds

Introduction

Environmental weeds are plants that invade native vegetation, usually suppressing the regeneration and survival of indigenous flora and fauna. Environmental weeds are a major conservation threat in Victoria (indeed, throughout Australia and worldwide). Human activity is largely responsible for environmental weed spread (with altered ecosystems generally favouring weedy species rather than indigenous species). By understanding how weeds are spread and the factors that render sites prone to weed invasion, we can not only conserve areas of native vegetation, but also restore degraded areas by encouraging the regeneration of indigenous species.

The nature of the threat

Environmental weeds often pose an insidious threat in that they cause the slow decline of plant communities over many years. A major threat to native vegetation in and around farmland is exotic grasses that compete with native species and prevent them from regenerating. The effect of these weeds may not be noticed until the trees in the landscape die out without regenerating, a process that may occur over many decades.

The effects of human activity

Land management practices in agriculture, including fertilising, ploughing, pasture improvement and grazing have all had negative impacts on native vegetation to varying degrees. Many of these changes favour the growth and proliferation of exotic species rather than native species and make remnant vegetation susceptible to weed invasion.

Fragmentation of native vegetation caused by clearing and the effects of agricultural practices have brought about severe ecological problems. 'Fragments' of vegetation still remaining (i.e. remnant vegetation such as lone paddock trees, isolated patches of bush and roadside strips of vegetation) are vulnerable to disturbance on many fronts. Often remnant vegetation has a large edge-to-area ratio (e.g. a roadside vegetation strip). Such areas are prone to damage from wind, high nutrient levels (from agricultural and urban runoff) and altered light levels. Also, narrow strips of vegetation are much more vulnerable to weed invasion than large blocks.

Although less apparent in the short term, threats due to hybridisation is another type of invasion. This can occur when cross pollination takes place between indigenous plants and exotic plants of the same genus introduced nearby. Vigorous hybrid offspring can invade native vegetation and threaten indigenous parent plants through competition.

About two-thirds of the environmental weeds in Victoria have been deliberately introduced, most as garden ornamentals. About half of these potential weed species are still commercially available in nurseries.

Environmental weed management

Key steps are as follows:

- Improve your plant identification. Become familiar with indigenous and weed species, particularly ground flora.
- Avoid introducing potential environmental weeds. Revegetate with indigenous plants grown from local seed, or other natives or exotics that will grow without becoming invasive. See Carr, Yugovic & Robinson (1992) for a list of those plants which can become invasive.
- Protect and expand remnant vegetation such as roadsides by fencing adjacent areas and replanting or encouraging natural regeneration, to create buffers against weed invasion.
- Remove environmental weeds from native vegetation, working from areas of least infestation to the most heavily infested areas. Either follow up with planting of indigenous plants and/or further weeding to ensure re-infestation does not take place.
- Encourage your local nursery to provide indigenous plants, or plants that are not potential weeds.

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Establishing vegetation

Introduction

Thorough planning is recommended for any planting project, particularly to help clarify your objectives, whether these be related to production, land repair, ecological considerations or a combination of these values. To achieve these values, emphasis needs to be placed on the correct selection of species. It is desirable to select species from stock with some proven performance in your area. Where ecological plantings are concerned, the use of local provenance material is best. Other productive plants such as those used for agroforestry or fodder should be selected on their ability to perform without undue inputs and without adverse impact on the land. (Some plants introduced for productive use or as ornamentals have become serious pest plants)

Permanently planted vegetation can provide the maximum multiple benefit when integrated into the farm through a property management plan. This often requires working cooperatively with adjoining landholders and considering areas of land beyond your boundary

The successful implementation of the planting project will depend on the use of good quality planting stock and undertaking sound site preparation such as weed and vermin control as well as protecting the site from grazing animals.

Planting design

There are a range of benefits which can be expected from vegetation including protection from wind and other weather extremes, uptake of ground or recharge water and for habitat including corridor links. To shelter livestock, pastures and crops from weather extremes, belts of vegetation are best oriented at right angles to problem winds. Shelterbelts can also function as habitat corridors for local wildlife if they are sufficiently wide, (e.g. > 20 m), particularly when linked to remnant vegetation retained on your property. Remnant areas can often be enhanced and regenerated by planting a surrounding "buffer" of similar vegetation. Streams, ridges and native grassland patches are important features to retain where habitat is a priority. Shelter belts need not be dense "walls" of vegetation. Open belts with a range of tree and shrub heights which are permeable to wind may perform adequately. The total quantity of shelterbelts and the intervals between them are important design considerations.

Vegetation intended for water uptake will need to be of a particular species and density to achieve the best results. Efficient water use and deep root penetration are important features of these plantations. Saline areas may require treatments such as mounding of planting areas to assist in early establishment of seedlings.

When growing trees for timber production, the more productive areas of the property will give the best results, although the marginal areas can also be considered for some species.

Species selection

Having determined the purpose of the vegetation, appropriate species can be selected. Indigenous species are generally the most suitable. Indigenous species are likely to be the longest lived, will self-regenerate and require little maintenance due to being adapted to local soils and climate. These species also benefit the local wildlife and preserve local landscape character. Indigenous species may not be suitable where the local environment is significantly changed (e.g. saline soils.)

Ecologically sympathetic planting designs

It is important to design your plantings to optimise ecological health. Planting a diverse mixture of trees, shrubs and groundflora provides a mutually supportive environment which is more ecologically stable than single isolated trees. Clumps or multi-rowed belts of trees and shrubs are likely to remain healthy for much longer than single trees as they provide better habitat for natural predators of insect pests and are protected from wind. While the planting of single isolated trees provides some benefit, they are expensive to protect and are exposed to many stresses.

Where possible fence older or dead remnant trees into the area to be planted to add to the habitat values. These are often very valuable for wildlife and provide perches and hollows used by many animals.

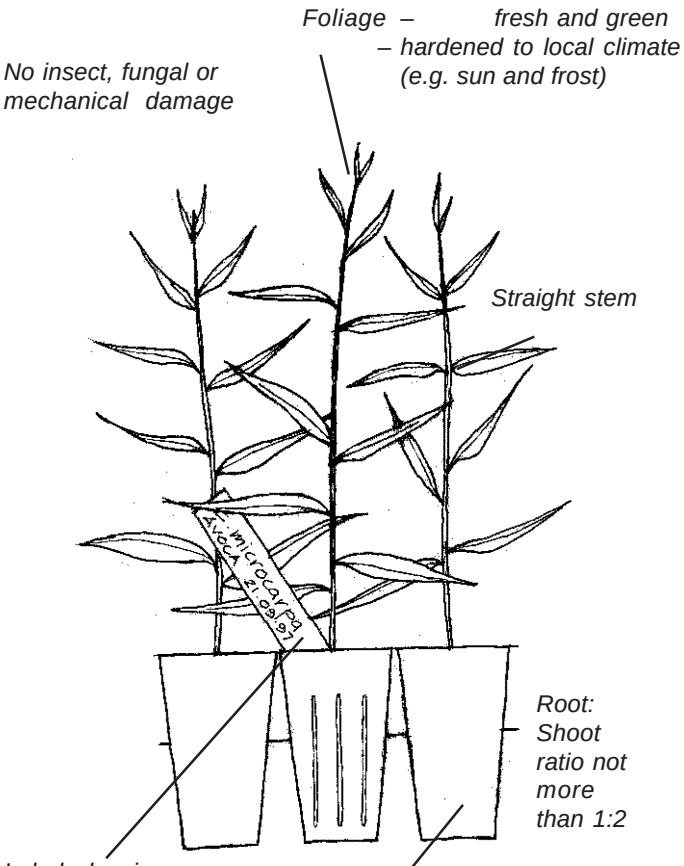

Figure 2: Plug grown and tubestock standards

Planting to establish vegetation

Obtaining good quality plants

The use of quality planting stock is essential for good results. Plants (whether barerooted, plug-grown or tubestock) should be ordered during the spring prior to the intended planting date to allow for seed collection and growing time.

Many nurseries will grow indigenous plants if you can supply them with locally collected seed. You may also consider growing your own nursery stock which will require an investment in some basic propagation equipment and some time. You may be surprised at how easy and satisfying this can be.

Good quality seedlings are those which are actively growing and free of pests.

At the time of planting, trees and shrubs should have a root-to-shoot ratio between 1:1 and 1:2. Smaller vigorous plants suffer little transplanting shock, and usually outgrow larger potted plants. Barerooted eucalypts should have compact, fine and prolific fibrous roots to about 12 cm with a small tap root; a root collar of about 1-1.5 cm and shoots with few lateral branches to about 50 cm tall. When purchasing plants, check that they are labelled indicating the species and provenance of the stock. (Ref. Fig 2. p.14.)

Planting time

Time your planting to avoid extremes of weather. Autumn planting is generally recommended for well drained sites as they are prone to drying out rapidly during spring (e.g. hill sites). Spring planting is recommended where severe frosts or poor drainage inhibit tree establishment. Planting lowland areas as late as November may also be possible provided weed control is adequate. A second watering may be required to insure survival through summer. Discussing the results of other planting projects in your area with locals will be valuable.

Fencing

Site preparation involves fencing, soil cultivation and good weed control. Fence the area before planting or direct seeding to prevent browsing and trampling damage by livestock. Where shrubs and groundflora are included in the planting, stock fencing may need to be permanent. Livestock may be allowed into the area to graze once the plants are established, but only on a seasonal basis for short periods at low stocking rates. Trees can be individually guarded, although fencing the entire area is often the most cost-effective means of protecting trees from stock.

Soil cultivation

Soil cultivation improves water infiltration and the root development of the plant by reversing the effects of compaction, poor aeration or lack of soil tilth. Deep ripping of the subsoils is recommended on clay, hardpan or compacted soils. Deep rip to a depth of at least 50 cm where possible when the soil is dry (e.g. summer/ early autumn) for a good shattering effect of the subsoil. Double or cross ripping will overcome the problem of tree instability caused by most roots growing along a single rip line. Avoid cultivation if planting into areas of weed-free native grasses as the disturbance encourages weed invasion. Working over an individual planting spot with a mattock or crowbar may be adequate and has an advantage over deep ripping in that weed growth from site disturbance is minimal.

Cultivation to create a soil tilth such as ploughing or rotary hoeing, may be required if the soil lacks structure sufficient to allow the roots of the planted stock to gain contact with the soil. Gypsum can improve the structure of the soil and can be applied in the late autumn before the spring planting.

Cultivation on a large scale is not always required.

Weed control

Weed control is essential to achieve high survival and growth rates. Weeds can stunt plants by out-competing seedlings for moisture, nutrients and light. Weed control may not be as necessary if planting into areas of native grasses which do not compete excessively for moisture.

Weeds are best killed prior to planting using a knockdown herbicide which can keep the plants weed free for about one year. A residual herbicide may also be used for longer term weed control depending on the soil type and location. Spray in spots (at individual planting sites), or in 1-2 m strips along the planting rows. Broad scale spraying is generally unnecessary. Weed control can be achieved without herbicides by mulching with weathered woodchips, paper, polythene or seedless straw. Mulch seedlings in spring after the soil has warmed. Mulching in autumn can be counter-productive due to keeping the soil cold around seedlings. Keep a weed free area of 60 cm radius around each seedling for a minimum of one year

Trials conducted in North Central Victoria comparing the effectiveness of different methods of weed control around trees have consistently shown that tree survival and growth is enhanced by good weed control. Best results occur when the weeds are killed early in the growing season. Once treated, weeds do not take up moisture and are unlikely to dry the soil out at the expense of the desirable plants. If plants are suffering from moisture stress due to weed growth, it is more effective and efficient to remove the weeds rather than provide additional water.

Protection from vermin

If rabbits or hares are present in the area, seedlings will require protection. A range of tree guards are commercially available, although vermin-proof fencing of the whole area may be equally efficient. A combination of fumigating, poisoning and shooting may also be advisable if vermin are in high numbers.

Watering

Watering trees at planting time will help to settle them into their new environment, but is sometimes not required if planting is implemented in the right season. Follow-up watering should not be required provided good quality seedlings have been planted into a well-prepared, weed free site at the right time of year. A second or follow up watering is recommended for cell-grown plants. Watering may also be required if the seedlings experience a particular dry season in their first year. Less frequent and thorough watering is preferable to light and frequent watering which encourages the development of shallow root systems.

Maintenance

Follow-up maintenance includes ensuring the seedlings are kept free of competing weeds and grasses during their first year. Fences should be checked regularly to ensure they are stock-proof.

Direct seeding to establish vegetation

Sowing seeds of native vegetation directly onto the plantation site is called direct seeding. If correctly planned, it can be one of the most successful and economical ways of revegetation.

Advantages include:

- the cost per plant is almost always much lower than planting tube, plug or bareroot grown stock;
- excellent root development occurs, with root to shoot ratios sometimes 10:1, making the plant far more stable and drought tolerant;
- random spacing of plants which results in a more 'natural' looking planting.

However there are several disadvantages including:

- results may be less reliable in comparison to planting;
- there is a need for larger amounts of seed compared to other methods;
- not all species direct seed with ease or reliability;
- plant spacings are more difficult to control.

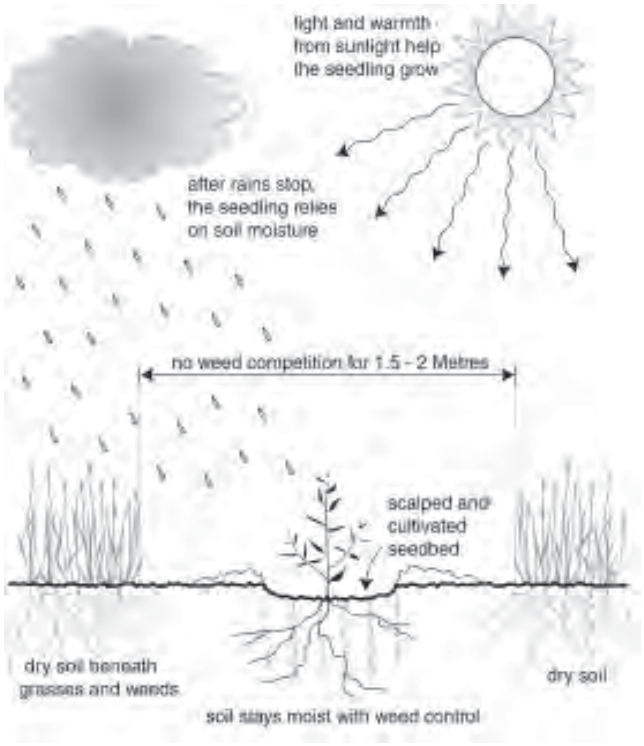

Figure 3: Site preparation for direct seeding

Direct seeding is a comparatively new practice and several issues have emerged in relation to understanding and applying this system of revegetation. For example, seed germination requirements of many species are still not well understood. There is evidence however that different kinds of sites may require different direct seeding prescriptions.

The success of direct seeding varies with a number of factors, some of which are controllable (such as weed control, time of year, species used) and some which are not (soil type, post sowing rainfall). Some sites which have been difficult include winter waterlogged sites, where spring rainfall is low or erratic, and in cracking clay soils where success is rare. In addition, non-wetting sandy soils may require application of a wetting agent with the seed to improve soil moisture. Use local contacts to help you find what is most suitable for your site.

Seed collection

Securing adequate stocks of seed is necessary and will need to occur in the year(s) before direct seeding. Either collect seed yourself (see page 21 – Seed Collection) or purchase from a seed collector. Greening Australia Victoria publishes a list of seed collectors and seedbanks for Victoria.

As a guide, the quantity of seed required for direct seeding woody plants is 200g to 500g per linear kilometre or ·5kg to 5kg per hectare depending on species, likely establishment rate and desired density.

Site preparation

Site preparation is essential and the factor that will most influence the success of a project. Weed control is a fundamental requirement, particularly in farmland conditions.

Weed control

There are essentially two options for weed control - physical removal of the weed plants and the weed seed bearing soil, or the use of herbicide to achieve the same effect.

Grading or scalping of topsoil can be used to remove the weed seedbank with general agricultural or purpose built equipment. Many direct seeding machines incorporate scalping implements and perform the sowing in a single pass.

Knockdown herbicides are commonly used and also residual herbicides which are applied to prevent the germination of weed seed. Where residuals are used, a narrow channel of soil is scraped away from the direct seeding zone at the time seeding. Tolerances to residual herbicides and rates have been observed and are discussed in some of the references below.

Preparation of seedbed

The seed bed usually requires some treatment such as scalping, ploughing or ripping. Scalping is often used although if applied in the wrong soil type can cause surface waterlogging due to subsoil clay. Alternatively, in less weedy sites, the natural soil profile can be left, with some weed control and shallow cultivation (or even no cultivation) being the only tasks undertaken to prepare the soil.

Timing

In most of North Central Victoria, direct seeding should be completed by the early spring, with the preparation being achieved over the previous year. In certain sites there are indications that an autumn or early winter sowing may be more appropriate, particularly in the free-draining sandy soils, granite rises and rainfall zones below 450 mm.

Method of seed sowing

Tractor or trailer mounted direct seeders are popular and work by creating a furrow into which a measured amount of seed is sown. Several types are available through the Department of Natural Resources and Environment and can be hired through the Greening Australia Victoria – Alcoa Revegetation Assistance Scheme at minimal cost, or contractors can be engaged. Alternatively, seed can be sown by hand. The seed is usually pressed into the soil using a light roller or rubbed over with a dragged chain, sack or tree brush.

Insect pest control

There can be several pest insects that can affect direct seeding. Some of these include:

Red-legged Earthmites – have caused severe damage. If present, there are pesticides available for their control. Signs of infestation of this tiny insect include whitening and leaf deformation.

Millipedes, Slugs and White Snails – which graze the young seedlings. These may be controlled by burning the site prior to seeding. Snail pellets are effective although domestic animals may be at risk.

Wingless Grasshoppers – which destroy young seedlings. Grasshoppers hatch and become active in late spring. Insecticides are available for their control. Direct sown trees are more resilient to defoliation than tubestock.

Ants – which will carry off the seed. This can easily be avoided by mixing magnesium carbonate in with the seed at the time of sowing. Use one teaspoonful in the seed box, it is available from the chemist. There are also several insecticidal preparations registered for use as an ant repellent seed dressing.

Aftercare

Weeds can still be a problem even when seedlings are apparently well established. Options for post-sowing weed control include overspraying with selective herbicides, or careful spot spraying or wick-wiping around individual plants or between rows.

Sites must be checked periodically to monitor any incidence of vermin, insect or grazing by animals.

Experimenting

Because there is still much to be discovered about direct seeding, your own experimenting and tinkering could contribute to the success of others. If you are trying something new, or would like to, you should consider developing a 'controlled experiment' in conjunction with DNRE or Greening Australia staff. If you are interested, Higgins (1995) provides a succinct guide. The results of such experiments will be useful for you and others in providing prescriptions for direct seeding in your local area.

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Weed control is critical to the success of direct seeding.

Streamsides: a focus for vegetation protection

Streamsides and their associated vegetation are high value areas for vegetation protection and enhancement. They generally have the greatest diversity of flora and fauna, and are natural wildlife or habitat corridors. Streamsides are also strategic areas for revegetation works, to prevent erosion and maintain water quality.

Limiting or excluding stock access along most of the streamside will protect the banks from erosion, and may allow remnant vegetation to regenerate. Additional benefits include improved water quality, land conservation and recreational opportunities. In revegetation, the first priority should be to encourage existing vegetation to regenerate. However, if competitive exotic grasses and weeds dominate the area, weeding may be required.

The following is a list of non-woody plants for streamside and dam revegetation that has been prepared for the southern part of the North Central area covered in this guide.

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Botanical name	Common name	First choice for revegetation	Propagation
Grasses, herbs and tufted plants.			
Amphibromus spp. L	Swamp Wallaby-grasses		seed
Crassula helmsii L		3	division
Lomandra longifolia #	Spiny-headed Mat-rush	3	seed
Lythrum salicaria	Purple Loosestrife	3	seed/cuttings
Microleana stipoides #	Weeping Grass	3	seed/division
Persicaria spp. *(e.g. decipiens, subsessilis)* W	Knotweeds	3	seed/division
Poa ensiformis #	Purple-sheath Tussock-grass	3	seed
Poa labillardieri #	Common Tussock-grass	3	seed/division
Rushes, Sedges, Reeds and Aquatics			
Alisma plantago-aquatica +	Water Plantain	3	seed
Baumea spp. + (Tall spp.)	Twig-rushes		seed/division
Bolboschoenus medianus ++	River Club Sedge	3	seed/division
Carex appressa L	Tall Sedge	3	seed/division
Carex fascicularis L or +	Tassell Sedge	3	seed/division
Carex gaudichaudiana L	Fen Sedge		division
Carex tereticaulis L or +	Rush Sedge	3	seed/division
Cyperus exaltatus L	Tall Flat-sedge	3	seed/division
Cyperus gunnii L	Flecked Flat-sedge	3	seed/division
Cyperus lucidus L	Tall Flat-sedge	3	seed/division
Eleocharis acuta +	Common Spike-sedge	3	seed/division
Eleocharis sphacelata ++	Tall Spike-sedge	3	seed
Juncus spp. W L	Native Rushes		seed/division
Lepidosperma laterale #	Variable Sword-sedge		seed/division
Myriophytlum spp. *(e.g. crispatum)* W +	Water Millfoil		division
Phragmites australis +	Common Reed	3	seed/division
Potamogeton spp. ++	Pondweeds		seed/division
Schoenoplectus validus ++	River Club-sedge	3	seed/division
Triglochin procerum ++	Water-ribbons		seed/division
Ferns			
Blechnum minus #	Soft Water-fern		spore/division
Blechnum nudum #	Fishbone Water-fern		spore/division
Polystichum proliferum #	Mother Shield-fern		spore/bulbils

L plant between high and low water levels W care should be taken as some exotic species are weeds

plant above high water level + can be planted underwater ++ should be planted underwater

Revegetating farm dams

Dams provide an ideal site for revegetation, yet are generally overlooked in this regard. Benefits from revegetation around fenced dams include: reduced evaporative losses, improved stock safety, shade and shelter for stock, improved water quality, wildlife attraction (and increased natural pest control), improved dam appearance and increased recreational opportunities.

The first step in improving the farm dam is usually to control stock. This enables the establishment of vegetation, prevents erosion and fouling of the water, and reduces the risk of stock drowning.

Stock can either be completely excluded from the dam by piping water to a nearby trough, or can be allowed restricted access to a section of deeper water (a gravel ramp will lessen stock impact on the dam). A small unfenced section will also allow larger native animals to drink at the dam.

A number of native birds prefer open sites near water for drinking and feeding. Extending the area of stock access to a wider section of deep water, and keeping vegetation (pasture) close cut will benefit such species.

Retain any remnant vegetation around the dam, and encourage it to regenerate. A diverse mixture of indigenous trees and shrubs should be planted to create a mosaic of thickets (if remnant vegetation is absent). The dam wall should not be planted with trees, as root growth can lead to the failure of the structure. Small shrubs and ground covers can be used instead. Try to position some of the trees so that they will eventually overhang and shade the water's edge during the summer months, allowing both waterbirds and fish to benefit.

Remnant grassy wetland with Red Gums (Eucalyptus camaldulensis)
Photo: Paul Foreman

Vegetation corridors (e.g. multi-rowed shelterbelts, erosion control plantings and timberbelts) joining dam plantings will enable wildlife to move from area to area with less threat from predators such as foxes and cats.

Suitable water plants for dams can be found in local swamps, springs, old dams and lagoons. Locally found water plants are recommended as they are adapted to local conditions and are not likely to become problem weeds. Common Reed (*Phragmites australis*), Bull-rush (*Typha* spp.) and *Eleocharis sphaceolata* can dominate shallow water areas to about 1.5 m in depth, but provide excellent cover for many waterbirds.

For wildlife around and in the dam, vegetation is the main source of security from predators. A log, a living or dead tree, or an earth or floating island can also be used to provide security and roost sites. Rocks and ground litter (branches, twigs and leaves) provides secure places for ground fauna and should be retained, if wildlife attraction is a priority.

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Shelterbelts

Strategically placed shelterbelts play an important role in farm productivity, by reducing climatic extremes and increasing yields.

Shelterbelts are best oriented at right angles to problem winds (generally cold south-westerlies and hot northerlies). Shelterbelts are most effective if they stretch without gaps for a distances of at least 12 times longer than their mature height (e.g. around 300 m long). Semi-permeable shelterbelts protect a greater area by filtering the winds, rather than blocking the wind and causing turbulence. Shelterbelts should consist of at least three rows, containing trees and lower growing plants, so as to provide a semi-permeable shield against the wind to ground level. When shelterbelts are of indigenous species and are over 20 m wide, they contribute significantly to the provision of wildlife habitat. Gaps that promote wind funnelling can be avoided by staggering the plants in the rows.

Agroforestry

Agroforestry is the integration of trees with agriculture to produce forest products, improve agricultural productivity and provide land and water benefits. There is an emphasis on design and management of commercial timber trees for multiple benefits. A carefully planned agroforestry system can be more productive than just agriculture or forestry alone. For example 8 ha of a carefully planned agroforestry project might produce the equivalent of 4 ha of forestry and 6 ha of conventional agriculture.

Red Gums at Yando. The spacing of trees is wide enough to allow pasture growth for periodic stock

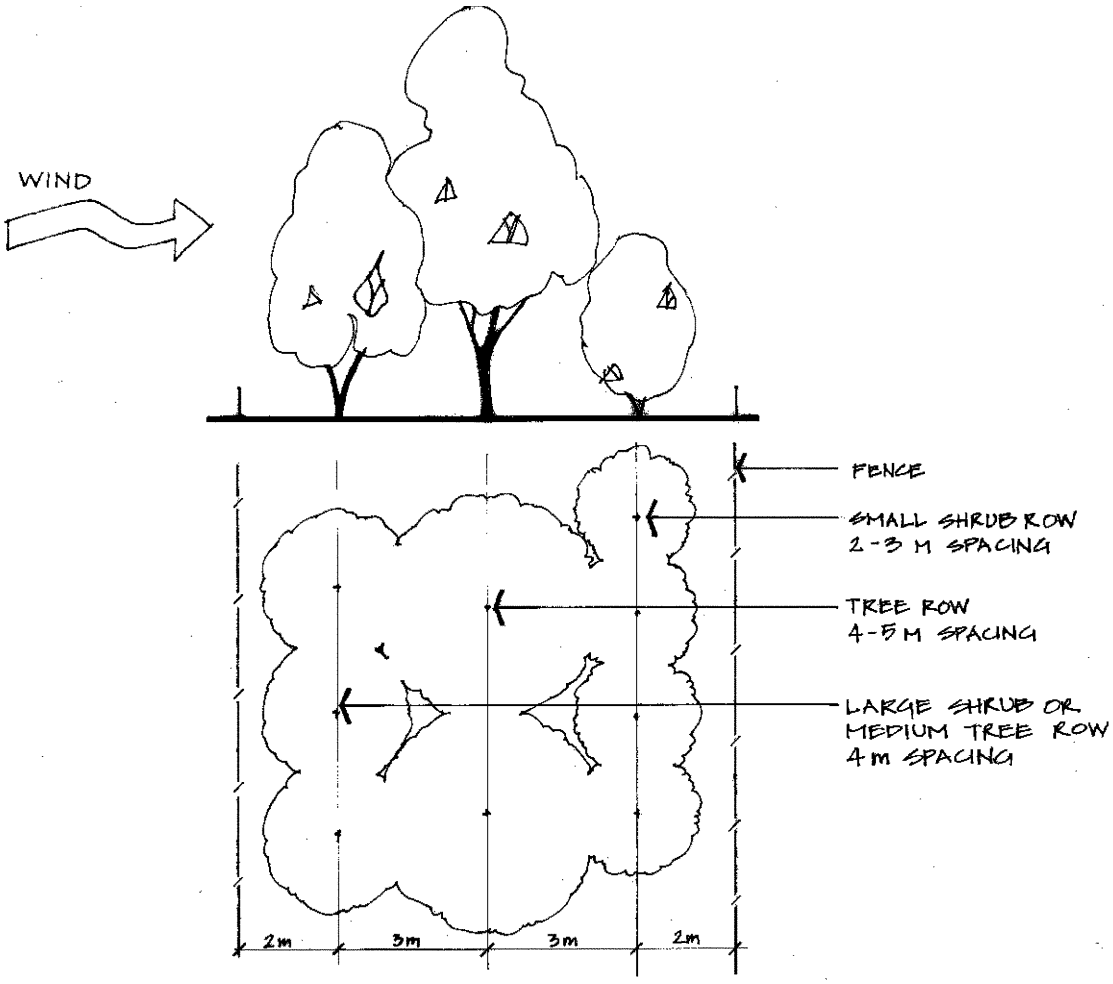

Figure 4: Multirow Shelterbelt Design.

Planning for agroforestry is sometimes thought of as a process of diagnosis and design. The problems and farm requirements are diagnosed and a solution that is specific to that site is designed. Agroforestry requires the development of some forestry skills, which can be easily learnt. Skills may include forest planning, pruning, thinning, harvesting, sawmilling, seasoning and marketing. It is important to be clear on the purpose of the trees when planting, for example firewood, pulpwood, posts, sawlog, and veneer logs or specialty timber. The purpose will determine species and site selection as well as a range of other considerations including plantation layout, management and marketing.

Assistance is available from the Department of Natural Resources and Environment and industry representatives. Additionally, Farmtree and Landcare groups are often valuable sources of locally relevant information. The North Central Agroforestry Network combines landholders, industry and government people interested in agroforestry and runs regular field events and produces a quarterly newsletter. To become a member, contact the Department of Natural Resources and Environment, Bendigo.

Further reading:

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Native plant seed collection

Introduction

Seed collection can be a simple and rewarding part of the revegetation programme. Collecting seed from most indigenous trees and shrubs is relatively easy, although specialist knowledge is generally required for the collection of native herbs and grasses (which will not be covered here).

Where possible, seed collection should occur in places that match the revegetation site in terms of geology/soil type and vegetation community. This chapter will outline factors involved in seed collection, extraction and storage.

The ethics and requirements of seed collection.

1) Seek permission

Seek permission from the landholder when collecting on private land. If collecting on public land a permit must be obtained; contact your regional office of Department of Natural Resources and Environment (DNRE) for an application form. Regional offices are found at:

Bendigo: 57 View St, Bendigo, 3550
Tel: 5430 4444

Swan Hill:324 Campbell St, Swan Hill, 3585
Tel. 5033 1290

St Arnaud:Long St, St Arnaud, 3478
Tel. 5495 1700

Additional permission is required from the land manager of the collection area. Another permit is required to collect orchids or Victorian Rare or Threatened species (VRoT's). A separate permit is also required if the area is managed under the provisions in the National Parks Act 1975 (National Parks, State Parks, Wilderness Parks and other parks and reserves), or from Reference Areas under the Reference Areas Act 1978. Information regarding these permits can be obtained from Parks Victoria (formerly the National Parks Service) through DNRE, PO Box 41, East Melbourne, 3002, tel. 9412 4011.

2) Level of collection

To ensure that remnant vegetation is not threatened by collection, permits stipulate certain conditions. These include:

•No seed or propagation material is to be taken from small populations

•A maximum of 10% of seed from a population can be taken.

3) Minimise Site Disturbance

Many areas of remnant vegetation used in seed collection are vulnerable to disturbance, especially to trampling and excessive removal of foliage. It is important that seed collectors treat all areas of remnant vegetation with care and respect.

When collecting in an area:

•Avoid excessive pruning or breaking of foliage, particularly where involving buds or immature fruit - the use of secateurs will assist in some cases, while in others hand-stripping of fruit will cause least damage;

•Take the opportunity to use fallen trees or branches caused by storms, powerline clearance or roadworks;

•Never fell trees for seed collection; and

•Watch where you walk or drive to avoid damaging small ground plants, particularly in wetlands.

4) Maintaining genetic diversity

Genetic diversity is important to the long-term survival of most species. A wide genetic base in a stand of trees or shrubs increases the likelihood that some of the individuals will be able to cope with environmental stresses such as pests and diseases, drought, frost, and longer-term influences such as climatic change.

To maximise genetic diversity, it is best to collect from as many parent plants as possible. Lone or isolated plants may have a high proportion of inbred seed due to self-fertilisation. Seedlings from inbred seed may not perform as well as those from cross-pollinated seed. Inbreeding results from breeding between closely related individuals such as plants descended from the same parent plant.

5) Keeping records

Correct labelling on the day of collection is an important but often neglected part of the seed collection operation. Label each collection with species, collection location, date, number of parent plants and collector's name. Knowing the source of revegetation plants will probably be very important in the future. If you can't identify the plant keep samples of leaves, buds, etc, with the seed.

Recognising mature fruit

Close examination of the fruiting body should be undertaken before seed is collected to ensure that viable mature seed is present!

Seed of many non-herbaceous native plants is found in woody or leathery fruit. It is important to ensure that the fruit is ripe when it is picked, as unripe fruit contains immature seed of low viability. Generally, ripe fruit of most species are available during summer. Regular monitoring is advisable, as some species release their seed immediately after ripening (e.g. wattles and bush peas), although others retain their seed for years (e.g. Red Stringybark, Prickly Tea-tree).

The seed of *Eucalyptus*, *Melaleuca*, *Leptospermum* and *Callistemon* species is found along with associated chaff in capsules. Upon ripening, capsules generally change from green to brown, becoming hard and woody. The valves (i.e. the slits in the fruit that open to release seed) become visible and pronounced and may open slightly without releasing the seed.

The seed of *Acacia, Senna, Platylobium, Pultenaea* and *Daviesia* species (i.e. wattles, peas and other legumes) is found in pods, which generally change from green to brown upon ripening. As this happens, the pods dry to a brittle texture, and will often curl into different shapes. The seed usually drops quickly for these species and close monitoring is required. *Grevillea, Dodonaea* and other genera also follow this pattern.

The seed of *Callitris* and *Allocasuarina* species (i.e. native pines, bulokes and sheokes) are found in cones. Cones also change from green to brown upon ripening, becoming woody, with valve edges becoming more pronounced.

Methods of seed collection

The methods used to collect seed depend on the species (the size of the parent plant in particular) and the amount of seed required.

Trees

Access distant fruit-laden branches by:

- shooting down the branches with a rifle;
- using a cherry picker;
- taking advantage of fallen trees and branches (e.g. storm damage); and
- using long-handled or pole pruners used from the back of a truck, depending on height.

Shrubs

Remove fruiting branches with secateurs or pruners, or alternatively hand-strip or hand pick the fruit. A drop sheet or tarpaulin spread out under the parent plant can be useful to collect falling fruit and seed. Shaking or lightly beating the parent plant with a pole will hasten the seed fall.

Some species (e.g. bush peas) eject their seed over a very short period. It is advisable to capture the seed by tying paper bags or stockings around fruiting branches a few days before anticipated seed maturity.

Seed extraction

Seed extraction involves removing the seed from the fruit and other debris. Cleaning the seed will improve the ease and success of sowing, either for direct seeding or sowing into seed trays.

Seed contained in capsules can be removed by drying the fruit, which causes the valves to open (e.g. eucalypts, sheokes, tea-trees and bottlebrushes). This can be speeded up if fruit are left attached to branches and foliage. To dry the fruit, store in a warm dry place free of seed eating insects, mice and birds. Avoid high temperatures, particularly if the seed is moist. In hot weather small capsules may open in hours. Most fruit should open within about two weeks. The seed can then be extracted by shaking, sieving and winnowing (using fans or blowing to separate waste from the seed). Some capsules may need to be shaken vigorously to ensure that all seed is released.

Seed contained in pods can be extracted by thrashing and sieving (e.g. wattles and bush peas).

Banksia seed can be extracted by placing the cones on a screen over hot coals. When the valves begin to open, the cones are immersed in cold water before drying in the sun.

Seed storage

Seeds have a variable lifespan in storage, depending on the species and the conditions they are stored in. Eucalypt seed has been known to remain viable when stored at 4°C for twenty years. Most seed in this genus, however, can be stored at room temperature (10-25°C) with some loss of viability after 5-10 years depending on the species. Sheoke seed however has been shown to lose viability after 18 months if not refrigerated, and seed of some of the Daisy bushes should be sown within 1-2 months or else very little germination will occur.

Optimum storage conditions for most species are as follows:

•Temperature at 1-5°C (with minimal fluctuations)
•Relative humidity at 4-8% (with minimal fluctuations)
•Sealed containers containing as much seed as possible
•Ensure the seed is thoroughly dry before storing.
•Ensure seed is insect-free, as insects can consume large quantities of seed. As a precaution, seal a moth ball in with each seedlot and remove after a week or two following fumigation.

Each seedlot should be labelled with species, provenance, collection date, number of parent plants and collectors name.

Further reading:

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Landcare TG/005 *How to collect seed from native trees and shrubs.*

Vens Creek Nursery near Boort.
Photo: Paul Haw

Native plant propagation

Introduction

Propagating can be a very rewarding activity and requires a few basic skills. This chapter explains the basics of how to propagate native plants from seed, cuttings and division.

Seed is generally the most convenient way of growing plants and ensures that most genetic variation is captured. Cuttings rooted into a prepared medium will work for many of the softer-tipped species. Division is a simple form of propagation involving the separation of root sections or basal growth. This is usually limited to herbs and grasses. Cuttings and division are done when it is difficult to grow the plant from seed.

Potting mixes

Plants propagated in containers require special potting mixes - not just soil from the ground. Whilst potting mixes vary for different types of uses, all potting mixes must be able to supply sufficient water, air and nutrients to the plants roots to be successful. Because pots can dry quickly, the mix must incorporate materials that retain water. To supply air to the roots, the mix should also be open and free draining. Fertilisers are also added to feed the plant.

There are many materials that can be used in a potting mix. It is important however that they are not toxic (e.g. with salts or acids) and are reasonably sterile. Materials may include combinations of:

•Sand/coarse sand – is used to provide support for the growing plant and allow free drainage of water;
•Peat – is organic and has a high water-holding capacity;
•Composted bark or woodchips – serve much the same purposes as peat but can use up nitrogen as they decompose so additional nutrients are required for successful plant growth;
•Coconut fibre – has a high water-holding capacity and can increase the porosity or openness of a mix;
•Rice hulls – are also used to increase porosity;
•Perlite – has a high water-holding capacity whilst being fairly porous
•Fertilisers can include ground-up manure, dry fertilisers (e.g. blood and bone, potash, micromax), soluble fertilisers (e.g. Thrive, Maxicrop or Aquasol) or slow-release fertilisers (e.g. Osmocote or Nutricote).

The incorporation of soil into a mix can be useful for certain species because of the beneficial microorganisms it contains. Problems may occur due to weed seeds and pathogens (e.g. bacteria and fungi). By partially heat-sterilising the mix to a specific temperature for a period of time, many of these weed seeds and disease-causing organisms are killed and some beneficial microorganisms are preserved.

Commercial mixes, suitable for different propagation methods, are available from larger nursery suppliers or specialised outlets. It is advisable to speak to someone who has had experience with various 'recipes' of potting media and growing local plants to assist in determining the best product for your situation.

Propagation by seed:

Seed can be germinated either in trays and the seedlings then pricked out, or they can be sown directly into the tubes or cells they are to be grown in. Sowing first and then pricking out is best when there is only a small amount of seed available or where the seed takes a long time to germinate. Direct-sowing into the pot is preferable for trees and shrubs to avoid disturbance to the roots which can affect the stability of the mature plant. (It is essential that the roots are not bent, kinked or curled within the pot because as the tree or shrub grows, these bends can weaken the plant and cause it to strangle itself and/or fall over.)

Seed dormancy

Seed from many native species will germinate readily if conditions are favourable. If the seed does not germinate under these conditions, then seed is described as being dormant. Seed dormancy works in nature to block germination until a favourable time for survival arises. This time is signalled by a trigger of some type. There are many types of dormancy mechanisms and ways in which they are overcome. For example, seeds with hard coats (e.g. wattles and bush peas) must be 'scarified' to break the seed coat and allow water and air to get to the seed. This seed coat breaking occurs naturally during fire and allows the seed to germinate when competition for light and water is low. Some common methods for overcoming different types of seed dormancy are described below.

Scarification

This is important for many hard-seeded species including most in the Fabaceae (the peas) and Mimosaceae (Acacia) families. Pouring boiling water over the seed and leaving it to soak for several hours before sowing will soften the seed coat. There should be at least ten times as much water as seed. Smaller seeds often need a shorter hot water treatment - water can simply be poured over seeds in a sieve to achieve this. Mechanical scarification is another method whereby the hard seed coat is nicked or filed with a knife or sandpaper. Machinery is available to do this for large quantities of seed.

Stratification

Seeds from species adapted to cold environments may need to be stratified or moist chilled to break dormancy. To do this, mix the seed with moist sand in a plastic bag and refrigerate for 3-6 weeks. Germination should begin within a week after removal from the refrigerator, and may even occur in the fridge for some species.

Smoke treatment

It has recently been shown that the seed of some plants germinate after exposure to smoke. This trigger occurs in nature during bushfires and afterwards when competition from established plants is reduced. Smoke can be applied as smoked water or by directly smoking the seed. More details are available in Ralph (1997) and Anon (1997) listed below.

Acid treatment and fermentation

Acid treatment such that occurs through the gut of an animal (such as a bird) can soften the seed coat and release inhibitors. Feeding seed to a bird and collecting the droppings is sometimes recommended as an effective method. Allowing the seed to ferment in a plastic bag with a small amount of water for 2-3 weeks may also break the seed's dormancy. Fleshy fruited plants like Coprosma, Hymenanthera and Nitraria respond to these treatments. A dilute solution of hydrochloric acid may also be used for certain species.

Leaching and after-ripening

Some species have chemical inhibitors in parts of the embryo or seed coat. These prevent germination for a period of time, or until rain has washed the inhibitor out of the seed. The leaching of inhibitors from the seed can be done by soaking the seed in an old nylon stocking in a toilet cistern for 1-10 weeks. After-ripening is a common dormancy mechanism for some grass species. It is overcome by storing the seed for several months. Dormancy can be occasionally be broken more quickly if seed is stored at high temperatures (30°C – 60°C) for short time periods.

Containers

Containers for sowing seed must have adequate drainage holes in their bases. Recycled margarine or ice cream containers can be used if enough holes have been pierced in their bases for drainage.

As a guide, a 12-cm pot can be used to raise up to 20 seedlings while a 30-cm x 50-cm seed tray will provide space for several hundred seedlings. Recommended pots include the speedlings or cell trays (such as those produced by Lannen and Hiko), or standard square tubes (50 mm x 50 mm x 125 mm). Of these options, cell trays are the cheapest since they use less potting mix and fertiliser. They do require close attention though, because of their tendency to let the plant dry out or mature more rapidly.

For plants in tubes, air pruning of the roots is recommended and can be achieved by packing them into wire trays and keeping them off the ground.

Growing mix for seeds

The type of growing mix depends on whether you are just germinating the seed or actually growing it on in that mix. Germination mixes must be free draining (waterlogged mixes can be a haven for root rotting fungi in seedlings). They do not need added fertilisers since the nutrition for the seedling is stored within the seed itself. Additional nutrition only becomes important once the seed is pricked out.

A suitable germinating mix comprises:

•1 part composted bark/fine woodchips/peat/perlite vermiculite

•1 part course sand

If the seed is to be directly sown into the mix and left in the container for growing on, then the mix can be varied slightly:

•6 parts composted bark/fine woodchips;
•4 parts coarse sand;
•1 cocoa peat.

The pH (measurement of acidity) should be about 6.0. The introduction of root rot (e.g. Phytophthora spp.) through contaminated seedlings, soils or potting mixes should be carefully avoided.

Sowing time and temperature conditions

Correct timing is important. As a grower, you should aim to produce plants that are actively growing at the chosen planting out date. At planting time, the shoots of the plants should not be more than twice as long as the roots.

Most seed is best sown when temperatures are sufficiently warm, and around five to eight months ahead of the intended planting date. The ideal temperature for germination varies between species. Many will germinate when daily maximum temperatures exceed 20°C. For some species on the other hand, Bursaria for example, low temperatures and short day lengths trigger germination. Table 1 provides a list of species with their optimum germination temperatures.

If you decide to sow when daily temperatures are below 20 C, you may require a greenhouse and some form of heating. If sowing during late spring to summer, you may require a shadehouse to provide a warm but sheltered site. Alternatively, a site beneath shrubs (with dappled light), or a sunny room may suffice.

Sowing procedures

Seeds can either be sown into trays and later pricked out and transplanted into pots, or sown directly into tubes.

a) Into seed trays

Level and firm the soil surface and scatter the seed evenly. Avoid sowing seed too thickly as this encourages spindly growth and fungal disease. Cover the seed to a depth of no more than twice its diameter with finely sieved soil.

Water the seeds in and label with species name, location of collection and date sown. Keep the seedbeds moist but not wet by watering with a fine mist spray. Alternatively, the tray can be stood in a container of water. This method, known as the Bog Method, is useful to prevent a very fine seed, such as Eucalyptus seed, from washing away due to overhead watering. Remove the tray from the water about a month after germination to reduce the risk of fungal infection. Acacia seed and seed from the pea family (Fabaceae) should not be raised using the Bog Method.

b) Directly into tubes

Direct seeding into tubes will result in better root development, as problems of distorted or girdled roots caused by careless pricking out of seedlings are avoided. Surplus seedlings can be thinned out by cutting them off, or by pulling them out after thorough watering. Direct seeding also allows greater flexibility in the schedule as thinning out to one seedling per tube can largely be carried out when time permits (e.g. within the first month or two after germination).

For species with large seeds (e.g. Acacia), place 3-5 seeds on the soil surface of each tube and cover with soil to the correct depth. For species with very small seeds (e.g. Eucalyptus, Leptospermum and Callistemon), place a pinch of the seed on the soil surface.

Transplanting

The roots must not be bent when pricking out! Care in pricking out is critical in producing quality plants with good root systems. When the seedlings are approximately 5-10 mm high they should be carefully pricked out into individual containers. Roots formed to 1-2 cm long are ideal for pricking out. Longer ones are more likely to be damaged or kinked and can be cut to a manageable size. Shortening the roots does not kill the seedling. Prick out the seedlings as follows:

Table 1. Optimum germination temperatures for native plants

Botanical Name	Common Name	Optimum Germination Temperature Range (°C)
Allocasuarina leuhmannii	Buloke	25
A. verticillata	Drooping Sheoke	25-30
Bursaria lasiophylla	Hairy Bursaria	mid-winter temperatures
B. spinosa	Sweet Bursaria	mid-winter temperatures
Eucalyptus albens	White Box	25
E. camaldulensis	River Red Gum	35
E. globulus ssp. *bicostata*	Eurabbie (Blue Gum)	27
E. macrorhyncha	Red Stringybark	16
E. melliodora	Yellow Box	27
E. obliqua	Messmate	21
E. polyanthemos	Red Box	32
E. radiata	Narrow-leaf Peppermint	21
E. rubida	Candlebark	27
E. sideroxylon	Mugga (Red Ironbark)	21
E. viminalis	Manna Gum	27

•water the seedlings thoroughly (this allows easy removal and prevents damage to the seedling);
•hold the seedlings by the leaves (in order not to damage the stem) and gently lever it out of the soil with a fine dibble stick (e.g. a pen or knitting needle);
•suspend the seedling in the individual container and fill around the roots, rather than trying to feed the roots into a dibble hole;
•fill the soil within 0.5 cm from the top of the container;
•place the pricked out seedlings into a shady area and water thoroughly.

If you have used the direct seeding method, you should remove all but one seedling – surplus seedlings can be cut off, or pricked out for use as replacements where other seedlings have failed.

Tending

Gradually reduce shade cover over the seedlings and always keep them well watered. Harden them off at the end of the growing season by removing all shade and spacing out the interval between watering. (Do not let the plants dry out.)

Propagation by cuttings:

While most native species are easily grown from seed, some species grow more readily from cuttings. This method of propagation is used when plants are being selected and propagated for specific genetic qualities.

Generally, the best results are achieved when cuttings are taken from half-hardened wood. This is usually available in mid to late summer for spring flowering species. (Consider this as a guide, as cutting material can often be obtained at any time of the year during a good season.)

Cuttings should be about 15-20 cm long, and ideally collected early in the morning when plant material is turgid. Immediately place cuttings into wet newspaper in plastic bags. Keep material as cool as possible until used. Some species may be refrigerated up to 1 week prior to use. Label each collection to avoid confusion.

Tip cuttings are also effectively propagated for some species. These cuttings should be about 5-10 cm long. Using a sharp tool, make a clean bottom cut just below a node (i.e. a point on the stem from which a leaf, whorl of leaves or petiole emerges), and a top cut above a node nearer the tip. Remove all leaves from the bottom two thirds of the cutting and buds or flowers if present.

A basic growing mix for cuttings is:
•1 part coarse river sand;
•1 part perlite;
•1 part peat.

Container depth is best kept below 12 cm. Root promoting substances can be experimented with: responses to this will vary between species. Avoid overcrowding the cuttings (disease may otherwise be encouraged). Water them in and keep the growing mix moist but not saturated. Maintain high humidity around the cuttings, and keep the foliage cool by spraying it several times a day if possible. Heat beneath the cuttings will improve the strike rate but is not essential.

Roots will form at any time within 3 to 20 weeks depending on the species, cutting material, potting mix and time of year. Once a sizable root system has developed the cuttings can be potted on. (Refer to Transplanting, p.25.)

Propagation by division:

This is a simple method and involves taking a plant from the ground or a pot and cutting it into several pieces that all bear both roots and shoots. It is important that the division has at least two or three connected roots and shoots for it to survive. New divisions must be watered regularly and should not be allowed to dry out until they have recovered from the loss of roots experienced during division.

Many grasses, herbaceous plants and wetland plants are suited to division, as are suckers from some shrubby plants such as several Melaleuca and Acacia species.

Advice and permission (where appropriate) should be sought before attempting to remove uncommon plants from remnant vegetation.

Disease prevention

A few simple yet effective hygiene measures can prevent the loss of a crop of seedlings. Avoid spreading plant diseases in soil attached to tools, benches, gloves and reused trays and pots. Make a habit of washing your hands, tools and work areas regularly. Consider using a disinfectant if disease has been a problem with your plants in the past. Disinfectants can be purchased from nurseries or chemists, or made up using household laundry bleach (20-ml bleach: 1-L water). Reused pots and trays should be soaked in the disinfectant for 5-10 minutes, as a precaution.

Avoid conditions of poor ventilation (prone to high humidity) and cold, wet conditions (aggravated by poorly drained soil mixes and over-watering).

Table 2. Propagation diseases

Disease	Symptom	Cause	Treatment
Damping Off	Rotting of seeds or seedling stems, beginning in a patch and spreading.	Fungus species that become active during warm moist conditions.	Promptly soak the tray in a soil fungicide. Repeat if necessary. Avoid watering late in the day.
Root rots and stem rots	Roots or lower stem become soft and brown. Seedlings may fall over.	Fungus species that becomes active during wet, misty conditions.	As above .
Leaf spots	Brown spots on dead plant tissues or leaves. Growth slows. Death may result.	Fungus species that becomes active during humid conditions.	Apply fungicide. Isolate infected stock Reduce watering during hot weather (to reduce humidity). Increase ventilation.
Mildew	Grey, powdery, felt-like covering or stain.	Humid conditions.	As above .

Further reading:

Anon. (1997). *Vegetation establishment techniques*. Notes from 1997 Seminar and Training Program, Greening Australia Victoria.

Burke, S. (1990). *Growing trees by direct seeding.* Department of Conservation & Environment. Melbourne.

Elliot, W.R. & Jones, D.L. (1990). *Encyclopaedia of Australian plants suitable for cultivation*. Vol 1. Lothian. Melbourne.

Handreck, K. & Black, N. (19850. *Growing media for ornamental plants and turf.* University of New South Wales Press, Sydney.

Hartmann, H.T., Kester, D.E. & Davies, F.T. (1990). *Plant propagation: principles and practices.* Prentice-Hall International, New Jersey.

Langkamp, P. (1987). *Germination of Australian native plant seed.* Inkata Press, Melbourne.

Ralph, M. (1997). *Growing Australian native plants from seed.* Self-published, Fitzroy, Victoria.

Stewart, D. & Stewart, R.E. (1995). *A complete guide to growing Australian trees and shrubs from seed.* Agmedia, East Melbourne.

Roadside remnant vegetation

Why is it so important?

Roadside remnants are vitally important for nature conservation. In some cases they contain the only remaining examples of intact ground flora. For example, paddock remnants may only contain 5% of the original flora while the roadside remnants might retain considerably more diversity. Roadside remnants are of even greater value where reserves aren't common.

Just as importantly, roadside remnants often provide a corridor for wildlife movement that otherwise does not exist. This is most important for birds but can play a role for insects and mammals as well as plant pollination.

Roadside remnants often provide us with a continuous linear example of what the local vegetation may have looked like and how it changed across the landscape. This information is not only important to ecologists but is enormously important for revegetation in the farm paddock as it can provide a model for revegetation.

How to manage a roadside remnant

The first thing to be considered is the question of "where are your good roadsides?" Basic plant identification skills are enough to help you with this task. Excellent guidelines for assessment of roadside vegetation and Assessment Sheets are available free from the Roadsides Conservation Advisory Committee (see further reading below). Some regions of Victoria have well developed Roadside Management Plans and categorise areas of high, medium or low value.

Objectives for roadside management

Protect – indigenous vegetation
– rare or threatened flora or fauna
– cultural and heritage values
– community assets from fire

Enhance – indigenous vegetation communities
– fauna habitats and corridors

Maintain – safe functions of the road
– indigenous vegetation communities
– fauna habitats and corridors
– visual amenity and landscape qualities
– water quality

Minimise – land degradation
– spread of weeds and vermin
– spread of soil borne pathogens
– risk and impact from fire
– disturbance during installation and maintenance of service assets

Once the conservation values of the roadsides have been mapped, then a strategy to manage the roadsides can be developed according to a set of roadside management objectives. This will need to take into account the various needs of different interest groups – there are many! Stock graziers, electricity suppliers, road safety bodies, the Country Fire Authority, local government, wood collectors, adjoining farmers and conservation bodies all have an interest in the way the local roadsides are managed. This can create many issues which need to be resolved. Issues can be categorised as:

Functional
- Firewood collection and timber harvesting
- Fire prevention
- Installation and maintenance of services
- Road construction and road widening
- Road maintenance
- Stockpile and dumpsite management
- Vegetation removal
- Vehicle and machinery activity
- Water supply catchments

Cultural and Recreational
- Cultural and heritage values
- Horse riding
- Visual amenity and landscape values
- Wayside stops

Landcare
- Apiculture
- Cropping and haymaking
- Grazing
- Insect pests
- Moving livestock
- Pest animals
- Ploughing, cultivating and grading
- Revegetation and site rehabilitation
- Weeds

Roadsides are often the only remnants of native vegetation in a region, forming valuable corridors for wildlife.

Conservation

•Native grasslands and grassy woodlands
•Protecting and conserving remnant indigenous vegetation
•Rare, threatened or significant flora and fauna
•Regeneration of native plant communities
•Roadside marking of special environmental areas
•Unused road reserves
•Wetlands
•Wildlife habitat
•Wildlife corridors

Part of the strategy plan may include roadside action plans which are prepared for individual roads. These should be a brief works programme that will enable conservation values and other uses to be managed compatibly. The roadside strategy plan should be a document

Further information

Anon. (1995). *Roadside management planning – background and guidelines.* Roadside Conservation Committee of Victoria, East Melbourne.

Breckwoldt, R. (1990). *Living corridors.* Greening Australia Ltd., Canberra.

Ern Perkins (undated) *Roadside conservation values.* Poster by the Shire of Mount Alexander (Maldon District).

The Roadside Conservation Advisory Committee can be contacted at PO Box 41, East Melbourne, 3002 or on 03 9412 4048.

Mistletoe ecology and management

Introduction

Mistletoes are an important and natural component of the Australian environment, providing habitat for many birds, mammals and insects. Mistletoes are semi-parasitic, producing their own energy through photosynthesis, while relying on its host for the supply of mineral nutrients and water. Excessive mistletoe populations may indicate an imbalance in the environment, with the need for remedial action to create a more balanced environment.

Ecology

A wide range of trees host mistletoe, particularly species of *Eucalyptus*, *Acacia*, *Casuarina*, *Banksia* and several introduced trees.

Mistletoe is an important part of Australian ecosystems. Many mistletoes flower at times when other sources of nectar and flowers are scarce, affording a valuable food source for many birds, insects, possums and gliders. Mistletoe fruit is a vital part of the diet of the Mistletoebird and various honeyeaters including the painted honeyeater (classified rare in Victoria). The dense foliage provides refuge (perching and nesting sites) for various birds. Possums use the clumps of foliage for daytime shelter and as a food source. Many species of butterfly (e.g. *Delias* spp.) rely on mistletoe foliage as a source of food (with caterpillars defoliating whole plants).

Effects of mistletoes on host plants

In most cases, mistletoe does not significantly harm host plants.

Hosts supporting high numbers of mistletoe plants may lose vigour for the following reasons. Firstly, host plants may suffer more severely from drought stress than plants free of mistletoe, as mistletoe uses water freely. Secondly, mistletoe may reduce host vigour by withdrawing mineral nutrients. Thirdly, mistletoe reduces the amount of foliage on host plants, perhaps reducing vigour due to reduced photosynthesis. Height growth rates are generally affected more than diameter growth rates.

Host death often coincides with high numbers of mistletoe plants particularly in the upper third of the canopy. Host plants may be killed directly by mistletoe, although death probably results from a number of stresses (e.g. soil compaction, drought, imbalances in the local environment, due to the removal of understory plants), one of which may be mistletoe. Increasing mistletoe populations therefore may be useful in indicating an unhealthy or imbalanced environment that requires remedial action.

Mistletoe occurrence

There is a greater occurrence of mistletoe on plants isolated in paddocks, on roadsides, on the forest edge and in semi-cleared land. This may be due to the birds that disperse the seed (that perhaps have a preference for open habitat), and the fact that open grown trees retain their lower limbs and, with them, mistletoe plants. It is possible that the prolonged absence of fire in many agricultural areas has led to a mistletoe population

buildup, as mistletoe is sensitive to fire. The decrease in brushtail possums (which feed mistletoe foliage) may also contribute to increasing mistletoe populations in some areas. Applications of fertilisers, and general decline in tree vigour and health due to old age, insects and exposure to climatic extremes may also be relevant factors in the apparent increase in mistletoe populations in some areas.

Mistletoe management

Considering the ecological importance of mistletoes in the Victorian environment, one should first ascertain whether any action to control it is desirable. Where mistletoe populations are very high, this should be seen as an indication of an 'unhealthy' environment, requiring long-term remedial action aimed at creating an environment with a greater degree of ecological health.

Creating a healthier environment for existing trees involves reducing stresses such as soil compaction and isolation (with associated exposure to wind and insect attack). This may be achieved by fencing out affected trees or clumps of trees and encouraging their regeneration, and the growth of understorey plants (e.g. shrubs and groundcovers) in the vicinity. By connecting these areas undergoing restoration with other vegetated areas, wildlife (which potentially includes mistletoe predators) may be encouraged to move into the area. Eventually tree regeneration will lead to the demise of some mistletoe plants due to shading. Revegetation and regeneration will not guarantee the survival of individual trees, but it will help to ensure the survival of native vegetation in the vicinity, with associated benefits to farm productivity.

Where there is concern over the health of individual trees due to high mistletoe numbers, short-term control measures may be considered. Options include:

•Cutting off the mistletoe. Ensure removal of entire plants to prevent resprouting. A 'cherry picker' may be required to gain access to large trees.

•Burning the mistletoe. Mistletoe is usually killed by low intensity fires, whereas host eucalypts can recover.

The above options can be used to achieve only a temporary reprieve, as they fail to address the underlying causes of mistletoe abundance. However, such measures can be used to complement long-term strategies of improving the ecological health of the environment and so achieve a balanced state where mistletoe is not present in excessive numbers.

Nursery growers of local plants

Information contained in the following list of nurseries was current at the time of publication. Those with an asterisk (*) prceding the name are found just outside the North Central Victorian area, but may grow plants for a part of the region.

- Acres Wild
  Robin Baker
  170 High Street
  Woodend, 3442
  Phone 5427 2007
  Note: Acres Wild deal exclusively with plants of theMacedon Ranges

- Boort Farm Trees
  GI & VE Keeble
  "Minmindie"
  RSD 4
  Boort, 3537
  Phone 5455 4283

- *Ballarat Indigenous Nursery
  Tim Dombrain and Meredith Alexander
  RSD R572
  Dereel, 3352
  Phone 5346 1495
  Open by appointment

- Creswick Nursery
  Neville Monson
  PO Box 3
  Creswick,
  Phone 5345 2502
  Open from 8 to 4.30 weekdays and
  10 to 4 on weekends and public holidays

- *Donald Nursery
  Jeff Rye and Coonie Smith
  Sheep Hills Rd (PO Box 3)
  Donald, 3480
  Phone 5497 1244
  Open from 9 am

- EmCee Trees
  Gary Hutton & Merri Hogan
  RMB 4322A
  Moonambel, 3478
  Phone 5467 2204

- Gannawarra Trees
  Colin Pearce
  Carwardines Rd
  Gannawarra,
  Phone 5456 3027

- Goldfields Revegetation P/L
  Marilyn Sprague
  Tannery Lane
  Mandurang, 3551
  Phone 5439 5384
  Open from 9 to 5, seven days a week

- *Greenfingers Nursery
  Peter Pianta and Athol Fraser
  PO Box 135
  Stawell, 3380
  Phone 5358 1364
  Open 8.30 till 4 weekdays.

- Kanbowro Creek Nursery
  Micheal O'Brien
  Thompsons Rd
  Leitchville, 3567
  Phone 5487 1485

- *McKindlays Riverine Nursery
  John and Deb McKindlay
  Perricoota Rd
  Moama, 2731
  Phone 5483 6240
  Open by appointment

- Natural Resources Conservation League
  Rochester Nursery
  Scott Wise
  Northern Highway, PO Box 163
  Rochester, 3561
  Phone 5484 3777
  Open 8 to 4.30 weekdays

- Sandhurst Nursery
  Bruce McGowan
  Cnr John St and Crane St
  North Bendigo, 3550
  Phone 5442 2152
  Open 8.30 to 5 weekdays and 10.30 to 4 on weekends

- The Propagation Unit
  Helen Newell or Faye Cameron
  Marnoo Cell of ARCIS
  Marnoo, 3387
  Phone 5359 2241

- Traditional Plants
  96 High Street
  Wedderburn, 3518
  Phone 5494 3033

- Vens Creek Nursery
  Bradley, Paul and Cathie Haw
  PO Box 184
  Boort, 3537
  Phone/Fax 5455 2476
  Open by appointment

- *Wail Nursery
  Lynn Wolfe
  Forest Rd (off Western Highway)
  Wail, 3414
  Phone 5389 1733
  Open 8 to 4.30 weekdays.

- Woodlea
  David Allen
  RMB 2420
  Mitiamo, 3573
  Phone 018 590 265
  Seller of Old Man Saltbush

- *Yambuna Native Plant Nursery
  Dianne Plattfuss
  RMB 1725, Scobie Rd
  Tongala, 3621.
  Phone 5859 6201
  Open 9 to 4 Thursday to Monday

Regional Indigenous Seedbanks are located at Swan Hill, Echuca and Creswick. For more information contact Greening Australia Victoria on (03) 9457 3024.

Section 2

Planting Zones Maps

and

Planting Zone Profiles

Introduction to planting zones

What is a planting zone?

The planting zones in this book attempt to group vegetation patterns in a very broad sense for revegetation purposes. The zones are based on a more complex system of 17 Land Management Units (LMU) found in the area. The LMUs are very closely linked to the geology and geomorphology of the landscape, often suggesting the likely topography and soils. In turn, this provides a strong indication of what vegetation is likely to grow well in a given place. This is because each type of soil and topography largely determines the amount of water available to the plants, as well as the levels of soil nutrition, light and warmth the plants are exposed to.

Limitations of the planting zones

In this book North Central Victoria has been divided into six general planting zones for ease of use. Because these zones are a much simpler version of more complex Land Management Units (LMU), much detail is lost. The planting zones described and the species suggested can only be a very general solution for your site. For this reason an understanding of local vegetation is often more useful for planning revegetation. Local information and experience is much more accurate and therefore should be used where possible.

Good local information can be found in experts with local knowledge. People with this experience can include Department of Natural Resources and Environment staff, Landcarers, Greening Australia Rural Facilitators/Nursery Growers/Regional Seedbanks, Field Naturalists and many who are revegetating their own properties. The amount of experience they can offer will vary according to the person, but they will all be able to help you get a better idea of what may work best in your planting.

An understanding of local vegetation is often best obtained by visiting nearby remnants. These often occur along roadsides, in reserves and sometimes on neighbouring properties. The local remnant should match your project in terms of slope, aspect and soil type to give a good indication of what may have once grown on your site. It can be very valuable if you spend some time in a nearby patch of remnant bush observing where different groups of plants grow.

The planting zones used in this book are described below:

Sedimentary

Sedimentary landscapes are formed from decomposed sedimentary rocks. Sedimentary soils in the classification of this book are quite variable, with particles both large (sands) and small (clays). Sedimentary rock was originally formed from deposited sediments from streams, lakes or the sea. Because sedimentary soils are made of very old and weathered particles, they are often relatively low in nutrients.

Sedimentary soils can be vulnerable to sheet, track and gully erosion, some surface sealing, and minor salting at the base of hills, depending on the location.

Volcanic

The volcanic landscapes described in this zone are those which have been formed by volcanic activity, usually in the more recent past. Typically these are relatively new soils and as such may have higher levels of nutrients. Often, hard basalt rocks may be present, and the soils are formed from weathered volcanic material. Soils in these zones may consist of red gradational soils, grey cracking clays or brown duplex soils (often containing buckshot).

While volcanic soils are relatively fertile, the clays hold water very well. This can lead to waterlogging in the winter months, making revegetation works difficult. Planting of many species is probably best delayed until spring to avoid waterlogging during establishment. Tree establishment on reactive cracking clays in some areas of the volcanic planting zone is difficult as deep cracking over the summer months can break the root system of young trees. Overall, volcanic soils are quite stable, although they are vulnerable to some minor salting and sheet erosion, and are relatively easily compacted on the surface (for example, by livestock).

Because the volcanic soils are so productive, little of the original vegetation is left.

Granite

Granitic landscapes are composed of decomposed granite rock that has been exposed by erosion of overlying rock. This is a hard rock that is formed from molten material that has slowly cooled deep beneath the earth. The slow cooling allows large mineral crystals to form, such as quartz and feldspar, as it solidifies.

The granitic soils we see tend to have highly permeable topsoils of low nutrient status. The ability of the soils to hold water and nutrients is low because of the coarse nature of the soils. Tree losses can occur if the summer is dry, so autumn planting/sowing may be best. Granitic soils are vulnerable to minor sheet and gully erosion, and some salting on low hills. Salting at the base of low hills is sometimes treated with 'break of slope' tree planting, where trees are established as the slope levels out and this intercepts the water flow. Not only does this help prevent a saline water table from rising, but it also offers an opportunity for timber growing in an otherwise dry planting zone.

Riverine Plain

The Riverine Plain is formed from sediments deposited by floods. The soils are often made of fine silts and clays, with some sand deposits from prior steams occurring in northern areas. In some areas, the soils have been scooped out by the wind causing 'lunettes' or crescent shaped dunes to form. These are often found on the eastern sides of lakes and former stream beds. The township of Boort is built on an enormous lunette. Gilgais, low mounds or depressions around 2–4 metres apart, are also common. They are formed either by topsoil crumbling into cracks in the clay or by water preferentially

entering the soil through the cracks causing the subsoil below to swell and push the surface up to form low mounds.

With winter rainfall, the Riverine Plains tend to become waterlogged, so traditionally planting or direct seeding has been left until the spring when the soils are beginning to dry. Lunettes, because they are higher and tend to dry more quickly, do not suffer this problem.

Riverine Plain (subject to flooding)

The Riverine Plain subject to flooding is the Riverine Plain described above where it is still subject to flooding in winter by the Murray and its tributaries. Although natural flow patterns have been greatly altered by human regulation of the streams, flooding still occurs, particularly along the unregulated Avoca River. The soils are typically heavy clays and silt deposits. Establishing indigenous vegetation in these areas can be difficult because of flooding, and spring establishment is likely to be the most successful. Any plantings here must use species that are tolerant of being waterlogged for extended periods.

Marine Plain

The Marine Plain landscape incorporates areas of true Marine Plain, as well as some areas of Mallee Plain that occur in the far west of the North Central CMA area. It only occurs in areas of below 500 mm rainfall. True Marine Plains consist of former marine deposits from times when the area was once beneath the sea. The areas are often characterised by eucalypts with a 'mallee' habit. The 'mallee' habit is seen by the many tree stems that arise from an underground swelling with many buds – an organ called a 'lignotuber'. The 'mallee' habit evolved so the tree could re-shoot after fire. Seed regeneration on the light sandy soils of Marine Plains is often difficult because they dry very quickly and sometimes repel water. When trying to revegetate in this planting zone it is important that plants have good access to water when young. Direct-seeding is sometimes done with a bituminous binder to retain water, and wetting agents can be used to overcome water-repellency. Autumn sowing/planting is often advisable as sandier soils tend to dry out very quickly in summer and they do not typically become waterlogged.

Further information

More detailed information about the land systems and soils in the North Central Victorian area is available from some of the following:

Badawy, N.S. (1984). Soils of the eastern Wimmera, Victoria. State Chemistry Laboratory, Soil Science Section, Research Report Series No 189. Department of Agriculture, Melbourne.

Butler, B.E., Blackburn, G., Bowler, J.M., Lawrence, C.R., Newell, J.W. & Pels, S. (1973). A geomorphic map of the Riverine Plain of south-eastern Australia. A.N.U. Press, Canberra.

Cochrane, G.R., Quick, G.W. & Spencer-Jones, D. (1991). Introducing Victorian geology. Victorian Division, Geological Society of Victoria.

Conn, B.J. (1993). Natural regions and vegetation of Victoria. **In** Foreman, D.B. & Walsh, N.G. (eds). Flora of Victoria. Volume 1. Inkata Press, Melbourne.

Lorimer, M.S. & Rowan, J.N. (1982). A study of the land in the catchment of the Avoca River. TC-15, Soil Conservation Authority, Kew.

Lorimer, M.S. & Schoknecht, N.R. (1987). A study of the land in the Campaspe River catchment. TC-18, Land Protection Division, Department of Conservation, Forests and Lands, Melbourne.

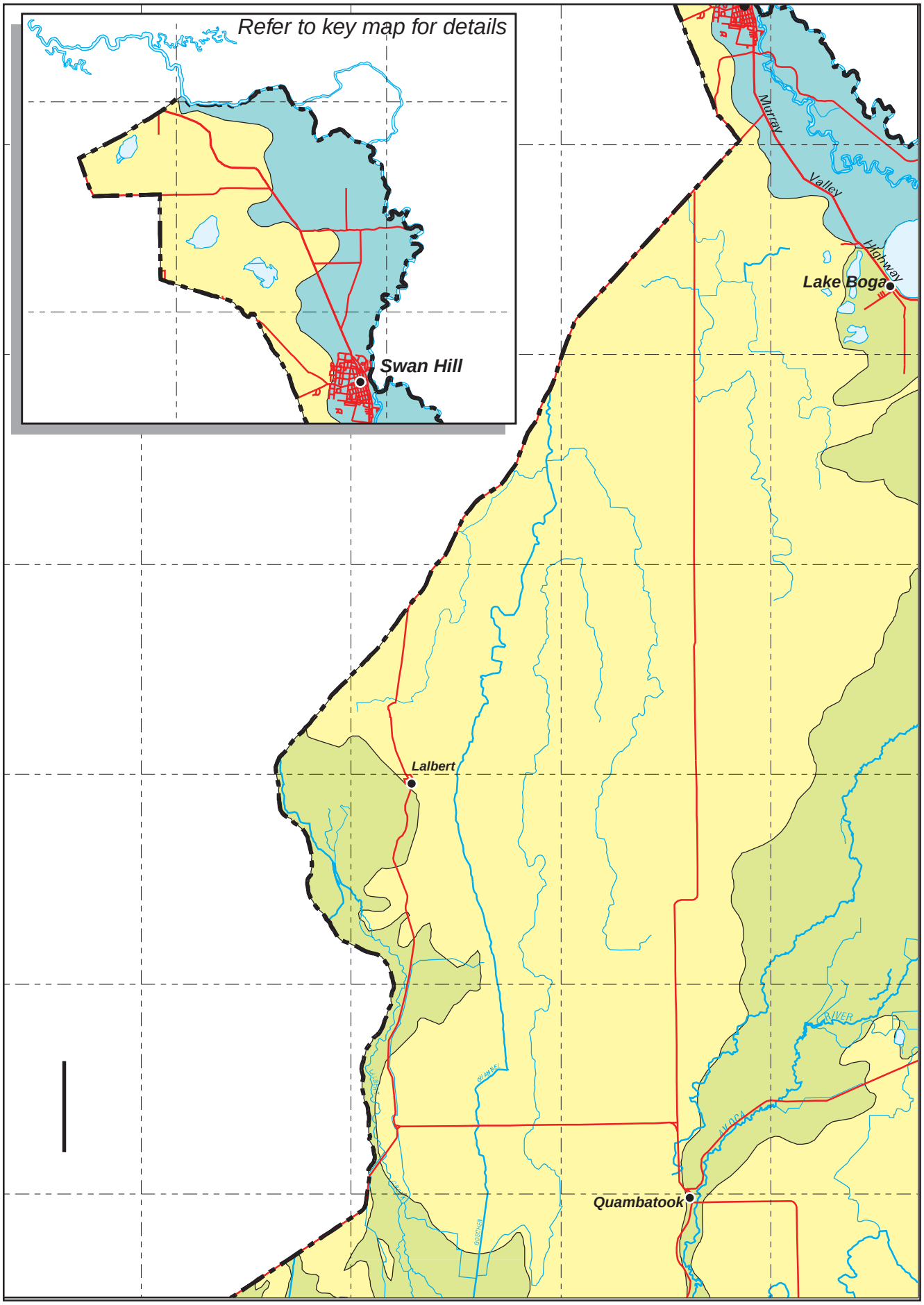
Macumber, P.G. (1991). Interaction between ground water and surface systems in northern Victoria. Department of Conservation and Environment, Melbourne.

Schoknecht, N.R. (1988). Land inventory of the Loddon River catchment – a reconnaisance survey. Land Protection Division, Department of Conservation, Forests and Lands, Melbourne.

Hills, E.S. (1975). Physiography of Victoria – an introduction to geomorphology. Whitcombe and Tombs, Melbourne.

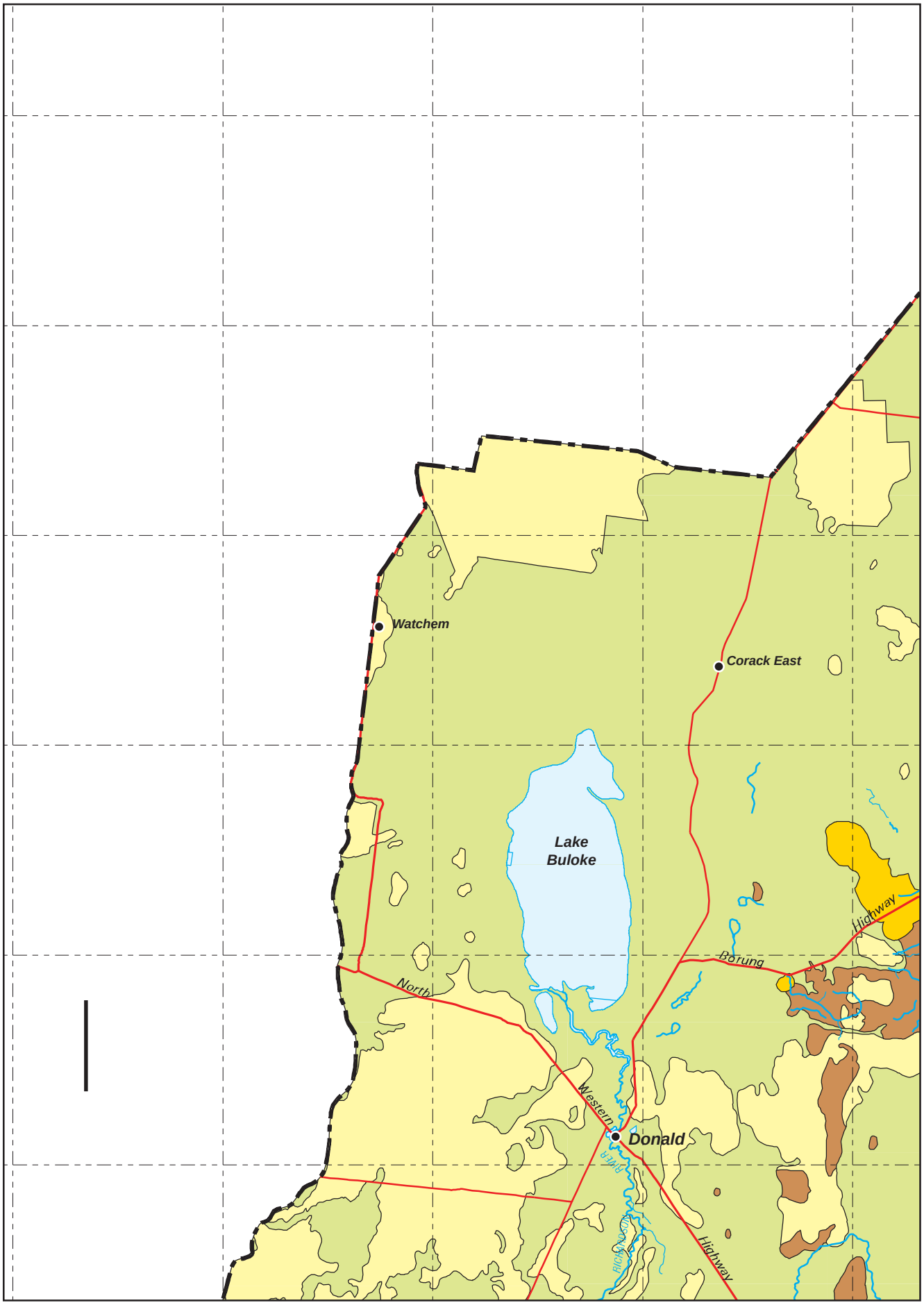
Skene, J.K.M. (1971). Soils and land use in the Loddon Valley, Victoria. Technical Bulletin No. 22. Department of Agriculture, Victoria.

Planting Zones of North Central Victoria – Map 1

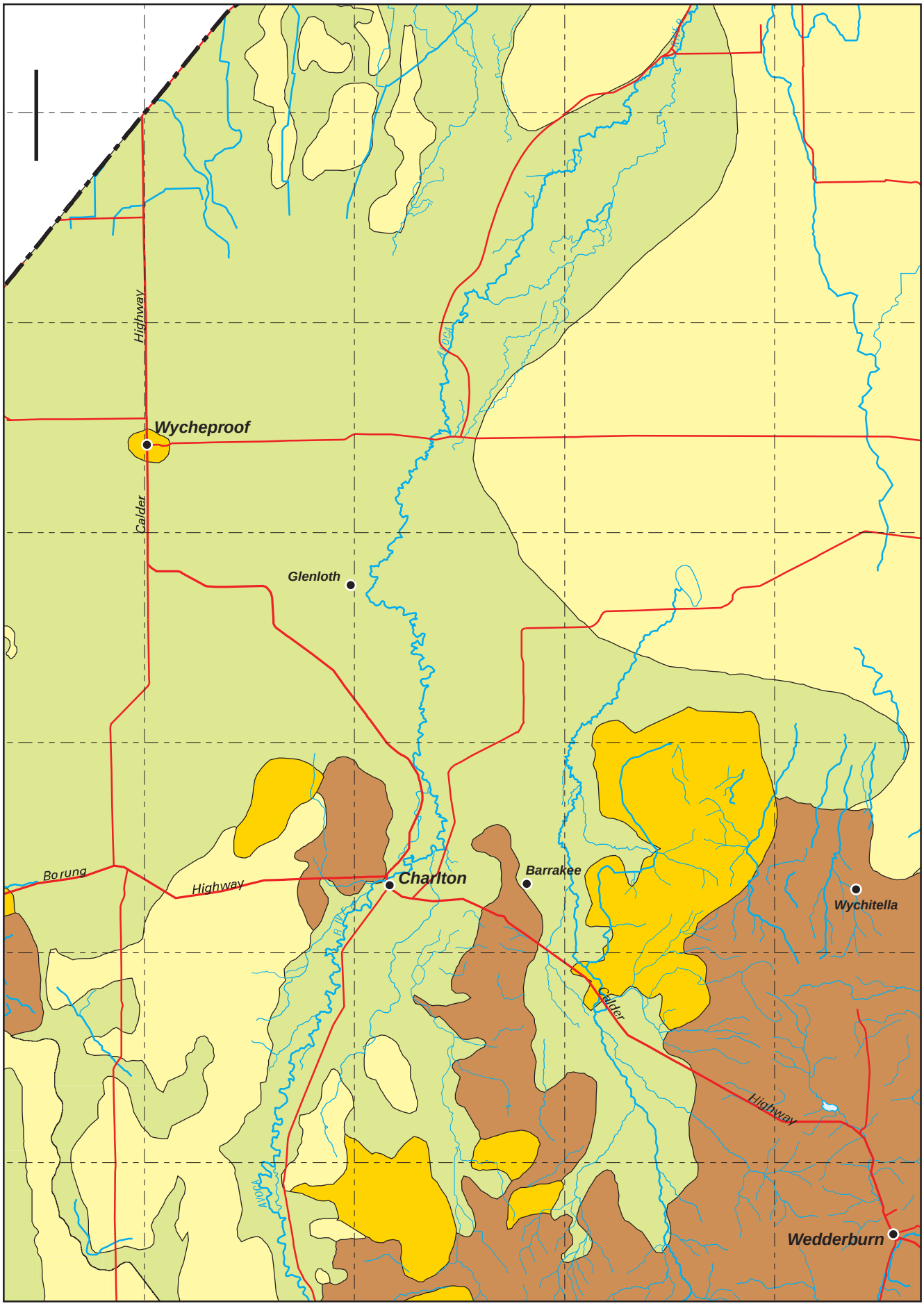


Planting Zones of North Central Victoria – Map 2

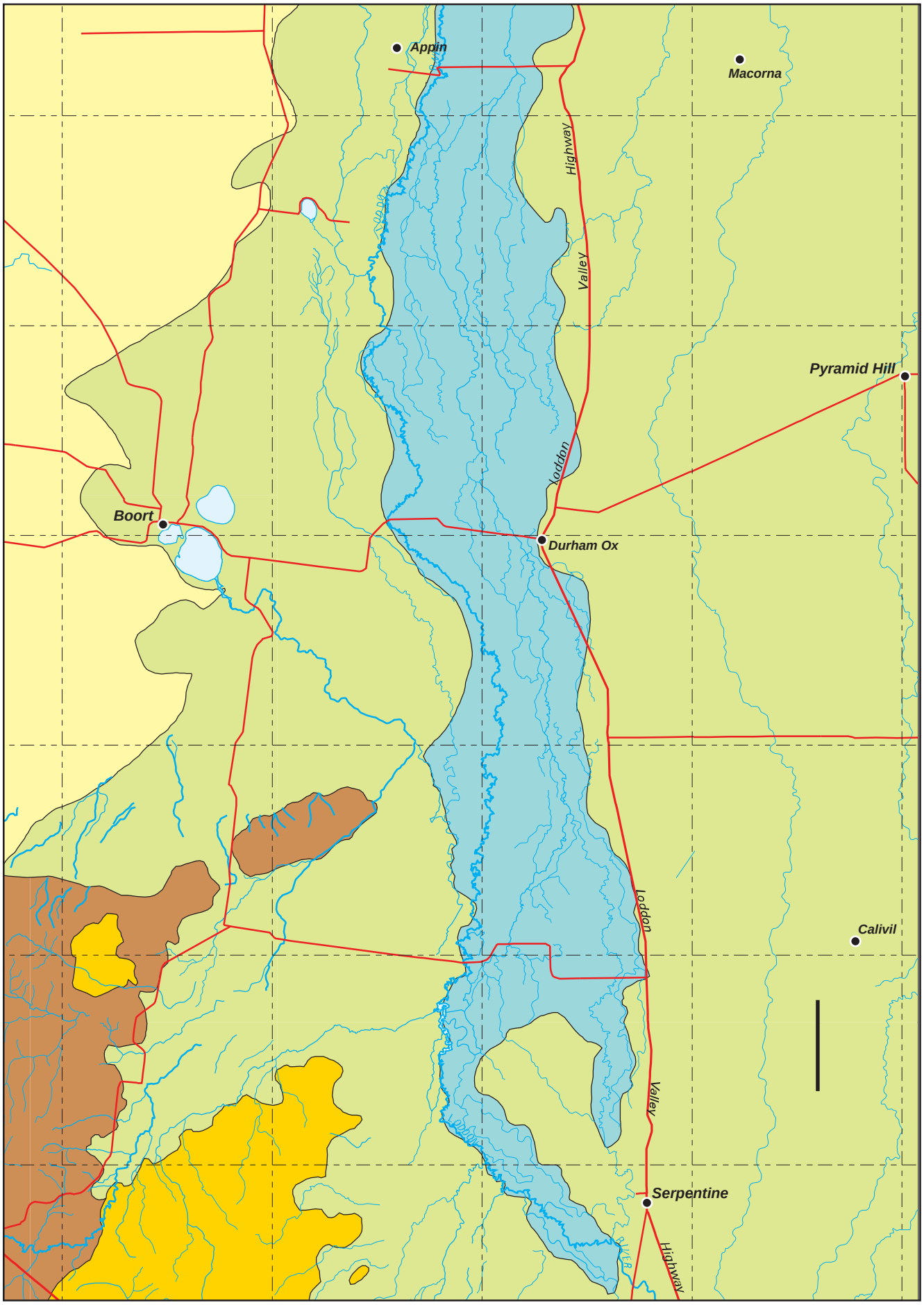
Planting Zones of North Central Victoria – Map 3



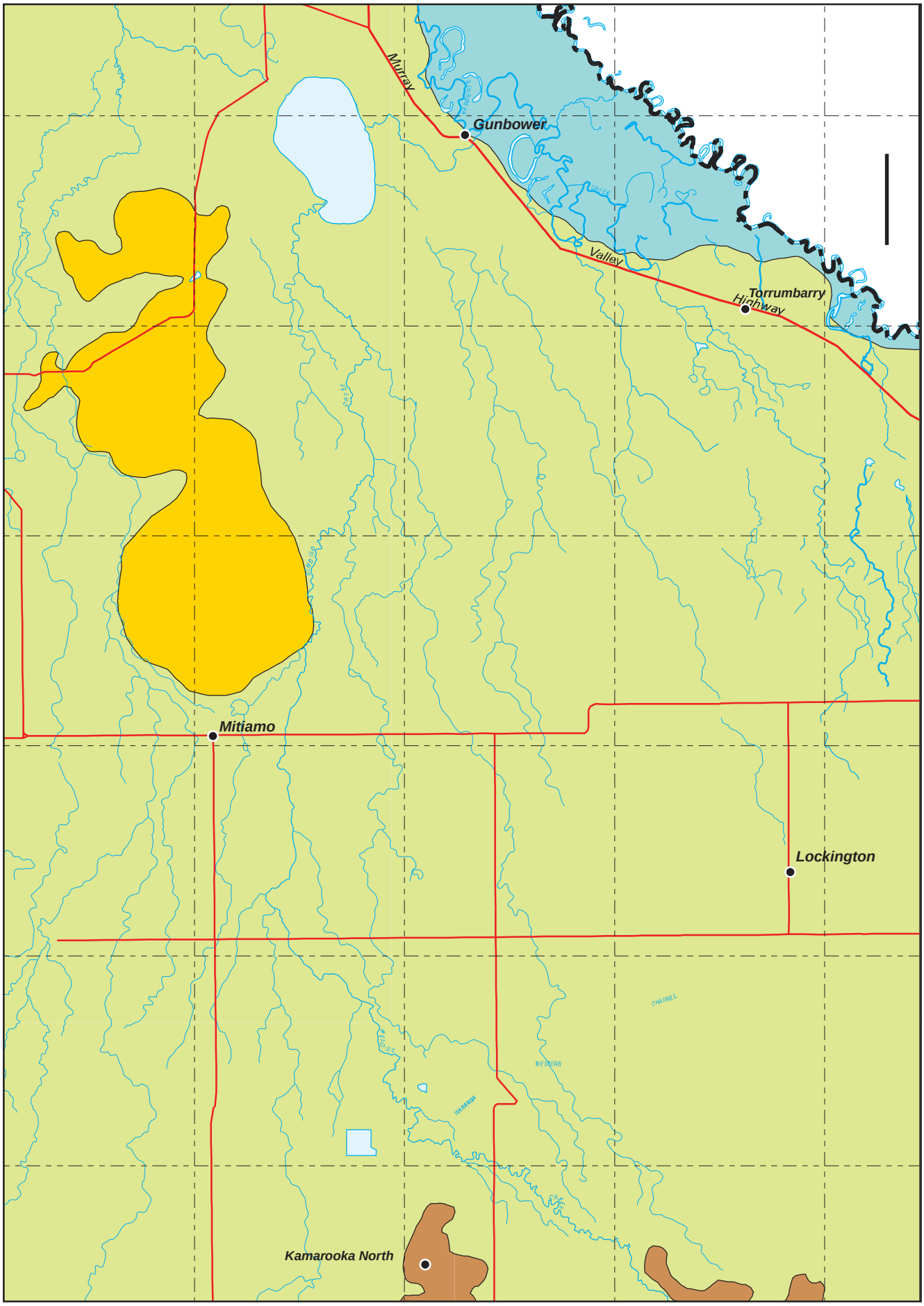
Planting Zones of North Central Victoria – Map 4



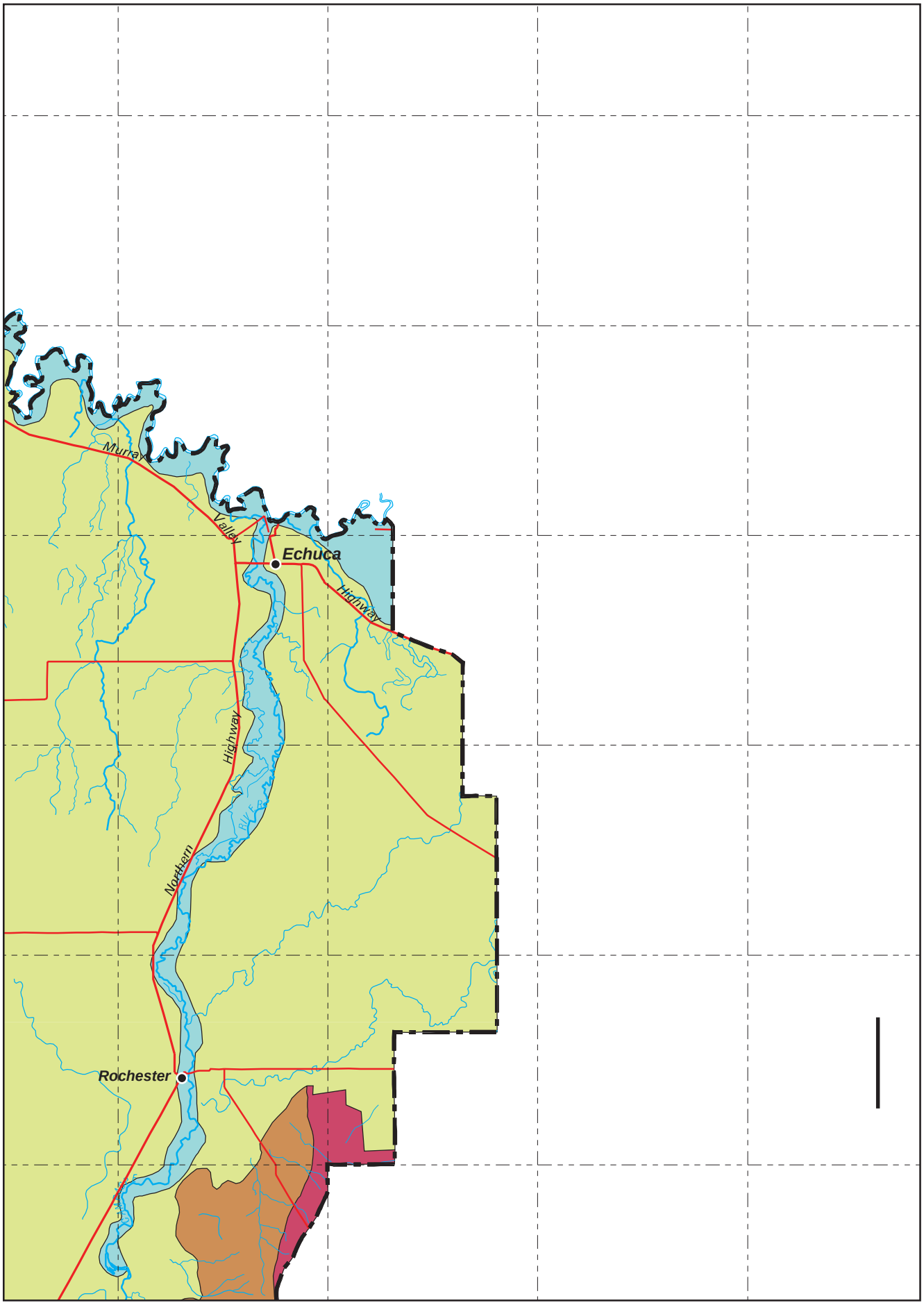
Planting Zones of North Central Victoria – Map 5



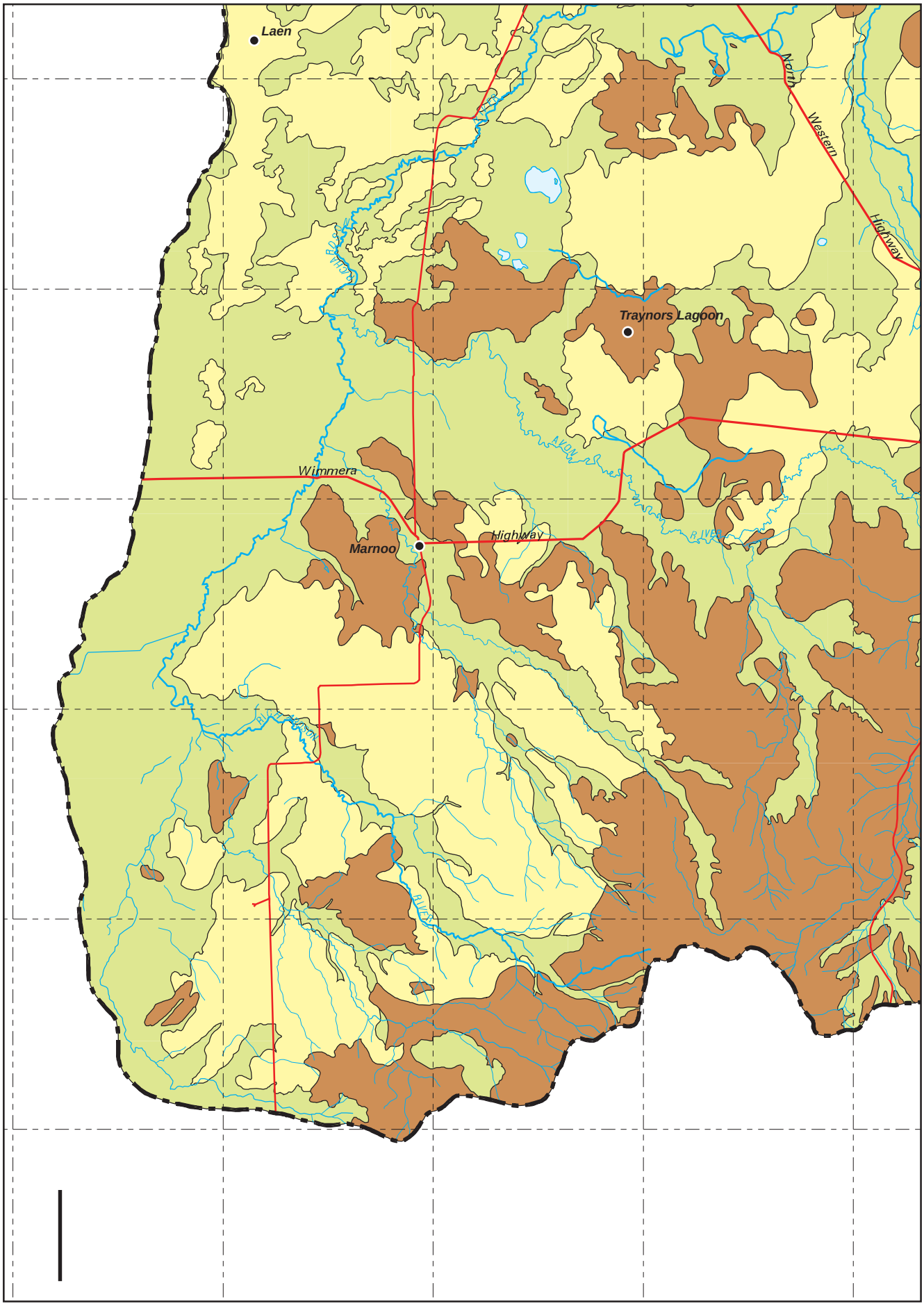
Planting Zones of North Central Victoria – Map 6



Planting Zones of North Central Victoria – Map 7



Planting Zones of North Central Victoria – Map 8

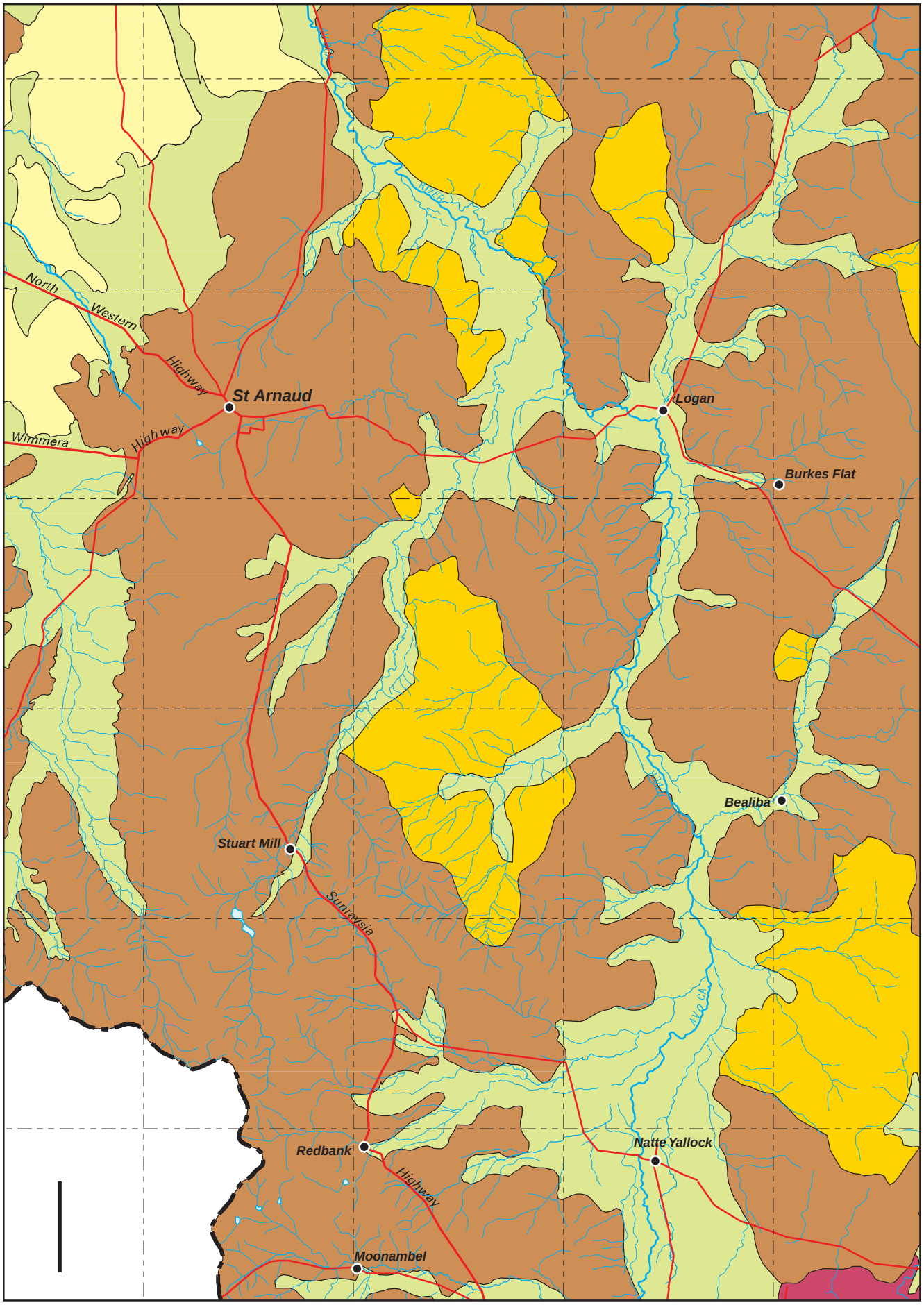


0 2.5 5 10

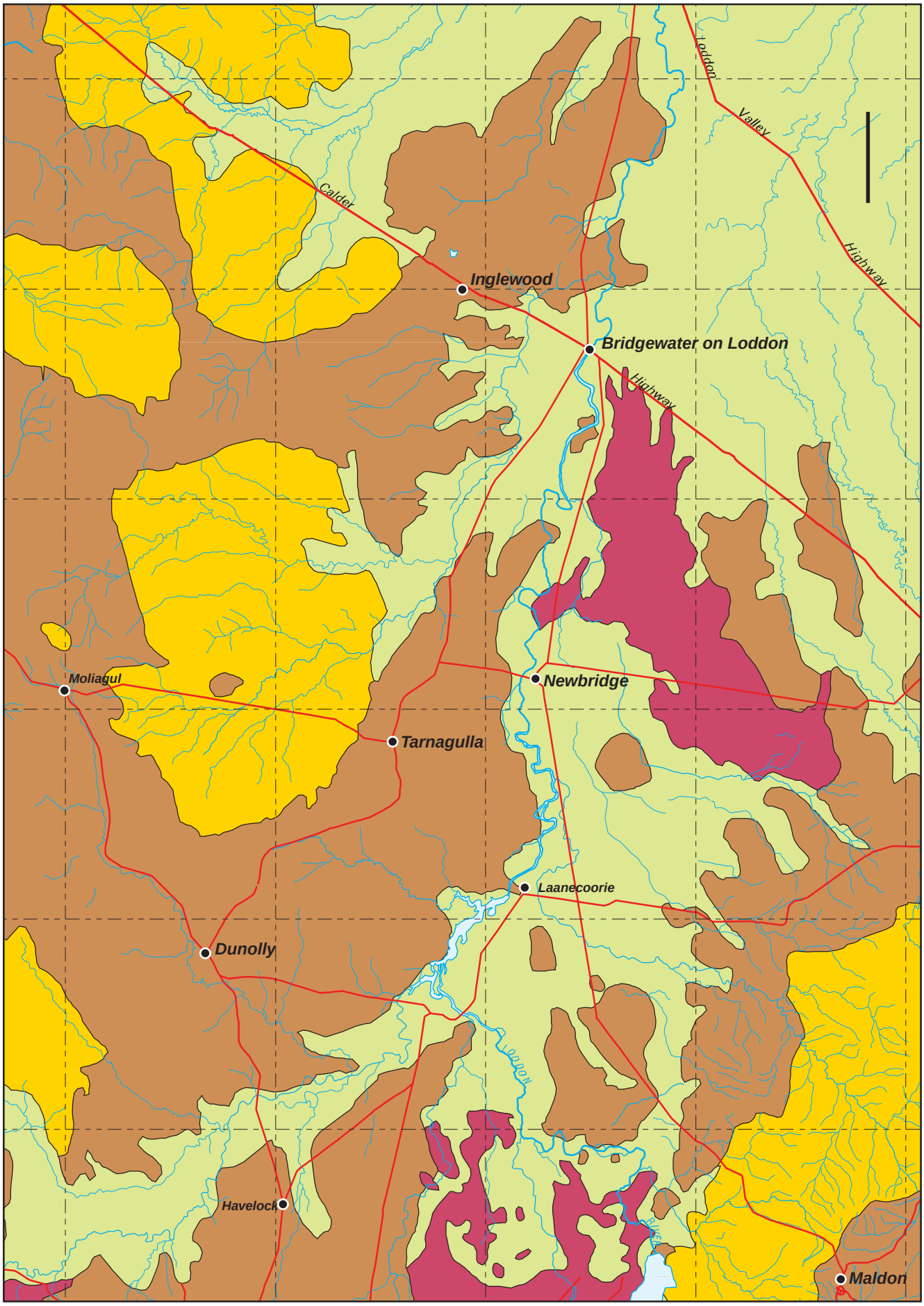
Kilometres
Scale 1:250 000

- Riverine Plain
- Riverine Plain subject to flooding
- Marine Plain
- Sedimentary
- Granite
- Volcanic
- Water bodies

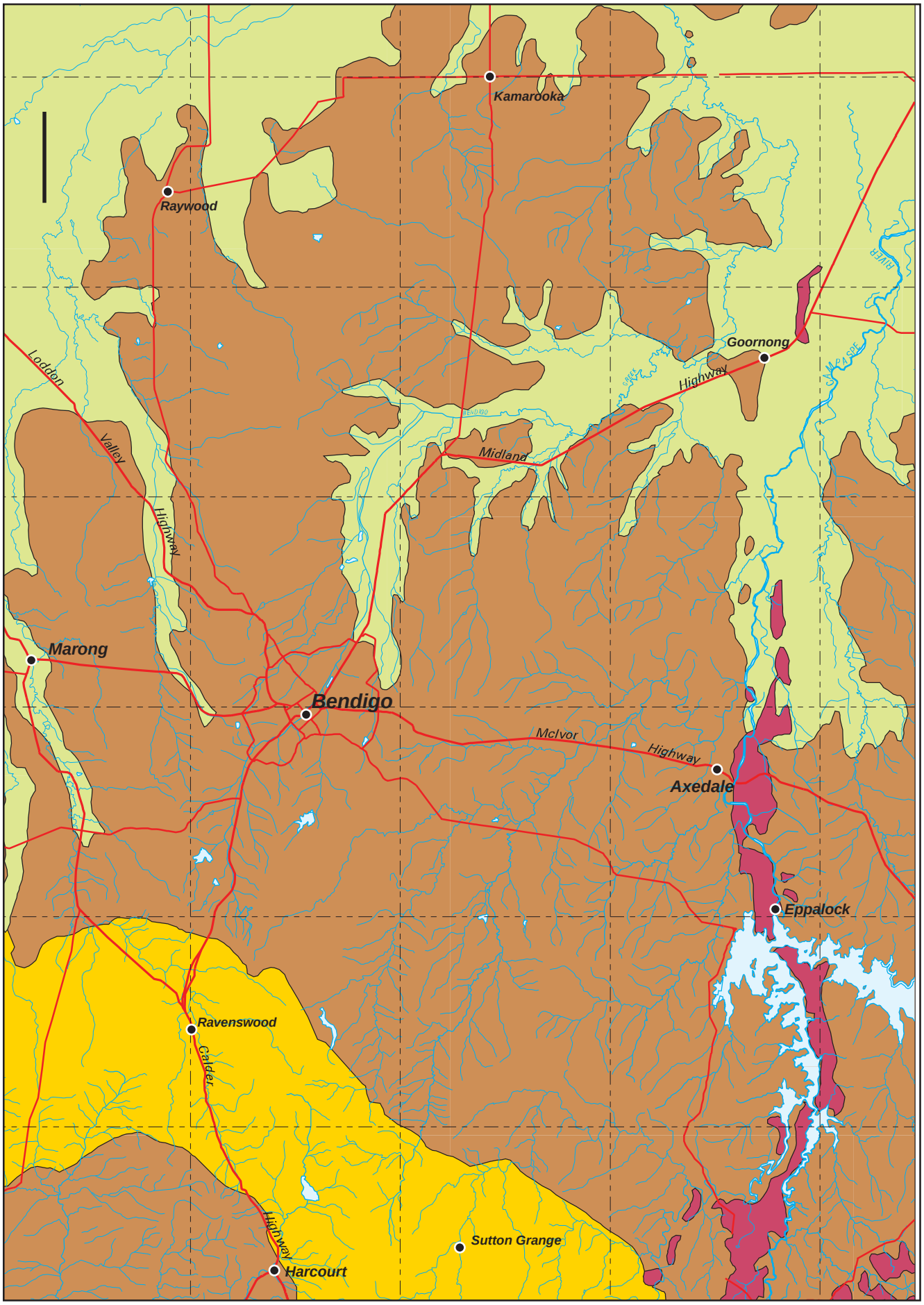
Planting Zones of North Central Victoria – Map 9



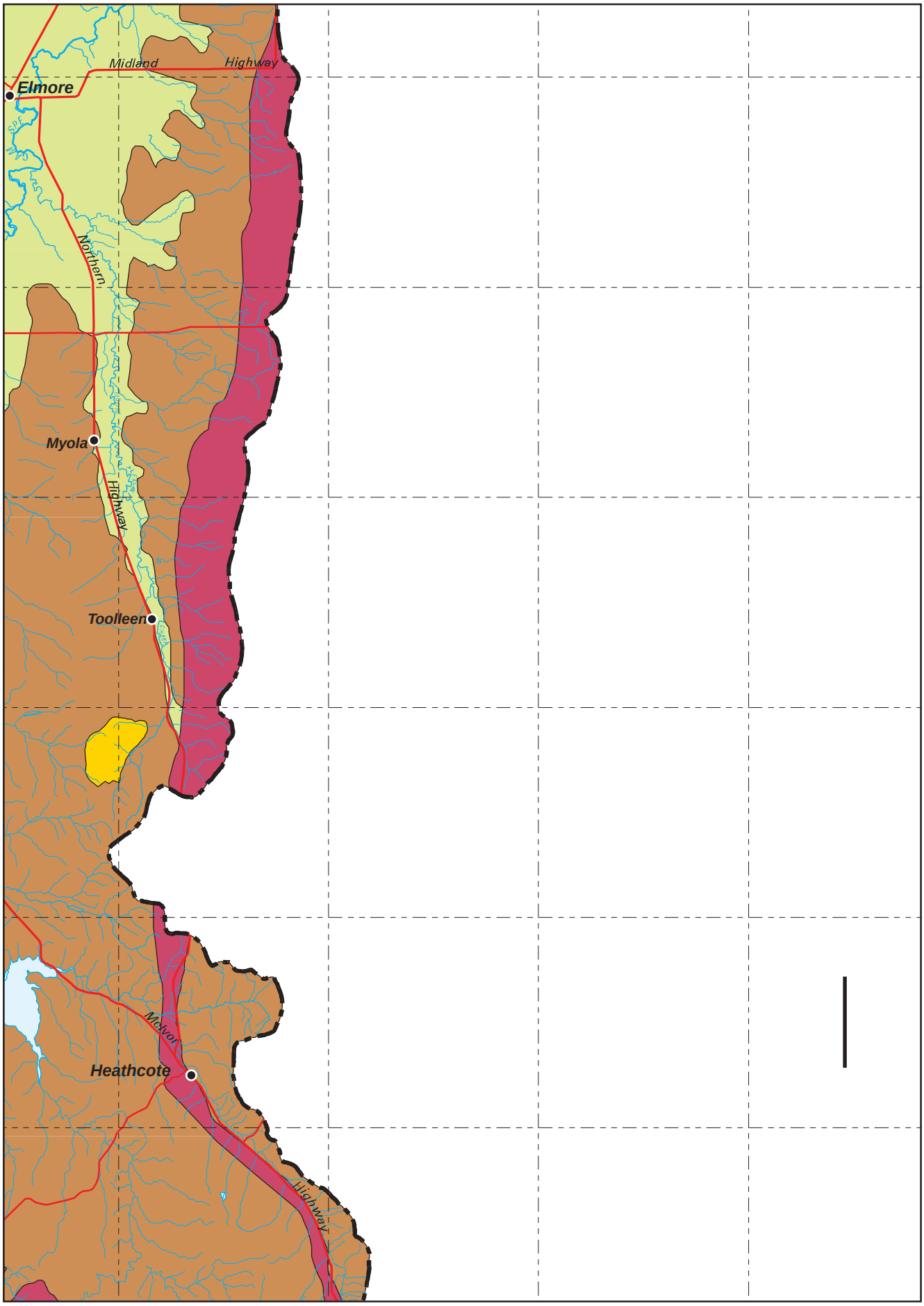
Planting Zones of North Central Victoria – Map 10



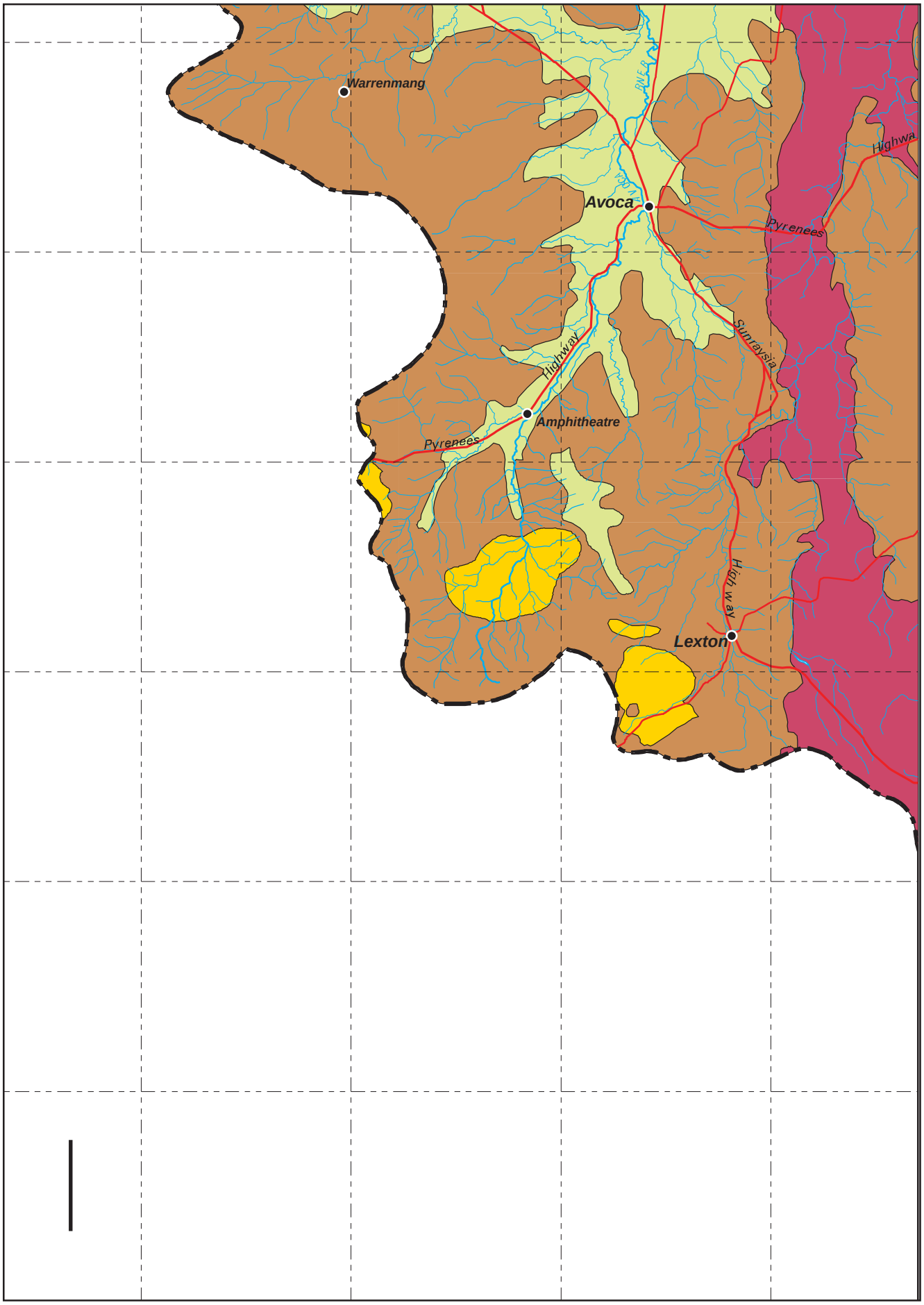
Planting Zones of North Central Victoria – Map 11



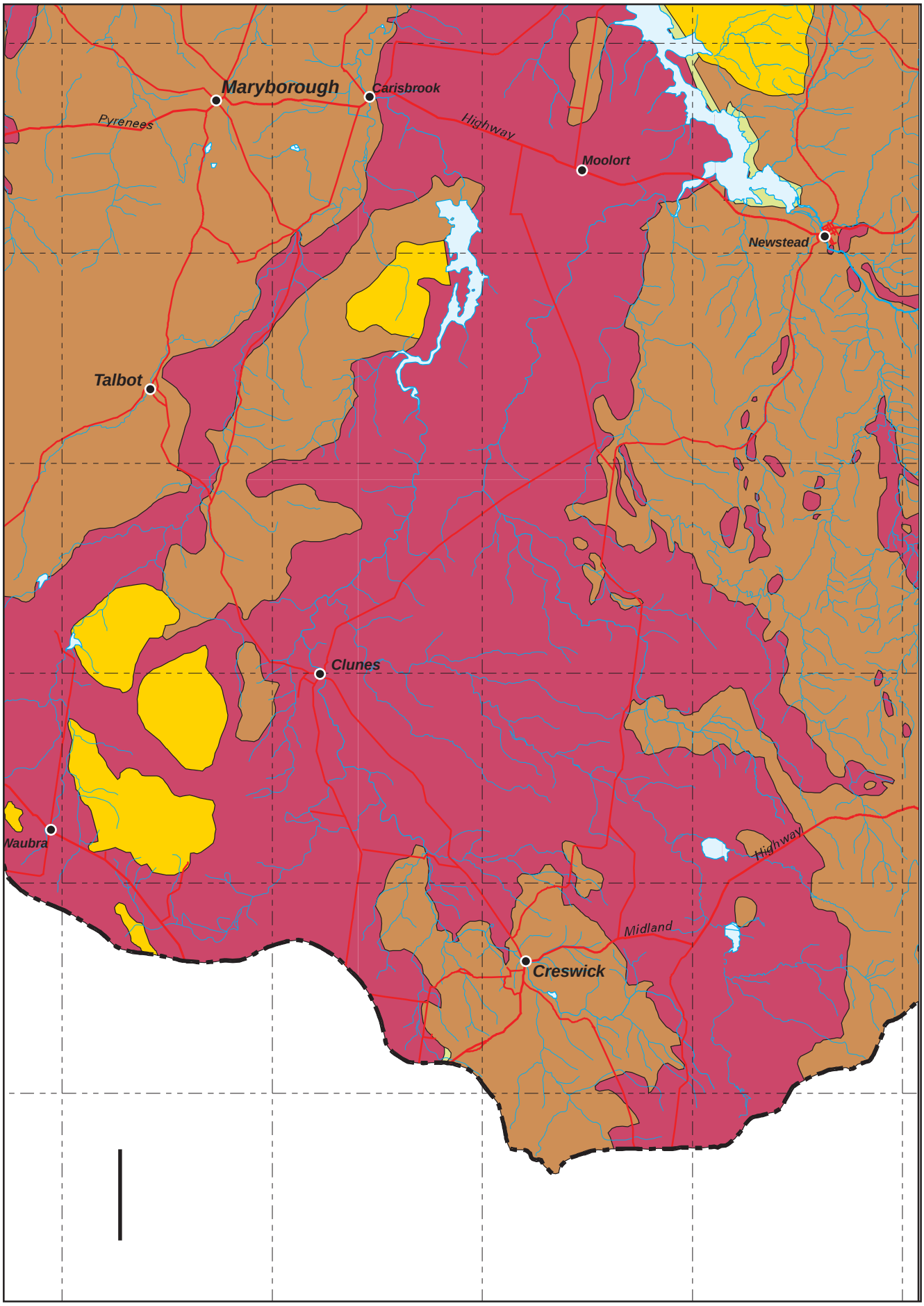
Planting Zones of North Central Victoria – Map 12



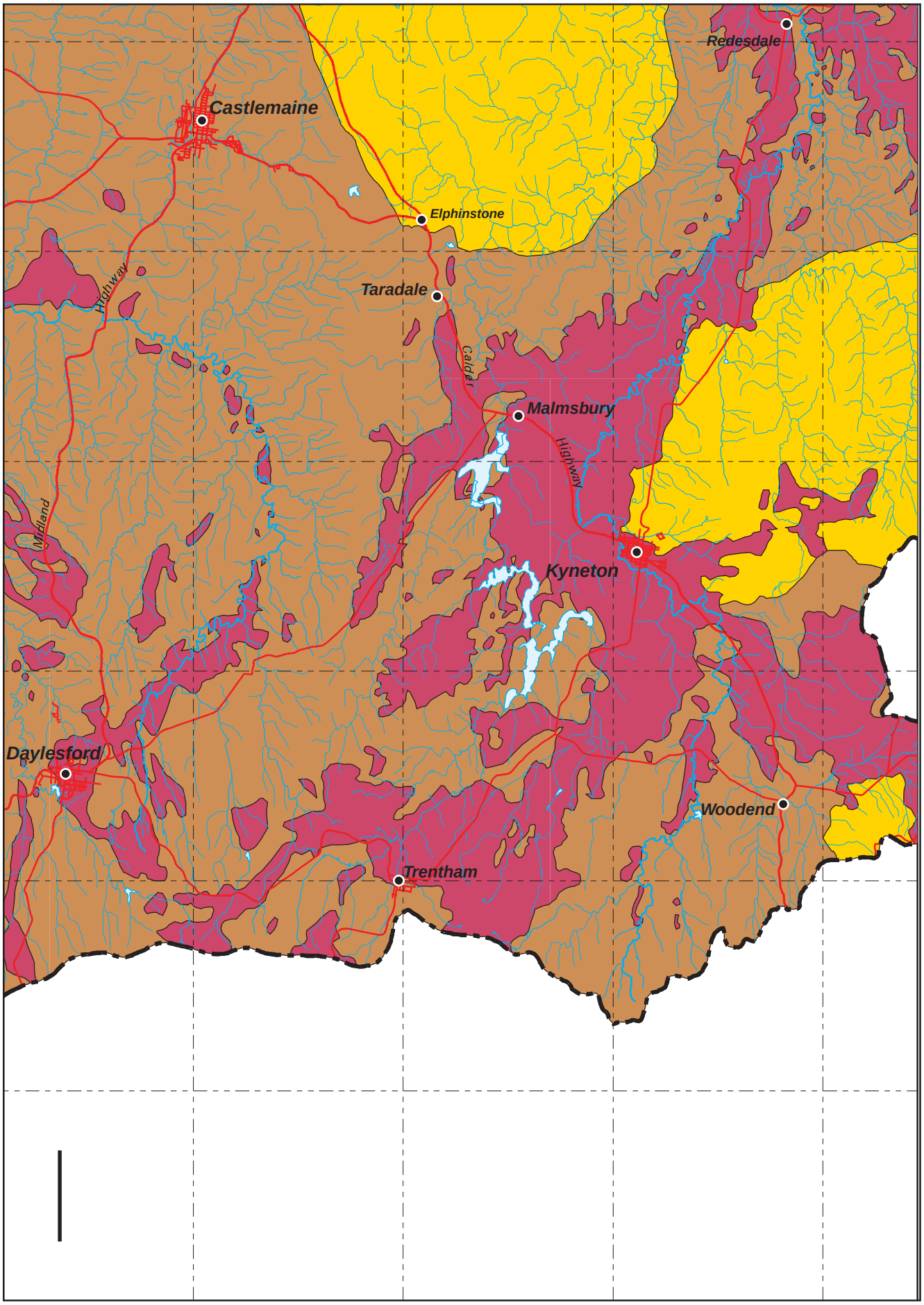
Planting Zones of North Central Victoria – Map 13



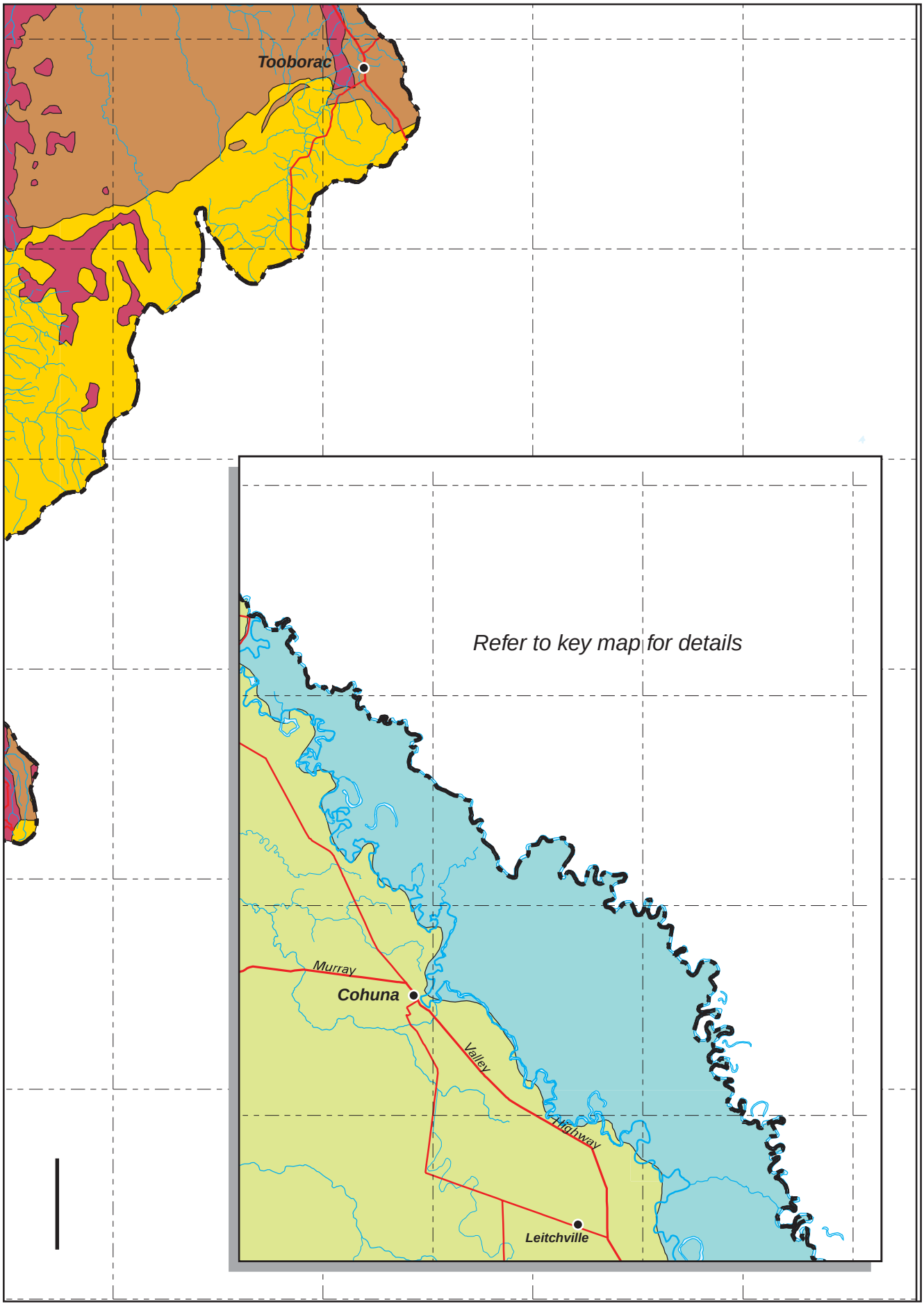
Planting Zones of North Central Victoria – Map 14



Planting Zones of North Central Victoria – Map 15



Planting Zones of North Central Victoria – Map 16



0 2.5 5 10

Kilometres
Scale 1:250 000

- Riverine Plain
- Riverine Plain subject to flooding
- Marine Plain
- Sedimentary
- Granite
- Volcanic
- Water bodies

Sedimentary – more than 500 mm annual rainfall

Hills

Groundcover

Chrysocephalum semipapposum	Clustered Everlasting
Danthonia spp.	Wallaby-grasses
Dianella revoluta	Black-anther Flax-lily
Juncus spp.	Rushes
Microlaena stipoides	Weeping Grass
Themeda triandra	Kangaroo Grass
Lomandra longifolia	Spiny-headed Mat-rush
Stipa spp.	Spear-grasses

Shrubs

Acacia acinacea	Gold-dust Wattle
Acacia aspera	Rough Wattle
Acacia ausfeldii	Ausfeld's Wattle
Acacia genistifolia	Spreading Wattle
Acacia lanigera var. *whanii*	Woolly Wattle
Acacia mitchellii	Mitchell's Wattle
Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Acacia retinodes var *retinodes*	Wirilda
Acacia verniciflua	Varnish Wattle
Acacia verticillata	Prickly Moses
Bursaria spinosa	Sweet Bursaria
Calytrix tetragona	Common Fringe-myrtle
Cassinia arcuata	Drooping Cassinia
Daviesia leptophylla	Slender Bitter-pea
Dodonaea viscosa	Narrow-leaf Hop-bush
Grevillea alpina	Cat's Claws
Hakea decurrens	Bushy Needlewood
Indigofera australis	Austral Indigo
Kunzea ericoides	Burgan
Leptospermum myrsinoides	Heath Tea-tree
Ozothamnus obcordatus	Grey Everlasting

Low Hills

Groundcover

Chrysocephalum semipapposum	Clustered Everlasting
Clematis microphylla	Small-leaf Clematis
Danthonia spp.	Wallaby Grass
Dianella revoluta	Black-anther Flax-lily
Juncus spp.	Rushes
Microlaena stipoides	Weeping Grass
Themeda triandra	Kangaroo Grass
Lomandra longifolia	Spiny-headed Mat-rush
Stipa spp.	Spear-grasses

Shrubs

Acacia acinacea	Gold-dust Wattle
Acacia aspera	Rough Wattle
Acacia ausfeldii	Ausfeld's Wattle
Acacia genistifolia	Spreading Wattle
Acacia lanigera var. *whanii*	Woolly Wattle
Acacia mitchellii	Mitchell's Wattle
Acacia montana	Mallee Wattle
Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Acacia retinodes var *retinodes*	Wirilda
Acacia verniciflua	Varnish Wattle
Acacia verticillata	Prickly Moses
Bursaria spinosa	Sweet Bursaria
Calytrix tetragona	Common Fringe-myrtle
Cassinia arcuata	Drooping Cassinia
Daviesia leptophylla	Slender Bitter-pea
Dodonaea viscosa	Narrow-leaf Hop-bush
Grevillea alpina	Cat's Claws
Hakea decurrens	Bushy Needlewood
Indigofera australis	Austral Indigo
Kunzea ericoides	Burgan
Leptospermum myrsinoides	Heath Tea-tree
Olearia spp.	Daisy-bushes
Ozothamnus obcordatus	Grey Everlasting
Pultenaea daphnoides	Large-leaf Bush-pea

Flats

Groundcover

Chrysocephalum semipapposum	Clustered Everlasting
Clematis microphylla	Small-leaf Clematis
Danthonia spp.	Wallaby Grass
Dianella revoluta	Black-anther Flax-lily
Juncus spp.	Rushes
Microlaena stipoides	Weeping Grass
Themeda triandra	Kangaroo Grass
Lomandra longifolia	Spiny-headed Mat-rush
Stipa spp.	Spear-grass

Shrubs

Acacia acinacea	Gold-dust Wattle
Acacia aspera	Rough Wattle
Acacia ausfeldii	Ausfeld's Wattle
Acacia genistifolia	Spreading Wattle
Acacia lanigera var. *whanii*	Woolly Wattle
Acacia montana	Mallee Wattle
Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Acacia retinodes var *retinodes*	Wirilda
Acacia verniciflua	Varnish Wattle
Acacia verticillata	Prickly Moses
Bursaria spinosa	Sweet Bursaria
Calytrix tetragona	Common Fringe-myrtle
Cassinia arcuata	Drooping Cassinia
Daviesia leptophylla	Slender Bitter-pea
Dodonaea viscosa	Narrow-leaf Hop-bush
Hakea decurrens	Bushy Needlewood
Hymenanthera dentata	Tree Violet
Indigofera australis	Austral Indigo
Leptospermum myrsinoides	Heath Tea-tree
Olearia spp.	Daisy Bush
Ozothamnus obcordatus	Grey Everlasting
Pultenaea daphnoides	Large-leaf Bush-pea

Depression/Drainage Line

Groundcover

Carex spp.	Sedges
Danthonia spp.	Wallaby Grass
Juncus spp.	Rushes
Microlaena stipoides	Weeping Grass
Phragmites australis	Common Reed
Poa spp.	Tussock-grasses
Themeda triandra	Kangaroo Grass
Typha orientalis	Cumbungi
Lomandra longifolia	Spiny-headed Mat-rush
Stipa spp.	Spear-grasses

Shrubs

Acacia retinodes var *retinodes*	Wirilda
Acacia verticillata	Prickly Moses
Bursaria spinosa	Sweet Bursaria
Callistemon sieberi	River Bottlebrush
Cassinia arcuata	Drooping Cassinia
Dodonaea viscosa	Narrow-leaf Hop-bush
Hymenanthera dentata	Tree Violet
Kunzea ericoides	Burgan
Leptospermum lanigerum	Woolly Tea-tree
Leptospermum obovatum	River Tea-tree
Melaleuca parvistaminea	Rough-barked Honey-myrtle

Sedimentary – more than 500 mm annual rainfall

Hills

Trees

Acacia dealbata	Silver Wattle
Acacia implexa	Lightwood
Acacia mearnsii	Black Wattle
Acacia melanoxylon	Blackwood
Acacia pycnantha	Golden Wattle
Allocasuarina verticillata	Drooping She-Oak
Banksia marginata	Silver Banksia
Eucalyptus aromaphloia	Scent-bark
Eucalyptus baxteri	Brown Stringybark
Eucalyptus cypellocarpa	Mountain Grey Gum
Eucalyptus dives	Broad-leaved Peppermint
Eucalyptus globulus ssp. *bicostata*	Blue Gum
Eucalyptus goniocalyx	Long-leaved Box
Eucalyptus macrorhyncha	Red Stringybark
Eucalyptus melliodora	Yellow Box
Eucalyptus microcarpa	Grey Box
Eucalyptus obliqua	Messmate
Eucalyptus polyanthemos	Red Box
Eucalyptus radiata	Narrow-leaf Peppermint
Eucalyptus rubida	Candlebark
Eucalyptus tricarpa	Red Ironbark
Eucalyptus viminalis	Manna Gum
Exocarpos cupressiformis	Cherry Ballart

Low Hills

Trees

Acacia dealbata	Silver Wattle
Acacia implexa	Lightwood
Acacia mearnsii	Black Wattle
Acacia melanoxylon	Blackwood
Acacia pycnantha	Golden Wattle
Allocasuarina luehmannii	Buloke
Allocasuarina verticillata	Drooping She-Oak
Banksia marginata	Silver Banksia
Eucalyptus albens	White Box
Eucalyptus aromaphloia	Scent-bark
Eucalyptus baxteri	Brown Stringybark
Eucalyptus cypellocarpa	Mountain Grey Gum
Eucalyptus dives	Broad-leaved Peppermint
Eucalyptus globulus ssp. *bicostata*	Blue Gum
Eucalyptus goniocalyx	Long-leaved Box
Eucalyptus macrorhyncha	Red Stringybark
Eucalyptus melliodora	Yellow Box
Eucalyptus microcarpa	Grey Box
Eucalyptus obliqua	Messmate
Eucalyptus polyanthemos	Red Box
Eucalyptus radiata	Narrow-leaf Peppermint
Eucalyptus rubida	Candlebark
Eucalyptus tricarpa	Red Ironbark
Eucalyptus viminalis	Manna Gum
Exocarpos cupressiformis	Cherry Ballart

Flats

Trees

Acacia dealbata	Silver Wattle
Acacia implexa	Lightwood
Acacia mearnsii	Black Wattle
Acacia melanoxylon	Blackwood
Acacia pycnantha	Golden Wattle
Allocasuarina luehmannii	Buloke
Allocasuarina verticillata	Drooping She-Oak
Banksia marginata	Silver Banksia
Eucalyptus aromaphloia	Scent-bark
Eucalyptus cypellocarpa	Mountain Grey Gum
Eucalyptus dives	Broad-leaved Peppermint
Eucalyptus goniocalyx	Long-leaved Box
Eucalyptus leucoxylon ssp. *pruinosa*	Yellow Gum
Eucalyptus macrorhyncha	Red Stringybark
Eucalyptus melliodora	Yellow Box
Eucalyptus microcarpa	Grey Box
Eucalyptus obliqua	Messmate
Eucalyptus ovata	Swamp Gum
Eucalyptus polyanthemos	Red Box
Eucalyptus radiata	Narrow-lea Peppermint
Eucalyptus rubida	Candlebark
Eucalyptus tricarpa	Red Ironbark
Eucalyptus viminalis	Manna Gum
Exocarpos cupressiformis	Cherry Ballart

Depression/Drainage Line

Trees

Acacia dealbata	Silver Wattle
Acacia mearnsii	Black Wattle
Acacia melanoxylon	Blackwood
Eucalyptus camaldulensis	River Red Gum
Eucalyptus melliodora	Yellow Box
Eucalyptus microcarpa	Grey Box
Eucalyptus obliqua	Messmate
Eucalyptus ovata	Swamp Gum
Eucalyptus rubida	Candlebark
Eucalyptus viminalis	Manna Gum

Sedimentary – less than 500 mm annual rainfall

Hills

Groundcover

Chrysocephalum semipapposum	Clustered Everlasting
Danthonia spp.	Wallaby-grasses
Poa spp.	Tussock-grass
Stipa spp.	Spear-grasses
Themeda triandra	Kangaroo Grass

Shrubs

Acacia acinacea	Gold-dust Wattle
Acacia aspera	Rough Wattle
Acacia ausfeldii	Ausfeld's Wattle
Acacia calamifolia	Wallowa
Acacia flexifolia	Bent-leaf Wattle
Acacia genistifolia	Spreading Wattle
Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Bursaria spinosa	Sweet Bursaria
Calytrix tetragona	Common Fringe-myrtle
Correa glabra	Rock Correa
Dodonaea viscosa	Narrow-leaf Hop-bush
Grevillea alpina	Cat's Claws
Hakea decurrens	Bushy Needlewood
Leptospermum myrsinoides	Heath Tea-tree
Melaleuca uncinata	Broom Honey-myrtle
Prostanthera nivea	Snowy Mint-bush

Low Hills

Groundcover

Chrysocephalum semipapposum	Clustered Everlasting
Clematis microphylla	Small-leaf Clematis
Danthonia spp.	Wallaby-grasses
Poa spp.	Tussock-grass
Stipa spp.	Spear-grasses
Themeda triandra	Kangaroo Grass

Shrubs

Acacia acinacea	Gold-dust Wattle
Acacia aspera	Rough Wattle
Acacia ausfeldii	Ausfeld's Wattle
Acacia calamifolia	Wallowa
Acacia flexifolia	Bent-leaf Wattle
Acacia genistifolia	Spreading Wattle
Acacia lineata	Streaked Wattle
Acacia montana	Mallee Wattle
Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Acacia rigens	Nealie
Acacia verniciflua	Varnish Wattle
Acacia williamsonii	Whirrakee Wattle
Allocasuarina muelleriana	Slaty She-Oak
Bursaria spinosa	Sweet Bursaria
Calytrix tetragona	Common Fringe-myrtle
Correa glabra	Rock Correa
Dodonaea viscosa	Narrow-leaf Hop-bush
Eutaxia diffusa	Spreading Eutaxia
Grevillea alpina	Cat's Claws
Hakea decurrens	Bushy Needlewood
Leptospermum lanigerum	Woolly Tea-tree
Leptospermum obovatum	River Tea-tree
Leptospermum myrsinoides	Heath Tea-tree
Melaleuca decussata	Totem-poles
Melaleuca uncinata	Broom Honey-myrtle
Olearia spp.	Daisy-bushes
Pomaderris paniculosa spp. *paniculosa*	Inland Pomaderris

Flats

Groundcover

Bothriochloa macra	Red-leg grass
Chloris truncata	Windmill Grass
Chrysocephalum semipapposum	Clustered Everlasting
Clematis microphylla	Small-leaf Clematis
Danthonia spp.	Wallaby-grasses
Enchylaecna tomentosa	Ruby Saltbush
Juncus spp.	Rushes
Microlaena stipoides	Weeping Grass
Poa spp.	Tussock-grass
Stipa spp.	Spear-grasses
Themeda triandra	Kangaroo Grass

Shrubs

Acacia acinacea	Gold-dust Wattle
Acacia aspera	Rough Wattle
Acacia ausfeldii	Ausfeld's Wattle
Acacia brachybotrya	Grey Mulga
Acacia calamifolia	Wallowa
Acacia flexifolia	Bent-leaf Wattle
Acacia genistifolia	Spreading Wattle
Acacia lineata	Streaked Wattle
Acacia montana	Mallee Wattle
Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Acacia rigens	Nealie
Acacia verniciflua	Varnish Wattle
Acacia williamsonii	Whirrakee Wattle
Allocasuarina muelleriana	Slaty She-Oak
Bursaria spinosa	Sweet Bursaria
Calytrix tetragona	Common Fringe-myrtle
Dodonaea viscosa	Narrow-leaf Hop-bush
Eremophila longifolia	Long-leaf Emu-bush
Eutaxia diffusa	Spreading Eutaxia
Hakea decurrens	Bushy Needlewood
Hymenanthera dentata	Tree Violet
Leptospermum myrsinoides	Heath Tea-tree
Melaleuca decussata	Totem-poles
Melaleuca uncinata	Broom Honey-myrtle
Melaleuca wilsonii	Violet Honey-myrtle
Olearia spp.	Daisy-bushes
Senna artemisioides	Desert Cassia
Westringia spp.	Westringias

Depression/Drainage Line

Groundcover

Carex spp.	Sedges
Chloris truncata	Windmill Grass
Danthonia spp.	Wallaby-grasses
Juncus spp.	Rushes
Microlaena stipoides	Weeping Grass
Phragmites australis	Common Reed
Poa spp.	Tussock-grasses
Stipa spp.	Spear-grasses
Typha orientalis	Cumbungi

Shrubs

Acacia montana	Mallee Wattle
Bursaria spinosa	Sweet Bursaria
Correa glabra	Rock Correa
Dodonaea viscosa	Narrow-leaf Hop-bush
Hymenanthera dentata	Tree Violet
Leptospermum obovatum	River Tea-tree
Melaleuca decussata	Totem-poles
Melaleuca parvistaminea	Rough-barked Honey-myrtle
Melaleuca uncinata	Broom Honey-myrtle
Melaleuca wilsonii	Violet Honey-myrtle

Sedimentary – less than 500 mm annual rainfall

Hills

Trees

Acacia implexa	Lightwood
Acacia pycnantha	Golden Wattle
Callitris glaucophylla	White Cypress Pine
Eucalyptus leucoxylon ssp. *pruinosa*	Yellow Gum
Eucalyptus microcarpa	Grey Box

Low Hills

Trees

Acacia implexa	Lightwood
Acacia pycnantha	Golden Wattle
Allocasuarina luehmannii	Buloke
Callitris glaucophylla	White Cypress Pine
Eucalyptus albens	White Box
Eucalyptus behriana	Bull Mallee
Eucalyptus camaldulensis	River Red Gum
Eucalyptus leucoxylon ssp. *pruinosa*	Yellow Gum
Eucalyptus microcarpa	Grey Box
Eucalyptus polybractea	Blue Mallee
Eucalyptus viridis	Green Mallee
Melaleuca lanceolata	Moonah

Flats

Trees

Acacia implexa	Lightwood
Acacia pycnantha	Golden Wattle
Allocasuarina luehmannii	Buloke
Callitris glaucophylla	White Cypress Pine
Eucalyptus behriana	Bull Mallee
Eucalyptus camaldulensis	River Red Gum
Eucalyptus leucoxylon ssp. *pruinosa*	Yellow Gum
Eucalyptus microcarpa	Grey Box
Eucalyptus polybractea	Blue Mallee
Eucalyptus viridis	Green Mallee
Melaleuca lanceolata	Moonah
Pittosporum phylliraeoides	Weeping Pittosporum

Depression/Drainage Line

Trees

Acacia melanoxylon	Blackwood
Eucalyptus camaldulensis	River Red Gum
Eucalyptus leucoxylon ssp. *pruinosa*	Yellow Gum
Eucalyptus microcarpa	Grey Box
Eucalyptus polybractea	Blue Mallee
Eucalyptus tricarpa (In Whipstick area)	Red Ironbark
Melaleuca lanceolata	Moonah

Volcanic – more than 500 mm annual rainfall

Cone

Groundcover

Chrysocephalum semipapposum	Clustered Everlasting
Clematis microphylla	Small-leaf Clematis
Danthonia spp.	Wallaby-grasses
Dianella revoluta	Black-anther Flax-lily
Juncus spp.	Rushes
Lomandra longifolia	Spiny-headed Mat-rush
Microlaena stipoides	Weeping Grass
Poa spp.	Tussock-grasses
Stipa spp.	Spear-grasses
Themeda triandra	Kangaroo Grass

Shrubs

Acacia paradoxa	Hedge Wattle
Acacia retinodes var. *retinodes*	Wirilda
Acacia verniciflua	Varnish Wattle
Bursaria spinosa	Sweet Bursaria
Correa glabra	Rock Correa
Dodonea viscosa	Narrow-leaf Hop-bush
Hymenanthera dentata	Tree Violet
Solanum laciniatum	Kangaroo Apple

Plain

Groundcover

Carex spp.	Sedges
Chrysocephalum semipapposum	Clustered Everlasting
Danthonia spp.	Wallaby-grasses
Dianella revoluta	Black-anther Flax-lily
Juncus spp.	Rushes
Lomandra longifolia	Spiny-headed Mat-rush
Microlaena stipoides	Weeping Grass
Poa spp.	Tussock-grass
Stipa spp.	Spear-grasses
Themeda triandra	Kangaroo Grass

Shrubs

Acacia acinacea	Gold-dust Wattle
Acacia retinodes var. *retinodes*	Wirilda
Hymenanthera dentata	Tree Violet
Leptospermum lanigerum	Woolly Tea-tree

Lower Slopes

Groundcover

Carpobrotus modestus	Inland Pigface
Chrysocephalum semipapposum	Clustered Everlasting
Clematis microphylla	Small-leaf Clematis
Danthonia spp.	Wallaby-grasses
Lomandra longifolia	Spiny-headed Mat-rush
Poa spp.	Tussock-grass
Stipa spp.	Spear-grasses

Shrubs

Acacia acinacea	Gold-dust Wattle
Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Acacia retinodes var. *retinodes*	Wirilda
Acacia verniciflua	Varnish Wattle
Bursaria spinosa	Sweet Bursaria
Cassinia arcuata	Drooping Cassinia
Correa glabra	Rock Correa
Dodonaea viscosa	Narrow-leaf Hop-bush
Hymenanthera dentata	Tree Violet
Indigofera australis	Austral Indigo
Solanum laciniatum	Kangaroo Apple

Depression/Drainage Line

Groundcover

Carex spp.	Sedges
Danthonia spp.	Wallaby-grasses
Juncus spp.	Rushes
Lomandra longifolia	Spiny-headed Mat-rush
Microlaena stipoides	Weeping Grass
Phragmites australis	Common Reed
Poa spp.	Tussock-grass
Stipa spp.	Spear-grasses
Typha orientalis	Cumbungi

Shrubs

Acacia paradoxa	Hedge Wattle
Acacia retinodes var. *retinodes*	Wirilda
Acacia verticillata	Prickly Moses
Callistemon sieberi	River Bottlebrush
Hymenanthera dentata	Tree Violet
Kunzea ericoides	Burgan
Leptospermum lanigerum	Woolly Tea-tree
Leptospermum obovatum	River Tea-tree
Viminaria juncea	Golden Spray

Volcanic – more than 500 mm annual rainfall

Cone

Trees

Acacia dealbata	Silver Wattle
Acacia implexa	Lightwood
Acacia mearnsii	Black Wattle
Acacia melanoxylon	Blackwood
Allocasuarina verticillata	Drooping She-Oak
Banksia marginata	Silver Banksia
Eucalyptus cypellocarpa	Mountain Grey Gum
Eucalyptus melliodora	Yellow Box
Eucalyptus obliqua	Messmate
Eucalyptus ovata	Swamp Gum
Eucalyptus radiata	Narrow-leaf Peppermint
Eucalyptus rubida	Candlebark
Eucalyptus viminalis	Manna Gum
Exocarpos cupressiformis	Cherry Ballart

Plain

Trees

Acacia dealbata	Silver Wattle
Acacia implexa	Lightwood
Acacia mearnsii	Black Wattle
Acacia melanoxylon	Blackwood
Allocasuarina luehmannii	Buloke
Allocasuarina verticillata	Drooping She-Oak
Banksia marginata	Silver Banksia
Eucalyptus camaldulensis	River Red Gum
Eucalyptus melliodora	Yellow Box
Eucalyptus microcarpa	Grey Box
Eucalyptus ovata	Swamp Gum
Eucalyptus radiata	Narrow-leaf Peppermint
Eucalyptus rubida	Candlebark
Eucalyptus viminalis	Manna Gum

Lower Slopes

Trees

Acacia dealbata	Silver Wattle
Acacia implexa	Lightwood
Acacia mearnsii	Black Wattle
Acacia melanoxylon	Blackwood
Acacia pycnantha	Golden Wattle
Allocasuarina verticillata	Drooping She-Oak
Banksia marginata	Silver Banksia
Eucalyptus melliodora	Yellow Box
Eucalyptus obliqua	Messmate
Eucalyptus rubida	Candlebark
Eucalyptus viminalis	Manna Gum
Exocarpos cupressiformis	Cherry Ballart

Depression/Drainage Line

Trees

Acacia dealbata	Silver Wattle
Acacia mearnsii	Black Wattle
Acacia melanoxylon	Blackwood
Eucalyptus camaldulensis	River Red Gum
Eucalyptus melliodora	Yellow Box
Eucalyptus ovata	Swamp Gum
Eucalyptus rubida	Candlebark
Eucalyptus viminalis	Manna Gum

Volcanic – less than 500 mm annual rainfall

Cone

Groundcover

Chrysocephalum semipapposum	Clustered Everlasting
Clematis microphylla	Small-leaf Clematis
Danthonia spp.	Wallaby-grasses
Poa spp.	Tussock-grasses
Stipa spp	Spear-grasses
Themeda triandra	Kangaroo Grass

Shrubs

Acacia aspera	Rough Wattle
Acacia genistifolia	Spreading Wattle
Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Acacia verniciflua	Varnish Wattle
Bursaria spinosa	Sweet Bursaria
Correa glabra	Rock Correa
Dodonea viscosa	Narrow-leaf Hop-bush
Hymenanthera dentata	Tree Violet

Trees

Acacia implexa	Lightwood
Allocasuarina verticillata	Drooping She-Oak
Eucalyptus melliodora	Yellow Box
Exocarpus cuppressiformis	Cherry Ballart

Plain

Groundcover

Bothriochloa macra	Red-leg Grass
Carpobrotus modestus	Inland Pigface
Carex spp.	Sedges
Chloris truncata	Windmill Grass
Chrysocephalum semipapposum	Clustered Everlasting
Danthonia spp.	Wallaby-grasses
Lavatera plebeia	Austral Hollyhock
Microlaena stipoides	Weeping Grass
Poa spp.	Tussock-grass
Stipa spp.	Spear-grasses
Themeda triandra	Kangaroo Grass

Shrubs

Eutaxia diffusa	Spreading Eutaxia
Hymenanthera dentata	Tree Violet
Acacia acinacea	Gold-dust Wattle

Trees

Acacia implexa	Lightwood
Allocasuarina luehmannii	Buloke
Eucalyptus camaldulensis	River Red Gum
Eucalyptus microcarpa	Grey Box

Lower Slopes

Groundcover

Carpobrotus modestus	Inland Pigface
Chrysocephalum semipapposum	Clustered Everlasting
Clematis microphylla	Small-leaf Clematis
Danthonia spp.	Wallaby-grasses
Lavatera plebia	Austral Hollyhock
Stipa spp.	Spear-grasses

Shrubs

Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Bursaria spinosa	Sweet Bursaria
Correa glabra	Rock Correa
Dodonaea viscosa	Narrow-leaf Hop-bush
Hymenanthera dentata	Tree Violet
Acacia acinacea	Gold-dust Wattle

Trees

Acacia implexa	Lightwood
Acacia pycnantha	Golden Wattle
Allocasuarina verticillata	Drooping She-Oak
Eucalyptus melliodora	Yellow Box
Exocarpus cuppressiformis	Cherry Ballart

Depression/Drainage Line

Groundcover

Carex spp.	Sedges
Danthonia spp.	Wallaby-grasses
Lavatera plebia	Austral Hollyhock
Microlaena stipoides	Weeping Grass
Phragmites australis	Common Reed
Poa spp.	Tussock-grasses
Stipa spp.	Spear-grasses
Teucrium racemosum	Grey Germander
Typha orientalis	Cumbungi

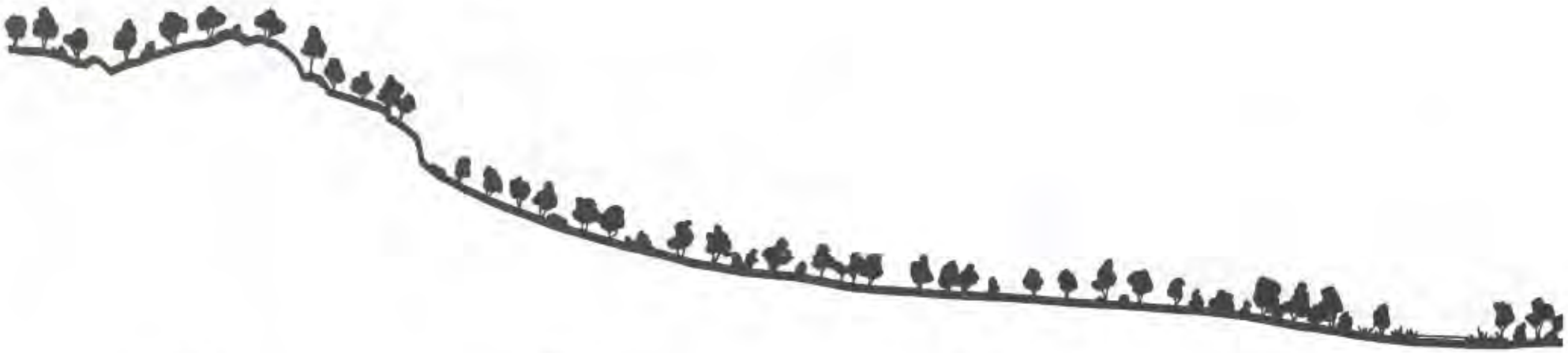
Shrubs

Acacia paradoxa	Hedge Wattle
Acacia retinodes	Wirilda
Callistemon sieberi	River Bottlebrush
Hymenanthera dentata	Tree Violet
Leptospermum obovatum	River Tea-tree
Muehlenbeckia florulenta	Tangled Lignum

Trees

Acacia melanoxylon	Blackwood
Eucalyptus camaldulensis	Red River Gum

Granite – more than 500m annual rainfall



Hill

Groundcover

Carex spp.	Sedges
Chrysocephalum semipappesum	Clustered Everlasting
Clematis microphylla	Small-leaf Clematis
Danthonia spp.	Wallaby-grasses
Dianella revoluta	Black-anther Flax-lily
Juncus spp.	Rushes
Microlaena stipoides	Weeping Grass
Poa spp.	Tussock-grasses
Themeda triandra	Kangaroo Grass

Shrubs

Acacia acinacea	Gold-dust Wattle
Acacia genistifolia	Spreading Wattle
Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Acacia verniciflua	Varnish Wattle
Acacia verticillata	Prickly Moses
Bursaria spinosa	Sweet Bursaria
Calytrix tetragona	Common Fringe-myrtle
Cassinia arcuata	Drooping Cassinia
Daviesia leptophylla	Slender Bitter-pea
Dodonaea viscosa	Narrow-leaf Hop-bush
Grevillea alpina	Cat's Claws
Hymenanthera dentata	Tree Violet
Indigofera australis	Austral Indigo
Kunzea ericoides	Burgan
Solanum laciniatum	Kangaroo Apple

Slope

Groundcover

Chrysocephalum semipappesum	Clustered Everlasting
Clematis microphylla	Small-leaf Clematis
Danthonia spp.	Wallaby-grasses
Dianella revoluta	Black-anther Flax-lily
Juncus spp.	Rushes
Lomandra longifolia	Spiny-headed Mat-rush
Microlaena stipoides	Weeping Grass
Poa spp.	Tussock-grasses
Stipa spp.	Spear-grasses
Themeda triandra	Kangaroo Grass

Shrubs

Acacia acinacea	Gold-dust Wattle
Acacia genistifolia	Spreading Wattle
Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Acacia verniciflua	Varnish Wattle
Bursaria spinosa	Sweet Bursaria
Calytrix tetragona	Common Fringe-myrtle
Cassinia arcuata	Drooping Cassinia
Daviesia leptophylla	Slender Bitter-pea
Dodonaea viscosa	Narrow-leaf Hop-bush
Grevillea alpina	Cat's Claws
Hymenanthera dentata	Tree Violet
Indigofera australis	Austral Indigo
Ozothamnus obcordatus	Grey Everlasting
Solanum laciniatum	Kangaroo Apple

Plain

Groundcover

Carex spp.	Sedges
Chrysocephalum semipappesum	Clustered Everlasting
Clematis microphylla	Small-leaf Clematis
Danthonia spp.	Wallaby-grasses
Dianella revoluta	Black-anther Flax-lily
Juncus spp.	Rushes
Lomandra longifolia	Spiny-headed Mat-rush
Microlaena stipoides	Weeping Grass
Poa spp.	Tussock-grasses
Stipa spp.	Spear-grasses
Themeda triandra	Kangaroo Grass

Shrubs

Acacia acinacea	Gold-dust Wattle
Acacia genistifolia	Spreading Wattle
Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Acacia retinodes var. *retinodes*	Wirilda
Bursaria spinosa	Sweet Bursaria
Calytrix tetragona	Common Fringe-myrtle
Cassinia arcuata	Drooping Cassinia
Daviesia leptophylla	Slender Bitter-pea
Hymenanthera dentata	Tree Violet
Myoporum viscosum	Sticky Boobialla
Ozothamnus obcordatus	Grey Everlasting
Solanum laciniatum	Kangaroo Apple

Depression/Drainage Line

Groundcover

Carex spp.	Sedges
Danthonia spp.	Wallaby-grasses
Juncus spp.	Rushes
Lomandra longifolia	Spiny-headed Mat-rush
Microlaena stipoides	Weeping Grass
Phragmites australis	Common Reed
Poa spp.	Tussock-grasses
Stipa spp.	Spear-grasses

Shrubs

Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Acacia retinodes var. *retinodes*	Wirilda
Acacia verticillata	Prickly Moses
Bursaria spinosa	Sweet Bursaria
Callistemon sieberi	River Bottlebrush
Hymenanthera dentata	Tree Violet
Kunzea ericoides	Burgan
Leptospermum lanigerum	Woolly Tea-tree
Leptospermum obovatum	River Tea-tree
Solanum laciniatum	Kangaroo Apple

Granite – more than 500m annual rainfall

Hill

Trees

Acacia implexa	Lightwood
Acacia mearnsii	Black Wattle
Acacia melanoxylon	Blackwood
Acacia pycnantha	Golden Wattle
Allocasuarina verticillata	Drooping She-Oak
Banksia marginata	Silver Banksia
Eucalyptus baxteri	Brown Stringybark
Eucalyptus camaldulensis	River Red Gum
Eucalyptus cypellocarpa	Mountain Grey Gum
Eucalyptus dives	Broad-leaved Peppermint
Eucalyptus goniocalyx	Long-leaved Box
Eucalyptus macrorhyncha	Red Stringybark
Eucalyptus melliodora	Yellow Box
Eucalyptus microcarpa	Grey Box
Eucalyptus obliqua	Messmate
Eucalyptus polyanthemos	Red Box
Eucalyptus radiata	Narrow-leaf Peppermint
Eucalyptus viminalis	Manna Gum
Exocarpos cupressiformis	Cherry Ballart

Slope

Trees

Acacia dealbata	Silver Wattle
Acacia implexa	Lightwood
Acacia mearnsii	Black Wattle
Acacia melanoxylon	Blackwood
Acacia pycnantha	Golden Wattle
Allocasuarina luehmannii	Buloke
Allocasuarina verticillata	Drooping She-Oak
Banksia marginata	Silver Banksia
Eucalyptus baxteri	Brown Stringybark
Eucalyptus camaldulensis	River Red Gum
Eucalyptus dives	Broad-leaved Peppermint
Eucalyptus globulus ssp. *bicostata*	Blue Gum
Eucalyptus goniocalyx	Long-leaved Box
Eucalyptus macrorhyncha	Red Stringybark
Eucalyptus melliodora	Yellow Box
Eucalyptus microcarpa	Grey Box
Eucalyptus obliqua	Messmate
Eucalyptus polyanthemos	Red Box
Eucalyptus radiata	Narrow-leaf Peppermint
Eucalyptus rubida	Candlebark
Eucalyptus viminalis	Manna Gum
Exocarpos cupressiformis	Cherry Ballart

Plain

Trees

Acacia dealbata	Silver Wattle
Acacia implexa	Lightwood
Acacia mearnsii	Black Wattle
Acacia melanoxylon	Blackwood
Acacia pycnantha	Golden Wattle
Allocasuarina luehmannii	Buloke
Allocasuarina verticillata	Drooping She-Oak
Eucalyptus camaldulensis	River Red Gum
Eucalyptus dives	Broad-leaved Peppermint
Eucalyptus goniocalyx	Long-leaved Box
Eucalyptus macrorhyncha	Red Stringybark
Eucalyptus melliodora	Yellow Box
Eucalyptus microcarpa	Grey Box
Eucalyptus obliqua	Messmate
Eucalyptus ovata	Swamp Gum
Eucalyptus polyanthemos	Red Box
Eucalyptus radiata	Narrow-leaf Peppermint
Eucalyptus viminalis	Manna Gum
Exocarpos cupressiformis	Cherry Ballart

Depression/Drainage Line

Trees

Acacia dealbata	Silver Wattle
Acacia implexa	Lightwood
Acacia mearnsii	Black Wattle
Acacia melanoxylon	Blackwood
Acacia pycnantha	Golden Wattle
Allocasuarina verticillata	Drooping She-Oak
Eucalyptus camaldulensis	River Red Gum
Eucalyptus goniocalyx	Long-leaved Box
Eucalyptus melliodora	Yellow Box
Eucalyptus ovata	Swamp Gum
Eucalyptus viminalis	Manna Gum

Granite – less than 500m annual rainfall

Hill

Groundcover

Chrysocephalum semipapposum	Clustered Everlasting
Clematis microphylla	Small-leaf Clematis
Danthonia spp.	Wallaby-grasses
Juncus spp.	Rushes
Microlaena stipoides	Weeping Grass
Poa spp.	Tussock-grasses
Stipa spp.	Spear-grasses
Themeda triandra	Kangaroo Grass

Shrub

Acacia acinacea	Gold-dust Wattle
Acacia calamifolia	Wallowa
Acacia deanei ssp. *paucijuga*	Green Wattle
Acacia genistifolia	Spreading Wattle
Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Acacia verniciflua	Varnish Wattle
Bursaria spinosa	Sweet Bursaria
Calytrix tetragona	Common Fringe-myrtle
Correa glabra	Rock Correa
Grevillea alpina	Cat's Claws
Hymenanthera dentata	Tree Violet
Pomaderris paniculosa ssp. *paniculosa*	Inland Pomaderris

Slope

Groundcover

Chrysocephalum semipapposum	Clustered Everlasting
Clematis microphylla	Small-leaf Clematis
Danthonia spp.	Wallaby-grasses
Juncus spp.	Rushes
Microlaena stipoides	Weeping Grass
Poa spp.	Tussock-grasses
Stipa spp.	Spear-grasses
Themeda triandra	Kangaroo Grass

Shrub

Acacia acinacea	Gold-dust Wattle
Acacia calamifolia	Wallowa
Acacia deanei ssp. *paucijuga*	Green Wattle
Acacia genistifolia	Spreading Wattle
Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Acacia verniciflua	Varnish Wattle
Bursaria spinosa	Sweet Bursaria
Calytrix tetragona	Common Fringe-myrtle
Correa glabra	Rock Correa
Grevillea alpina	Cat's Claws
Hymenanthera dentata	Tree Violet
Olearia spp.	Daisy-bushes
Pomaderris paniculosa ssp *paniculosa*	Inland Pomaderris

Plain

Groundcover

Carex spp.	Sedges
Chrysocephalum semipapposum	Clustered Everlasting
Clematis microphylla	Small-leaf Clematis
Danthonia spp.	Wallaby-grasses
Juncus spp.	Rushes
Microlaena stipoides	Weeping Grass
Poa spp.	Tussock-grasses
Stipa spp.	Spear-grasses
Themeda triandra	Kangaroo Grass

Shrub

Acacia acinacea	Gold-dust Wattle
Acacia deanei ssp. paucijuga	Green Wattle
Acacia genistifolia	Spreading Wattle
Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Acacia verniciflua	Varnish Wattle
Bursaria spinosa	Sweet Bursaria
Calytrix tetragona	Common Fringe-myrtle
Hymenanthera dentata	Tree Violet
Olearia spp.	Daisy-bushes
Westringia spp.	Westringia

Depression/Drainage Line

Groundcover

Carex spp.	Sedges
Danthonia spp.	Wallaby-grasses
Distichlis distichophylla	Australian Salt-grass
Juncus spp.	Rushes
Microlaena stipoides	Weeping Grass
Phragmites australis	Common Reed
Poa spp.	Tussock-grasses
Stipa spp.	Spear-grasses
Typha orientalis	Cumbungi

Shrub

Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Bursaria spinosa	Sweet Bursaria
Callistemon sieberi	River Bottlebrush
Hymenanthera dentata	Tree Violet
Leptospermum obovatum	River Tea-tree

Granite – less than 500m annual rainfall

Hill

Tree	
Acacia implexa	Lightwood
Acacia deanei ssp. *paucijuga*	Green Wattle
Callitris glaucophylla	White Cypress Pine
Eucalyptus leucoxylon ssp. pruinosa	Yellow Gum
Eucalyptus microcarpa	Grey Box
Eucalyptus polyantherios	Red Box
Eucalyptus macrorhyncha	Red Stringybark
Eucalyptus melliodora	Yellowbox
Eucalyptus blakelyi	Hill Red Gum

Slope

Tree	
Acacia implexa	Lightwood
Acacia deanei ssp. *paucijuga*	Green Wattle
Acacia salicina	Willow Wattle
Allocasuarina luehmannii	Buloke
Callitris glaucophylla	White Cypress Pine
Eucalyptus behriana	Broad-leaved Mallee Box
Eucalyptus camaldulensis	River Red Gum
Eucalyptus leucoxylon ssp. pruinosa	Yellow Gum
Eucalyptus microcarpa	Grey Box
Myoporum platycarpum	Sugarwood
Eucalyptus blakelyi	Hill Red Gum

Plain

Tree	
Acacia implexa	Lightwood
Acacia deanei ssp. *paucijuga*	Green Wattle
Acacia salicina	Willow Wattle
Allocasuarina luehmannii	Buloke
Callitris glaucophylla	White Cypress Pine
Eucalyptus behriana	Broad-leaved Mallee Box
Eucalyptus camaldulensis	River Red Gum
Eucalyptus leucoxylon ssp. pruinosa	Yellow Gum
Eucalyptus microcarpa	Grey Box
Myoporum platycarpum	Sugarwood

Depression/Drainage Line

Tree	
Acacia dealbata	Silver Wattle
Acacia mearnsii	Black Wattle
Eucalyptus camaldulensis	River Red Gum
Eucalyptus leucoxylon ssp. pruinosa	Yellow Gum
Eucalyptus microcarpa	Grey Box
Myoporum platycarpum	Sugarwood

Riverine plain – more than 500 mm annual rainfall

Plain

Ground cover

Bothriochloa macra	Red-leg Grass
Carex spp.	Sedges
Chloris truncata	Windmill Grass
Chrysocephalum semipapposum	Clustered Everlasting
Clematis microphylla	Small-leaf Clematis
Danthonia spp.	Wallaby-grasses
Dianella revoluta	Black-anther Flax-lily
Enchylaena tomentosa	Ruby Saltbush
Juncus spp.	Rushes
Microlaena stipoides	Weeping Grass
Poa spp.	Tussock Grasses
Stipa spp.	Spear-grasses
Themeda triandra	Kangaroo Grass

Shrub

Acacia acinacea	Gold-dust Wattle
Acacia genistifolia	Spreading Wattle
Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Acacia retinodes	Wirilda
Banksia marginata	Silver Banksia
Bursaria spinosa	Sweet Bursaria
Cassinia arcuata	Drooping Cassinia
Dodonaea viscosa	Narrow-leaf Hop-bush
Ozothamnus obcordatus	Grey Everlasting
Solanum laciniatum	Kangaroo Apple

Tree

Acacia implexa	Lightwood
Acacia mearnsii	Black Wattle
Acacia pycnantha	Golden Wattle
Allocasuarina leuhmannii	Buloke
Callitris glaucophylla	White Cypress Pine
Eucalyptus baxteri	Brown Stringybark
Eucalyptus camaldulensis	River Red Gum
Eucalyptus melliodora	Yellow Box
Eucalyptus microcarpa	Grey Box
Exocarpus cupressiformis	Cherry Ballart

Depression/Drainage Line

Ground cover

Bothriochloa macra	Red-leg Grass
Carex spp.	Sedges
Chloris truncata	Windmill Grass
Clematis microphylla	Small-leaf Clematis
Danthonia spp.	Wallaby-grasses
Distichlis distichophylla	Australian Salt-grass
Enchylaena tomentosa	Ruby Salt-bush
Juncus spp.	Rushes
Lomandra longifolia	Spiny-headed Mat-rush
Microlaena stipoides	Weeping Grass
Poa spp.	Tussock Grasses
Stipa spp.	Spear-grasses
Typha orientalis	Cumbungi

Shrub

Acacia retinodes	Swamp Wattle
Callistemon sieberi	River Bottlebrush
Calytrix tetragona	Common Fringe-myrtle
Kunzea ericoides	Burgan
Leptospermum lanigerum	Woolly Tea-tree
Leptospermum obovatum	River Tea-tree

Tree

Acacia mearnsii	Black Wattle
Acacia melanoxylon	Blackwood
Eucalyptus camaldulensis	River Red Gum

Riverine plain – less than 500 mm annual rainfall

Lunette

Groundcover

Carpobrotus modestus	Inland Pigface
Chloris truncata	Windmill Grass
Chrysocephalum semipapposum	Clustered Everlasting
Clematis microphylla	Small-leaf Clematis
Danthonia spp.	Wallaby-grasses
Distichlis distichophylla	Australian Salt-grass
Enchylaena tomentosa	Ruby Saltbush
Juncus spp.	Rushes
Lavatera plebeia	Australian Hollyhock
Maireana decalvans	Common Bluebush
Rhagodia spinescens	Thorny Saltbush
Stipa spp.	Spear-grasses
Themeda triandra	Kangaroo Grass

Shrubs

Acacia acinacea	Gold-dust Wattle
Acacia lineata	Streaked Wattle
Acacia oswaldii	Miljee
Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Acacia rigens	Nealie
Atriplex nummularia ssp. *nummularia*	Old-man Saltbush
Dodonaea viscosa	Narrow-leaf Hop-bush
Eremophila longifolia	Long-leaf Emu-bush
Melaleuca uncinata	Broom Honey-myrtle
Olearia spp.	Daisy-bushes
Santalum acuminatum	Sweet Quandong
Senna artemisioides	Desert Cassia

Plain

Groundcover

Carex spp.	Sedges
Carpobrotus modestus	Inland Pigface
Chloris truncata	Windmill Grass
Chrysocephalum semipapposum	Clustered Everlasting
Clematis microphylla	Small-leaf Clematis
Danthonia spp.	Wallaby-grasses
Enchylaena tomentosa	Ruby Saltbush
Juncus spp.	Rushes
Lavatera plebeia	Australian Hollyhock
Maireana decalvans	Common Bluebush
Microlaena stipoides	Weeping Grass
Poa spp.	Tussock-grasses
Rhagodia spinescens	Thorny Saltbush
Stipa spp.	Spear-grasses
Teucrium racemosum	Grey Germander
Themeda triandra	Kangaroo Grass

Shrubs

Acacia acinacea	Gold-dust Wattle
Acacia brachybotrya	Grey Mulga
Acacia oswaldii	Miljee
Acacia paradoxa	Hedge Wattle
Atriplex nummularia ssp. *nummularia*	Old-man Saltbush
Chenopodium nitrariaceum	Nitre Goosefoot
Dodonaea viscosa	Narrow-leaf Hop-bush
Eremophila longifolia	Long-leaf Emu-bush
Eutaxia diffusa	Spreading Eutaxia
Melaleuca decussata	Totem-poles
Melaleuca halmaturorum	Salt Paperbark
Olearia spp.	Daisy-bushes
Santalum acuminatum	Sweet Quandong
Senna artemisioides	Desert Cassia

Depression/Drainage Line

Groundcover

Bothriochloa macra	Red-leg Grass
Carex spp.	Sedges
Chloris truncata	Windmill Grass
Danthonia spp.	Wallaby-grasses
Distichlis distichophylla	Australian Salt-grass
Enchylaena tomentosa	Ruby Saltbush
Juncus spp.	Rushes
Lavatera plebeia	Australian Hollyhock
Microlaena stipoides	Weeping Grass
Phragmites australis	Common Reed
Poa spp.	Tussock-grasses
Rhagodia spinescens	Thorny Saltbush
Stipa spp.	Spear-grasses
Teucrium racemosum	Grey Germander
Typha orientalis	Cumbungi

Shrubs

Chenopodium nitrariaceum	Nitre Goosefoot
Leptospermum obovatum	River Tea-tree
Melaleuca decussata	Totem-poles
Muehlenbeckia florulenta	Tangled Lignum

Riverine plain – less than 500 mm annual rainfall

Lunette

Trees

Acacia pendula	Weeping Myall
Acacia pycnantha	Golden Wattle
Acacia salicina	Willow Wattle
Acacia stenophylla	Eumong
Allocasuarina luehmannii	Buloke
Callitris glaucophylla	White Cypress Pine
Eucalyptus largiflorens	Black Box
Eucalyptus leucoxylon ssp. pruinosa	Yellow Gum
Eucalyptus microcarpa	Grey Box
Hakea tephrosperma	Hooked Needlewood
Melaleuca lanceolata	Moonah
Myoporum platycarpum	Sugarwood

Plain

Trees

Acacia implexa	Lightwood (uncommon)
Acacia pendula	Weeping Myall
Acacia pycnantha	Golden Wattle
Acacia salicina	Willow Wattle
Acacia stenophylla	Eumong
Allocasuarina luehmannii	Buloke
Callitris glaucophylla	White Cypress Pine
Eucalyptus camaldulensis	River Red Gum
Eucalyptus largiflorens	Black Box
Eucalyptus leucoxylon ssp. pruinosa	Yellow Gum
Eucalyptus microcarpa	Grey Box
Hakea tephrosperma	Hooked Needlewood
Melaleuca lanceolata	Moonah
Myoporum platycarpum	Sugarwood
Pittosporum phillyraeoides	Weeping Pittosporum

Depression/Drainage Line

Trees

Acacia salicina	Willow Wattle
Acacia stenophylla	Eumong
Eucalyptus camaldulensis	River Red Gum
Eucalyptus largiflorens	Black Box
Leptospermum lanigerum	Woolly Tea-tree
Pittosporum phillyraeoides	Weeping Pittosporum

Riverine plain (subject to flooding) – less than 500mm annual rainfall

Plain

Ground

Carex spp.	Sedges
Danthonia spp.	Wallaby-grasses
Enchylaena tomentosa	Ruby Saltbush
Juncus spp.	Rushes
Lavatera plebeia	Australian Hollyhock
Maireana decalvans	Common Bluebush
Phragmites australis	Common Reed
Poa spp.	Tussock-grasses
Rhagodia spinescens	Thorny Saltbush
Stipa spp.	Spear-grasses
Teucrium racemosum	Grey Germander
Themeda triandra	Kangaroo Grass
Typha orientalis	Cumbungi

Shrub

Acacia acinacea	Gold-dust Wattle
Acacia ausfeldii	Austfeld's Wattle
Acacia brachybotrya	Grey Mulga
Acacia oswaldii	Miljee
Acacia pycnantha	Golden Wattle
Acacia rigens	Nealie
Atriplex nummularia ssp. *nummularia*	Old-man Saltbush
Chenopodium nitrariaceum	Nitre Goosefoot
Dodonaea viscosa	Narrow-leaf Hop-bush
Eremophila longifolia	Long-leaf Emu-bush
Melaleuca decussata	Totem-poles
Melaleuca halmaturorum	Salt Paperbark
Muehlenbeckia florulenta	Tangled Lignum
Nitraria billardieri	Nitre Bush
Pittosporum phylliraeoides	Weeping Pittosporum
Santalum acuminatum	Sweet Quandong
Senna artemisoides	Desert Cassia

Tree

Acacia pendula	Weeping Myall
Acacia pycnantha	Golden Wattle
Acacia salicina	Willow Wattle
Acacia stenophylla	Eumong
Allocasuarina luehmannii	Buloke
Eucalyptus camaldulensis	River Red Gum
Eucalyptus largiflorens	Black Box
Eucalyptus melliodora	Yellow Box
Eucalyptus microcarpa	Grey Box

Depression

Ground

Carex spp.	Sedges
Danthonia spp.	Wallaby-grasses
Distichlis distichophylla	Australian Salt-grass
Enchylaena tomentosa	Ruby Saltbush
Juncus spp.	Rushes
Lavetera plebeia	Australian Hollyhock
Phragmites australis	Common Reed
Poa spp.	Tussock-grasses
Rhagodia spinescens	Thorny Saltbush
Teucrium racemosum	Grey Germander
Typha orientalis	Cumbungi

Shrub

Chenopodium nitrariaceum	Nitre Goosefoot
Muehlenbeckia florulenta	Tangled Lignum
Pittosporum phillyraeoides	Weeping Pittosporum

Tree

Acacia salicina	Willow Wattle
Acacia stenophylla	Eumong
Eucalyptus camaldulensis	River Red Gum
Eucalyptus largiflorens	Black Box

Marine – less than 500mm annual rainfall

Plain

Groundcover

Carpobrotus modestus	Inland Pigface
Chloris truncata	Windmill Grass
Chrysocephalum semipapposum	Clustered Everlasting
Clematis microphylla	Small-leaf Clematis
Danthonia spp.	Wallaby-grass
Dianella revoluta	Black-anther Flax-lily
Enchylaena tomentosa	Ruby Saltbush
Lavatera plebeia	Australian Hollyhock
Microlaena stipoides	Weeping Grass
Rhagodia spinescens	Thorny Saltbush
Stipa spp.	Spear-grasses
Themeda triandra	Kangaroo Grass

Shrub

Acacia acinacea	Gold-dust Wattle
Acacia brachybotrya	Grey Mulga
Acacia calamifolia	Wallowa
Acacia lineata	Streaked Wattle
Acacia oswaldii	Miljee
Acacia paradoxa	Hedge Wattle
Acacia pycnantha	Golden Wattle
Acacia rigens	Nealie
Atriplex nummularia ssp. *nummularia*	Old-Man Saltbush
Bursaria spinosa	Sweet Bursaria
Dodonaea viscosa	Narrow-leaf Hop-bush
Eremophila longifolia	Long-leaf Emu-bush
Eutaxia diffusa	Spreading Eutaxia
Melaleuca uncinata	Broom Honey-myrtle
Olearia spp.	Daisy-bushes
Pomaderris paniculosa ssp. *paniculosa*	Inland Pomaderris
Santalum acuminatum	Sweet Quandong
Senna artemisioides	Desert Cassia
Westringia spp.	Westringia

Trees

Acacia salicina	Willow Wattle
Allocasuarina luehmannii	Buloke
Callitris glaucophylla	White Cypress Pine
Eucalyptus behriana	Bull Mallee
Eucalyptus calycogona	Red Mallee
Eucalyptus microcarpa	Grey Box
Eucalyptus polybractea	Blue Mallee
Eucalyptus porosa	Black Mallee-box
Eucalyptus viridis	Green Mallee
Hakea [illegible]	Hooked Needlewood

Depression

Groundcover

Bothriochloa macra	Red-leg Grass
Carpobrotus modestus	Inland Pigface
Danthonia spp.	Wallaby-grasses
Distichlis distichophylla	Australian Salt-grass
Juncus spp.	Rushes
Maireana decalvans	Common Bluebush
Phragmites australis	Common Reed
Rhagodia spinescens	Thorny Saltbush
Stipa spp.	Spear-grasses
Teucrium racemosum	Grey Germander
Typha orientalis	Cumbungi

Shrub

Atriplex nummularia ssp. *nummularia*	Old-man Saltbush
Chenopodium nitrariaceum	Nitre Goosefoot
Muehlenbeckia florulenta	Tangled Lignum

Trees

Acacia salicina	Willow Wattle
Acacia stenophylla	Eumong
Eucalyptus camaldulensis	River Red Gum
Eucalyptus largiflorens	Black Box
Melaleuca halmaturorum	Salt Paperbark

Section 3

Species Description

Introduction to the species descriptions

The goal of this guide is to help people begin to use local plants in the landscape. Because of limitations to the size of this guide many valuable local species had to be omitted. The plants described here are a short-list of those chosen on the following merits:

•easy to propagate;
•easy to cultivate;
•commonly available;
•have some economic or farm potential; or
•will grow across a reasonably wide range of the guide area.

Some species were also chosen because of special interest value or as representatives of important groups of plants.

If a local plant is not listed in this guide it does not mean the plant is of no use. These plants are just as important to the environment and it is desirable that they are used where possible. Recent research suggests some species of understorey will not be too difficult to establish (Murray & Dalton, 1996).

Finally, if you are living near the edge of the area covered by this guide, it may be worthwhile examining other regional planting guides (if available) for more information on your planting zone.

Key to the species descriptions

Other common names

Because common names are not formally administered there are sometimes several common names for the same plant. Similarly, there are some species of plant which share the same common name. This often makes common names unreliable in describing a plant.

Botanical names

Botanical names sometimes change when botanists review how a plant has been classified. If there appears a better way to describe the plant, when compared with its earlier description and with its relatives, then a new scientific name is given.

Distribution

The distribution as described in this book only covers areas within the North Central (Avoca, Loddon, Campaspe and Avon-Richardson) catchments. Nearly every species described here will occur outside the areas covered by this guide.

Habit

Describes the growth pattern shown by the plant, i.e. whether it is a tree, shrub or grass, etc.

Height and spread

There is often much variation in the maximum height and spread listed in this guide. This is because plants will grow to different sizes in different areas. For example a wide-spread plant will be larger in a more moist and fertile environment in the south than in a drier nutrient-poor site in the north.

Growth Rate

Growth rate is given as a relative measure in this guide. If a plant is described as fast, then it is probably going to be fast-growing compared with other indigenous plants in the local area. Plant growth normally slows in drier or harsher conditions.

Life Span

The life span of species have mostly been grouped as short-lived (<20 years), medium-lived (20 to 80 years) or long-lived (80+ years). The assessment is based on estimates by experts in the region. Individuals may live longer than the figure suggested, however the age is provided as a general guide. Life span may vary at different sites because of environmental conditions. The lifespan of many indigenous plants is still unrecorded.

Salt Tolerance

Salt tolerance has been listed from different sources as identified below. A superscript in the text (next to the tolerance) matches the information source listed below:

1Marcar, Crawford, Leppert, Jovanovic, Floyd & Farrow (1995).
2local observations
3Bird, Kearney & Jowett (1996).

Drought Tolerance

In this guide drought tolerance is a relative measure for a given location. Species from higher ground or north facing slopes are typically more drought tolerant than those near watercourses or on south facing slopes in the same area. If a plant is being grown where it naturally would have occurred then drought tolerance should not be a problem.

Frost Tolerance

Frost may be a problem for some high ground plants if planted in a depression where cold air sinks and accumulates. If a plant is being grown where it naturally would have grown then frost tolerance should not be a problem unless unusual circumstances prevail or the plant is not grown from local seed.

Other Tolerances

Other tolerances may include tolerance of alkaline (lime) soils, infertile soils or waterlogging.

Flowering

There may be small variations in flowering time depending on location.

Land System/Planting Zone

For an explanation of the planting zones, see page 34.

Site Preference and Soil Preference

Site preference describes the site conditions where the plant is generally found. Soil preference describes the typical soil types where the plants are found. In revegetation, these are very important indicators of where a species may naturally grow.

Natural Regeneration

This describes the ways the plant would normally regenerate under natural conditions.

Direct Seeding

This describes how successfully the plant can be direct seeded. The comments are based on the experience of local experts. A species is well suited if it germinates and grows quickly and the seed is easy to obtain.

Propagation

Propagation information comes from a range of sources. These include:

Nursery Availability

The availability of plants is likely to change as we learn more about the propagation of difficult plants and interest grows in using indigenous plants. If the species can be propagated easily, is not rare and plants are ordered in advance then there should be no problems with availability.

Seed Collection Notes

See also *Native plant seed collection* on page 21. Please note that seed collection on public land requires a permit from the Department of Natural Resources and Environment. Most of the information listed comes from Ralph (1993) and the Melbourne Indigenous Seedbank.

Seed Collection Calendar

The timing of seed ripening may vary from year to year and across the North Central region. For species that hold seed for a short period, the maturing seed should be closely monitored so that seed is successfully collected. Most of the information listed comes from Ralph (1993) and the Melbourne Indigenous Seedbank, both of which are Melbourne based so these records may not correspond precisely with North Central Victoria.

Land Protection Value

This category describes the ability of the plant to protect the soil in the surrounding landscape from salinity, wind erosion and water erosion. The ability of the plant to provide leaf litter and to fix nitrogen is also mentioned where relevant.

When discussing recharge control (for preventing salinity) it should be noted that green or working foliage will withdraw water from the site. The amount of green foliage in a given area in the warm part of the year determines the amount of water that is removed from the soil, thus influencing groundwater recharge.

Wildlife Value

It should be recognised that all local native plants have some wildlife value for a range of insects, birds and animals. If there is something significant about a plant's wildlife value then it is recorded in this section.

Ornamental Value

All indigenous plants may be seen as attractive, depending on your point of view. The ornamental value of a plant is described in this category according to traditional horticultural tastes. You may be able use indigenous plants in other ways which are attractive to you! The views expressed here are those of local botanical experts.

Timber

Information on timber usage of the species comes from Phelan & Higgins (1996) and Bootle (1983).

Aboriginal Use

This information has mostly been sourced from *Koorie Plants, Koorie People* by Zola & Gott (1992).

Other Products & Uses

Some plants have uses outside those listed above. More information for other species may be found in Portelli *et al* in prep, and Lazarides & Hince (1993).

Agroforestry Potential

This assessment is based on a summary of the above functional criteria.

Similar Species

Similar species are listed where they may be either closely related or ecologically similar.

Native Grasses

Introduction

In rural situations native grasses can be very valuable. Many are deep-rooted, tolerant of difficult soil conditions and most are perennial. They do play an important role in low input pasture situations and are often very useful in times of drought.

Native grasses play a key role as ground cover species in remnant native vegetation. Overstorey and shrub species are more able to regenerate in the inter-tussock spaces present in areas of native grassland than in areas dominated by competitive introduced grasses. Native grasses, along with the many smaller herbaceous wildflowers, also provide essential food and habitat for many native animals. Many have potential applications in agriculture, revegetation and landscaping.

Identification of native grasses is often difficult unless the grass is in flower, which normally occurs over the spring and summer period.

Revegetation

Grasses, just like trees, can be planted in a revegetation project - you just need a lot more of them to fill the same area. It will be difficult however to create a weed free sward, so weed control is clearly very important. Grasses can either be direct-seeded or planted by tubestock.

Direct seeding is possible when you have plenty of seed, a species that is likely to germinate easily and a site that is correctly prepared. *Chloris truncata* readily direct seeds in disturbed environments and should be successful while *Themeda triandra* has several special requirements (see McDougall, 1989). The seed can often be sown as a hay which can be later burnt or left to provide a thin mulch. Some trial work has demonstrated that *Microleana stipoides* will direct seed well under trees onto decaying mulch.

Tubestock and cell-tray planting can be undertaken for more difficult species, when there is limited seed available or on smaller sites where planting is occurring directly into mulch. Cell-trays or 'plugs' are better than tubestock as they are far more efficient both in terms of cost and planting effort, and grasses do not need to be any larger to plant.

To collect seed, flowering must be carefully monitored. For most species, seed is ripe when it begins to come away from the plant easily. You need to check that the seed heads contain mature viable seed. Squeeze the seed, if it is firm rather than soft and milky or hollow then it is considered ripe.

It is very important to recognise that there are many areas in the North Central region that are naturally only lightly wooded. Open grasslands and grassy woodlands were common on both the volcanic and riverine plains. Where remnant grasslands remain, tree planting should not be undertaken to the detriment of the grassy ground flora.

Where remnant trees are naturally present in areas of native grasses, the best method of tree revegetation is to allow natural regeneration by fencing to control stock. This is a good option, as it requires minimal effort, while producing trees that are naturally adapted to the site. However, weed-free native grasslands are valuable in their own right. If tree planting is undertaken, ensure associated soil disturbance is minimised, to reduce the chances of weed invasion.

Wallaby-grass in seed – one of the most widely spread grasses in the state.
Photo: Paul Foreman

Habitat

Native grasses play an important role in habitat provision for native wildlife. The seed is a significant food source for many birds and insects. The foliage provides refuge for reptiles, small birds and ground-dwelling mammals, while providing forage for marsupials, etc. When pastures dominated by native grasses are stocked appropriately, a diverse array of lilies, orchids and other ground wildflowers can co-exist, providing diverse habitat.

Agricultural management

Many people are increasingly realising the importance of native grasses in agriculture. As mentioned previously, native grasses are often deep rooted, perennial grasses tolerant of acid soils. Due to their perennial nature they can respond to rainfall opportunistically. Additionally they are adapted to low phosphorous and nitrogen levels and as such are not dependent on fertiliser application, unlike many exotic pasture grasses. These grasses will play an important role in solving problems of erosion, salinity and induced soil acidity. The two most important factors that impact on native grasses are response to fertility and response to grazing. These are discussed in greater detail in Mitchell (1996). There is an opportunity for landholders with weed-free remnant grasses to harvest and sell the seed.

To maintain native pastures, avoid cultivation as this encourages weed invasion. Concentrating grazing during mid-summer and autumn (after flowering and seed set) may assist their conservation but in weedy areas heavy grazing in spring may be more useful. Native grasses (e.g. Kangaroo Grass, Weeping Grass) can be managed (by grazing or burning pre-summer) to provide a summer green natural firebreak.

Landscaping

The potential of native grasses in landscaping is also gaining recognition. Many species are being trialled and are beginning

to be used in large landscaping projects such as along freeways and in parks and gardens.

Advantages of native grasses over introduced grasses include their suitability (and hardiness) to local soils and rainfall. They generally require less maintenance in terms of watering, mowing and weed control (providing a low cost alternative to the average lawn). Native grasses also provide habitat and food, contributing to the diversity of insect and animal life in the garden. Finally, native grasses provide a strong sense of local Australian character. They can add much beauty and interest to native gardens, complementing native trees and shrubs.

Further reading:

Johnson, G. (1994). *Managing grasslands and grassy woodlands, in your patch of bush.* Managing Remnant Flora and Fauna in North-East Victoria. Victorian Conservation Trust, Melbourne.

McDougall, K. (?1987). *Direct seeding Kangaroo Grass.* Arthur Rylah Institute.

Mitchell, M & Miller, M. (1992) *The identification of some common native grasses in Victoria.* Department of Agriculture, Rutherglen.

Scarlett, N.H., Wallbrink, S.J. & McDougall, K. (1992). *Field guide to Victoria's native grasslands.* Victoria Press, South Melbourne.

Rushes and sedges

Rushes and sedges are an important component of revegetation programs in wetlands, streamsides and where the ground is waterlogged for at least part of the year. A wide range of these plants can be found throughout North Central Victoria.

As with native grasses, both sedges and rushes are herbaceous, relatively low growing and often common plants where they are found in nature. They play a very important role in waterbodies by improving water quality and helping prevent erosion. They also provide important habitat for many different species. Frogs, birds, fish and crustaceans all benefit from the presence of a range of sedges and rushes.

Rushes and sedges tend to reduce evaporation from wetlands and dams by reducing the amount of wind across the water. On grazing properties, rushes can be useful during lambing because they provide protection from harsh climatic conditions. The new growth of some species is also palatable for stock. Most rushes and sedges are very useful for ornamental situations, with foliage providing strong patterns and good architectural effects.

It is important to note that some of the dense tussocky species (such as *Carex* spp.) can provide a harbour for vermin, and should be managed and checked accordingly. Other species (*Typha* spp.) are sometimes considered to be a pest if they are blocking waterways. There are also introduced weedy rushes that are very undesirable, such as the noxious Spiny Rush (*Juncus acutus*) which tends to colonise saline areas.

Using rushes and sedges for revegetation is also referred to in Streamsides: A focus for vegetation protection on page 18.

Tall sedge (Carex appressa)

Glossary

Agroforestry
A sustainable land management practice that integrates agriculture and tree-growing on farms.

Arboreal
of, living, in trees.

Bipinnate
A leaf twice pinnately divided, the first divisions themselves again divided, as in the bipinnate wattles.

Bog Method
A method of propagation where the seed tray is placed in a container of water, to keep the seed continually waterlogged or boggy. It is highly recommended for species with fine seed.

Bract
A modified leaf that is often smaller than other leaves, and often found with a flower or flower bud.

Capsule
A dry fruit which opens or splits to release seed when ripe.

Community
All the living things (normally including plants and animals) in a particular area, which together with the non-living components of the environment form an ecosystem.

Coppice
Cutting a tree allowing regrowth from dormant buds under the bark of tree stumps after a tree has been felled.

Cubic metre (m3)
The unit of measurement used for wood volume: 1 m x 1 m x 1 m.

Dioecious
With single-sex flowers, so that male and female flowers are on separate plants.

Discharge Area
An area where ground water reaches the soil surface.

Drupe
A stone-fruit, composed of a single hard-coated seed surrounded by a fleshy pulp or leathery layer, and an outer skin.

Ecosystem
The complex relationship between all the living and decaying organisms (including plant and animals) and the non-living components (including soil, water, air and light) in a defined environment.

Epicormic Shoots
New shoots that grow on a mature tree trunk or branch after damage such as grazing, burning, pruning or insect defoliation.

Exotic
Introduced from abroad, i.e. a plant not native to Australia.

Funicle
The stalk of an ovule or seed.

Genus
A classification group composed of closely related species. For example, *Eucalyptus* is a genus.

Glaucous
Coated with a bluish-white 'bloom' (a powdery waxy secretion), sometimes giving leaves a grey or silvery appearance.

Habit
The general appearance of a plant, including size, shape and growth form.

Habitat
The environment in which a plant or animal lives.

Hybrid
Offspring that is formed from sexual reproduction between two different parent species.

Indigenous
Native to a particular area; not introduced.

Juvenile
(of leaves) the leaves of a young plant, especially when these differ from the adult leaves, as in many eucalypts.

Legume
(i) A dry fruit formed from one carpel and splitting along two longitudinal lines; more commonly referred to as a pod, as in wattles.
(ii) A general term for members of the families Fabaceae, Mimosaceae, Caesalpiniaceae.

Lignotuber
A woody swelling, partly or wholly formed underground at the base of certain plants, notably many eucalypts. Composed of food reserves and shoots which can emerge for survival if the plant's aerial parts are destroyed.

Mordant
A substance that fixes colour (in dyeing).

Naturalised
Not native to an area, but established and spontaneously reproducing itself there.

Node
The portion of the stem (often a 'joint') from which a leaf, or a whorl of leaves, or a bract, arises.

Operculum
A lid or cap, especially that which covers the flower parts in the buds of all eucalypts.

Perennial
Living for at least several years, and usually flowering each year.

Phyllode
The leaf-stalk (petiole) enlarged and commonly flattened, and performing the functions of a leaf, as in many wattle species such as the Blackwood and Lightwood.

Pioneer

Describing plants which colonise an exposed site in early stages of succession.

Pricking Out

The method of transplanting seedlings from trays to individual containers.

Provenance

The place of origin of a species, subspecies or variety.

Recharge

Area in which surface water enters the soil to become groundwater.

Riparian

Growing on a river-bank.

Shelterbelt

A linear planting of closely spaced trees and shrubs designed and strategically located to reduce wind speed.

Species

(abbreviations: sp. - singular; spp. - plural). A unit of classification of genetically similar organisms potentially capable of interbreeding to produce fertile offspring for many generations.

Subspecies

(abbreviation: ssp.) A subgrouping used to describe variants of a species.

Succession

The process in which the same area is progressively occupied by different plant communities, while other environmental factors are reasonably constant.

Understorey

A general term for the plants (usually shrubs) of a community occurring at levels lower than the top stratum (usually trees).

Viability

(of seed) having the potential to germinate.

References

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Key *Name* **76** (if you want to see a whole page about this plant) 86 (for a passing reference or comment on this plant)