

BUSHLAND MANAGEMENT

Nature Conservation Information Sheets



You can help nature on your property

You can help nature by managing the conservation values on your property. Nature Conservation's Bushland Management Information Sheet Series provides landowners with the advice needed to manage conservation values on their properties.

This document provides a set of all the Bushland Management Information Sheets for download. The Information Sheets can also be downloaded individually using the links on Nature Conservation's website – [Help Nature On Your Property](#). You can also contact the Nature Conservation Office on 9757 2202 and speak with a biodiversity officer if you have specific questions about your property.

The following Information Sheets are provided in this combined document:

- Caring For Your Bushland
- Biodiversity Property Plans
- Managing Environmental Weeds
- Managing Streams and Wetlands
- Dams for Biodiversity
- Revegetation with Local Natives
- Bushland and Fire
- Arum Lily Control
- Fox Control
- Marri Decline
- Rat Control and Local Wildlife

If you would like extra tips for your garden or own an urban residential property check out our [Gardens for Nature Information Sheets](#) or visit our [Help Nature In Your Garden](#) website page.



These Information Sheets were funded by the Australian Government's National Landcare Program

CARING FOR BUSHLAND

Nature Conservation Information Sheet



Bushland management overview

Bushland in the Margaret River region is valuable. In a largely altered landscape, remnant native vegetation provides a refuge for many species of plants and wildlife. It provides protection against soil erosion and salinity, assists in maintaining water quality, provides natural pest control, stores carbon and modifies climate. It provides diversity and beauty in a largely cleared and altered landscape.

Remnant native vegetation and associated wildlife face many threats including clearing, grazing, Phytophthora dieback, tree decline, weeds, feral animals and fire. A brief overview of some of the actions needed to conserve bushland and protect its many values is outlined below.

Develop a plan. A bushland management plan will provide a valuable tool to prioritise actions needed to conserve and improve the biodiversity values of your property. A plan includes identifying natural areas on your property, assessing their condition and ecological values, determining threats to them, and developing actions to manage the threats and to protect and improve environmental condition. See [Nature Conservation Information Sheet *Biodiversity Management Plans*](#).

Minimise disturbance. Don't use your bushland to store equipment or supplies, or dispose of rubbish, car bodies, garden refuse or dead livestock. Wherever possible don't extract gravel or sand from bushland and avoid creating tracks. These **disturbances can result in degradation** via the introduction and spread of weeds and disease, loss of vegetation, and soil compaction.

Control stock access. Stock should be kept out of bushland as they eat and trample native vegetation, ringbark trees, spread weeds, add nutrients and cause soil compaction. All the effects of grazing pressure occur under light stocking rates as well as under heavy stocking; the effects are largely a matter of degree and are slower to appear. The **negative impacts of grazing** are gradual and degradation may not be obvious in the short term. Grazed bushland will eventually be dominated by aging shrubs and trees and with no regenerating seedlings surviving, it will die out.

Control invasive introduced plants. Environmental weeds are plants that have been introduced to our area from other parts of the world, including other areas of Australia, and are spreading and displacing native species. In bushland, where the aim is to retain a healthy native vegetation community, environmental weeds represent a threat to vegetation condition. First consideration should be **prevention of establishment** which means keeping disturbance of the bush to an absolute minimum; ensuring the plants that you introduce to your garden, windbreaks and landscaping don't escape into bushland; and controlling emerging weed problems early before they become established and widespread. Second step is to plan and **implement weed management** as described in the [Nature Conservation Information Sheet: *Managing Environmental Weeds*](#).



Control introduced pest animals. Introduced animals that may impact on the biodiversity values of your bushland include rabbits, foxes, cats, pigs and feral honeybees. These animals compete with native fauna for food and shelter, damage native plants, prevent regeneration, and predate on native fauna. The conservation value of remnant vegetation will be improved if introduced pest animals are controlled. For further information go to <https://www.agric.wa.gov.au/pests-weeds-diseases/pests/pest-animals> and [Nature Conservation Information Sheet: *Fox Control*](#).

Manage Phytophthora dieback. Phytophthora dieback is a deadly plant disease caused by the introduced pathogen *Phytophthora cinnamomi*. This pathogen lives in soil and plant tissue and is spread in water and soil. It attacks the roots of plants causing them to rot and resulting in plant death. At least 40 percent of the plant species in the south west region are susceptible to Phytophthora dieback. The first principle of Phytophthora dieback management is to minimise the introduction and spread. **Any activity that introduces or moves soil, gravel or sand should be avoided if possible.** Considerations include: minimising tracks and roads through bushland; keeping footwear, vehicles, bicycles, tools and equipment entering bushland free of all mud and soil; not bringing soil, gravel or sand into bushland; and keeping out horses and stock. If dieback is already present in your remnant vegetation planning and management can minimise its impact. Excellent information on dieback management is available at www.dwg.org.au

Reduce tree decline. Native trees do best when growing in healthy bushland. They rely on complex interactions with the soil and other plants and animals. When these interactions are disturbed trees cannot function properly and may go into a slow decline leading to ill health and premature death. There are many factors that may result in native tree decline including climate change, drought, loss of native understorey, changes to soil composition and structure, over abundance of insect pests, plant pathogens and fire. Things you can do to protect and improve tree health include leaving bushland around trees intact, restoring native understorey, minimising soil compaction and root disturbance, preventing ring barking and trunk damage, controlling pests and diseases, and preventing and controlling dieback. Further information at [Nature Conservation Information Sheet: *Marri Decline*](#)

Retaining and creating habitat for wildlife. Retain old and dead standing trees as many of these contain hollows used by birds and small mammals. They also provide perching sites for birds of prey. Fallen timber provides habitat for reptiles, invertebrates and other animals and is an important element of healthy bushland. If there are too few nesting hollows on your property, artificial hollows or nest boxes may be a solution. Go to www.birdlife.org.au for information on nesting boxes for birds. For nest box designs for possums go to www.possumcentre.com.au/Pages/nestbox_1.html and <https://geocatch.asn.au/wp-content/uploads/2018/01/Nest-Boxes-for-Native-Animals.pdf>

Fire and biodiversity. Planned burns are used in remnant vegetation to reduce fire risk and/or encourage regeneration. An understanding of the ecological impacts of fire can enable land managers to plan and implement burns in a way that will minimise negative impacts on the ecosystem and hopefully result in improvements in condition. This is no simple

matter with many elements to consider including the reason for burning (hazard reduction or promoting regeneration), vegetation type to be burnt, fire history of the remnant, the possible frequency and timing of burning, the extent of the area to be burnt, the impacts on Phytophthora dieback management, and post-fire management needs including weed, feral animal and grazing control. For further detail see [Nature Conservation Information Sheet: *Bushland and Fire*](#).

Revegetation and assisted regeneration. As a general rule the priorities are to protect existing vegetation first, encourage natural regeneration next and lastly undertake revegetation. Protecting and enhancing natural regeneration is the most cost efficient and effective way to revegetate a site. Protecting natural regeneration requires the control of grazing and weeds, and can be enhanced by small pile burns and the introduction of seed through direct seeding and brushing.

In areas where natural regeneration is unlikely to occur revegetation can be used to improve the condition of bushland, streams and wetlands and to establish corridors between areas of remnant vegetation.

Using plants that are native to your area is highly recommended. These plants are valuable to local wildlife and will not become a weed problem in the future. When planting trees think carefully about the long term impact - will they shade your house or cause a fire risk once they reach their full size? For more see [Nature Conservation Information Sheet: *Revegetation with Local Natives*](#).

References and further information

- Brown, K & Brooks, K (2002) *Bushland Weeds A practical guide to their management*. Environmental Weeds Action Network. Available at https://www.natureconservation.org.au/wp-content/uploads/2019/03/Bushland_Weeds_Book.pdf
- www.herbiguide.com.au - Detailed information about weed species and control methods.
- Hussey, B.M.J. and Wallace, K.J. (1993) *Managing Your Bushland*. Department of Conservation and Land Management, Como, Western Australia.
- <https://florabase.dpaw.wa.gov.au/weeds/> - Detailed information about weed species and control methods
- <https://florabase.dpaw.wa.gov.au/> - Detailed information about native species
- Moore, J & Wheeler, J (2008) *Southern Weeds and their control*. Department of Agriculture and Food WA.
- Scott, J and Negus P (2013) *Wildflowers of Southwest Australia, Augusta-Margaret River Region*. Cape to Cape Publishing, Fremantle, WA.



BIODIVERSITY PROPERTY PLANS

Nature Conservation Information Sheet



Planning to protect biodiversity

This Information Sheet provides an overview of how to develop a plan to manage the bushland, waterways, wetlands and dams on your property to protect and enhance their biodiversity values

Step 1: Start with an aerial photo of your property

An aerial photograph makes a good base map and greatly assists in this planning process. You can build up information on this base map drawing on the photo or using overlays. Alternatively, you can use a computer-based mapping program. A GPS can be a useful tool for accurately locating property features. Mark property features on your map including:

- Property boundaries and fences.
- Natural features such as streams, wetland areas, dams.
- Access and walking tracks.

Use an aerial photo to look at your property within a *landscape context*. How does your remnant vegetation and creeklines fit in to the broader view? Is your remnant vegetation part of a larger area of vegetation across properties? Does it provide linkages between other bushland or wetland areas? Are there large remnants on adjoining properties that could be linked by revegetation to improve their habitat values? When developing management actions think about the landscape context and what you can do on both on your property and in collaboration with neighbours to protect and improve biodiversity.

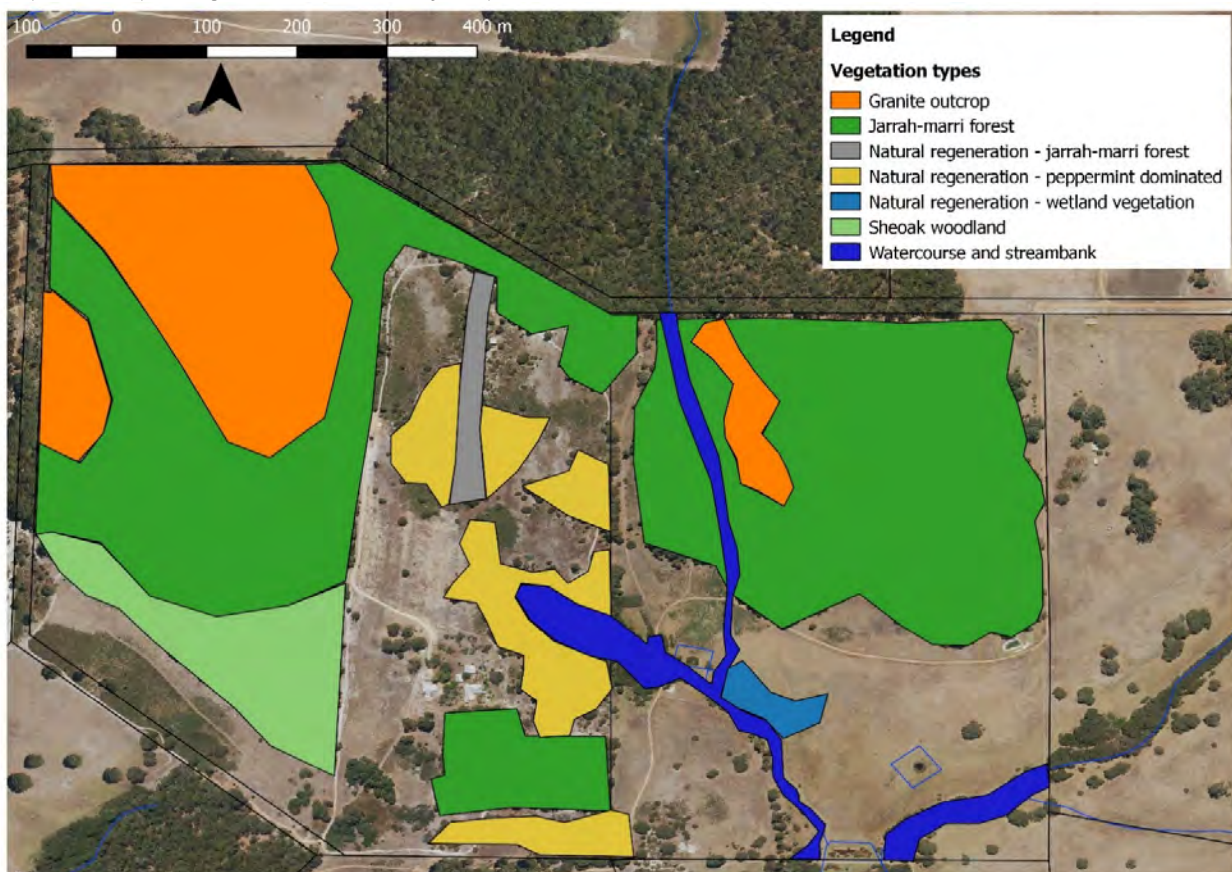
Step 2: Map remnant vegetation communities

Determine and map the native vegetation communities on your property. We recommend that you classify your vegetation using the communities described by Scott and Negus (2013) in *Wildflowers of Southwest Australia, Augusta-Margaret River Region* as outlined in Table 1. Map 1 provides an example vegetation type map.

Table 1: Vegetation communities modified from Scott and Negus (2013) in *Wildflowers of Southwest Australia, Augusta-Margaret River Region*

Vegetation community	Description
Peppermint woodland	Dense or open woodland of <i>Agonis flexuosa</i> found on sandy limestone soils.
Banksia woodland	Woodlands dominated by <i>Banksia attenuata</i> or <i>Banksia ilicifolia</i> on deep sand.
Karri forest	Tall forest of <i>Eucalyptus diversicolor</i> often with a dense shrub understorey. Confined to river valleys and sandy loam soils over deep limestone.
Jarrah-marri forest	Our most common vegetation community with a very diverse range of understorey species depending on soil, hydrology, topography and fire and grazing history. Jarrah (<i>Eucalyptus marginata</i>) is more dominant in areas of thin lateritic, ironstone soils. On sandy soils the understorey is denser and marri (<i>Corymbia calophylla</i>) is often more common.
Sheoak woodland	Common sheoak (<i>Allocasuarina fraseriana</i>) is sometimes the dominant tree, or more often mixed with jarrah or banksia (<i>Banksia grandis</i>) on sandy soils over granite. The sheoak's needle-like leaves cover the ground and discourage seedlings, so the understorey is usually fairly open.
Granite community	Includes areas of protruding granite rocks as well as where there is thin soil over granite with rock visible on the surface in places. A unique suite of species suited to withstanding both inundation and extreme drying. Typical species include mosses and ferns, <i>Hakea trifurcata</i> , <i>Kunzea ciliata</i> , <i>Darwinia citriodora</i> , <i>Drosera</i> spp.,
Sandplains	These areas of sandy/ peaty soils over clay are often damp in winter and generally support low heathland vegetation with the occasional taller shrubs.
Coastal heath	Dense shrubland ranging up to 3m or more in height. The dense nature of this community can provide excellent habitat for a range of bird and mammal species.
Winter wet swamps and wetlands	These areas are typified by winter inundation but with minimal flow and are often dominated by a diverse range of sedges and rushes. Typical species may include <i>Taxandria linearifolia</i> , <i>T. parvipiceps</i> , <i>Melaleuca lateritia</i> , <i>M. presissiana</i> , <i>Leptocarpus</i> spp., <i>Meeboldina</i> spp., <i>Lepidosperma tetraquetrum</i> .
Watercourses and stream banks	Wet areas low in the landscape with flowing water (often dry in summer/autumn) and dense vegetation. Dominated by a diverse range of species that grow in association with water such as tea trees, rushes and sedges.
Coastal dunes	This dynamic and harsh coastal environment is dominated by low, spreading plants critical in stabilising mobile soils and reducing wind and wave erosion.

Map 1: Example vegetation community map

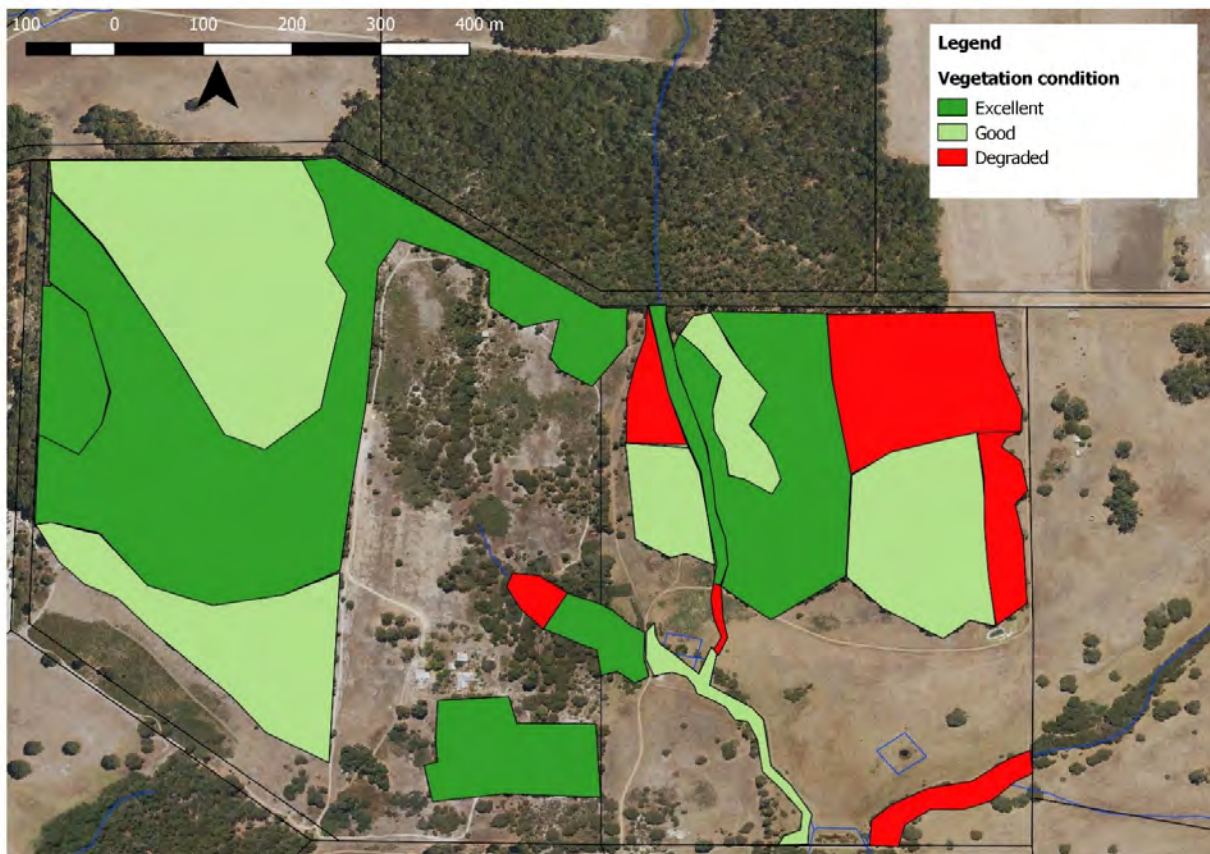


Step 3: Assess and map condition of remnant vegetation, creeks and wetlands

Have a close look at your remnant vegetation, creeks and wetlands and use the information in Table 2 to help you determine their condition. It is unlikely that the area you are assessing will fit neatly into one of these categories. The lists provide factors for you to consider when assessing condition and you will need to decide which of the three conditions is the best fit. Example photos for each category are included below and Map 2 provides an example vegetation condition map.

Table 2: Factors to assist assessment and determination of vegetation condition		
Excellent	Good	Degraded
The native tree cover remains largely intact. Minimal signs of tree clearing and related damage	Some tree clearing has occurred – eg. trees logged for firewood, bush poles, fence posts, timber. Many native trees remain.	The tree cover is partly or completely cleared
The trees have a healthy foliage	Some trees are showing signs of dieback	The trees show signs of dieback
There is a reasonably diverse and abundant cover of native understorey plants	Understorey plants remain but are limited in number and diversity	Little to no understorey plants remain
Very few weeds and exotic grasses are present. If present, very localised only.	Weeds and/or exotic grasses are present but not dominant	Weeds and/or exotic grasses are the dominant understorey
Regeneration of trees and other plants is occurring	Some regeneration of young trees and other plants is evident	Little to no regeneration of young trees and other plants
There are old trees with hollows	There are obvious signs of disturbance from clearing, logging and grazing	Active erosion occurring
There are fallen logs and timber	There are old trees with hollows	Introduced tree species may be present
Leaf litter is present	Leaf litter is present	
There may be some small areas of localised disturbance where the soil is exposed and there are some weeds.	There are fallen logs and timber	

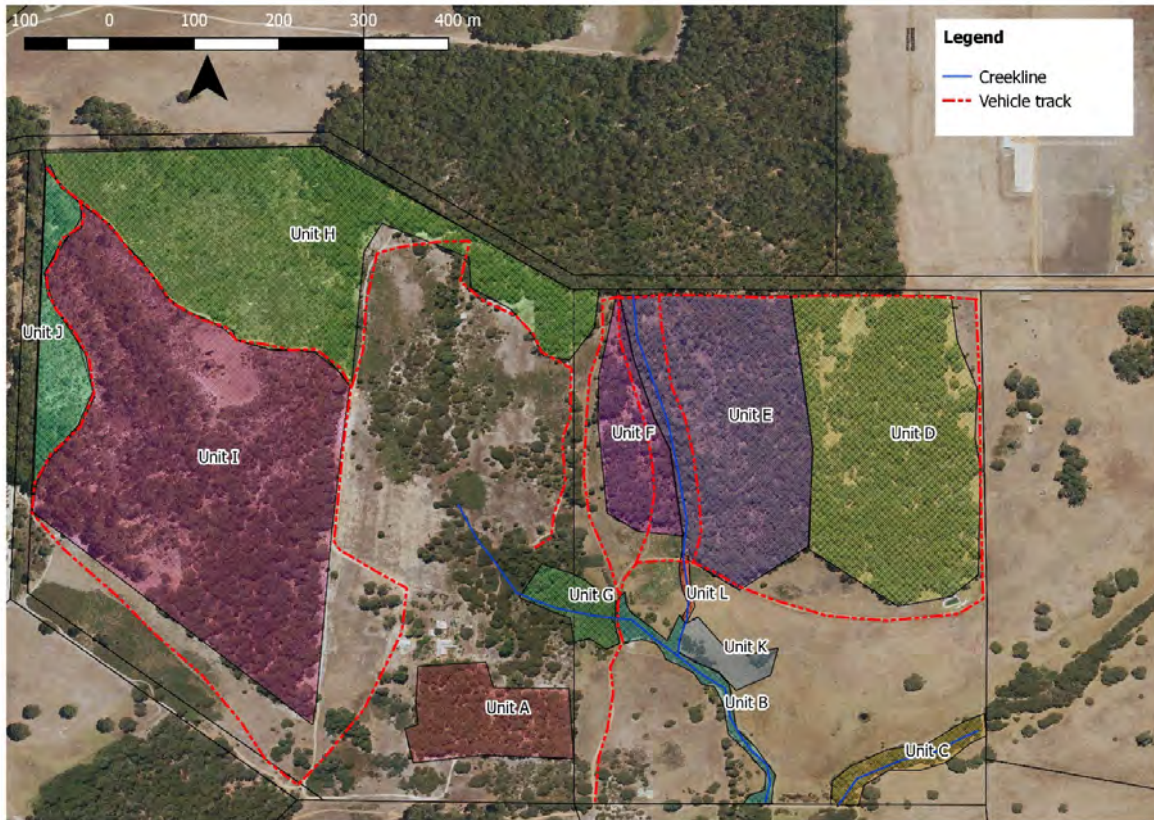
Map 2: Example vegetation condition map



Step 4: Determining management units

You can now divide your property into smaller management units based on natural or man-made features such as access tracks, creeklines and areas of vegetation. If practical it would be helpful to have management units that are made up of the same vegetation community and condition as these areas are likely to have similar management needs. Mark each management unit on your property map.

Map 3: Example management units map



Step 5: Identify threats to vegetation condition and biodiversity values

A crucial part of biodiversity management planning is to identify threats and rate their level of seriousness. Threats to biodiversity values include clearing, grazing, weeds, pest animals, inappropriate fire regimes, change to hydrology, poor water quality, Phytophthora dieback, tree decline, soil compaction and erosion.

See Map 4 for an example threats map.

Step 6: Determine management actions and priorities

Use information on vegetation condition and threats in each of the management units to determine what actions are required and set priorities. When doing so take into consideration the biodiversity value of the area affected and the potential impact of the threat. This will help you prioritise actions.

For example, a small outbreak of an invasive weed in an area of good quality vegetation is a serious threat requiring urgent attention. A larger patch of a less invasive weed in a more degraded area poses less of a risk to biodiversity values and is a lower priority.

Table 3 provides an example.

Map 4: Example threats map

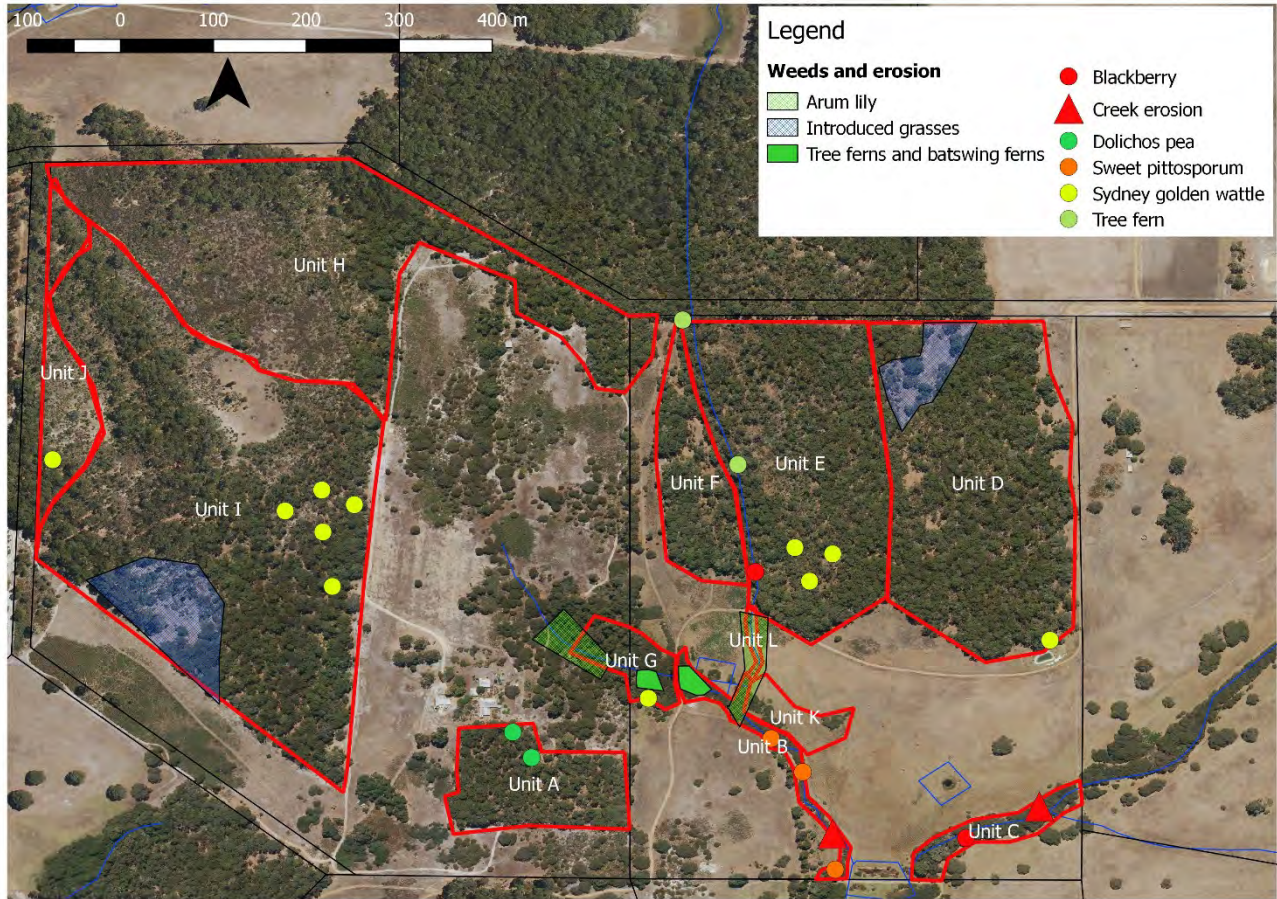


Table 3: Management actions

Management unit and vegetation community	Condition	Threats	Management action	Priority	Timing & Who
Unit J - Granite Unit I and E - Jarrah-marri forest	Excellent <i>(High value)</i>	Few Sydney golden wattle including some adult trees and a number of seedlings <i>(High level of threat)</i>	Cut and paint stump of mature trees, hand weed seedlings, monitor area for further seedlings for next 10 years.	Very high	All year Landholder
Unit E - Jarrah-marri forest and creekline vegetation	Excellent <i>(High value)</i>	Tree ferns and small blackberry infestation on excellent condition creekline <i>(High level of threat)</i>	Remove tree ferns and spray blackberry	Very high	Blackberry control Dec-March Tree ferns – all year Landholder
Unit L - Watercourse and stream bank	Degraded Adjacent to excellent condition creekline to north	Arum lily infestation <i>(Moderate level of threat)</i>	Spray arum lily	High	Arum lily control Aug-Oct Landholder
Unit A - Jarrah-marri forest	Excellent <i>(High value)</i>	Stock grazing and degrading remnant vegetation	Fencing	Very high	Fencing contractor

See below for a list of information resources to assist with management.

Step 7: Monitoring, evaluation and review

Monitoring the changes that result from your management actions can be as simple or detailed as you wish. At a minimum take photos (from the same spot, at the same time of year and day). You could also keep records of vegetation condition, weed presence and extent, plant species, animal observations etc.

Evaluate the outcomes of the management actions and adapt your approach if necessary.

Do you need assistance?

Nature Conservation can develop a bushland management plan for your property on a fee for service basis. If you would like to enquire about this service please email us at info@natureconservation.org.au

References and further information

- Brown, K & Brooks, K (2002) *Bushland Weeds A practical guide to their management*. Environmental Weeds Action Network. Available at https://www.natureconservation.org.au/wp-content/uploads/2019/03/Bushland_Weeds_Book.pdf
- www.herbiguide.com.au - Detailed information about weed species and control methods.
- Hussey, B.M.J. and Wallace, K.J. (1993) *Managing Your Bushland*. Department of Conservation and Land Management, Como, Western Australia.
- <https://florabase.dpaw.wa.gov.au/weeds/> - Detailed information about weed species and control methods
- <https://florabase.dpaw.wa.gov.au/> - Detailed information about native species
- Land for Wildlife Queensland Note G3, *Bushland Management Planning*
- Nature Conservation Information Sheets
- Moore, J & Wheeler, J (2008) *Southern Weeds and their control*. Department of Agriculture and Food WA.
- Scott, J and Negus P (2013) *Wildflowers of Southwest Australia, Augusta-Margaret River Region*. Cape to Cape Publishing, Fremantle, WA.



ENVIRONMENTAL WEEDS

Nature Conservation Information Sheet



A serious threat to biodiversity

Environmental weeds are plants that have been introduced to our area from other parts of the world, including other areas of Australia, and are spreading and displacing native species. They have been introduced as ornamental garden plants, for fruit production or other agricultural use and have escaped from gardens and farms and are invading creeklines, forests, woodlands and coastal areas.

Many of these plants are fast growing, hardy and highly adaptable. They have highly successful reproductive and seed dispersal mechanisms, including abundant seed production, seeds that remain viable for many years, and fruit and seeds that are attractive to birds and mammals. Many also have the ability to spread by vegetative means, such as rhizomes, bulbs and corms. They often have few predators or diseases to keep them under control in their new habitat.

Weeds are spread by seeds attached to shoes, clothing or vehicles, dumping of garden waste, and the movement of seed by wind, water and animals.

Why do environmental weeds matter?

Remnant native vegetation provides valuable food, shelter and breeding habitat for native plants and animals. Environmental weeds impact on the values of remnant vegetation by out competing native plants for space, water and nutrients, changing and simplifying the composition of vegetation communities and reducing their value as habitat for native animals. Many weeds also increase fuel loads and fire risk.

Invasive environmental weeds present one of the most serious threats to biodiversity in the Margaret River region.

What you can do

Prevention: don't give weeds the chance

- Keep disturbance of bushland and waterways to an absolute minimum. Creating tracks, firebreaks, excavating for sand and gravel, and rubbish dumping will all create a favourable environment for weed establishment.
- Don't divert water into bushland as this will favour weed growth.
- Check your existing introduced plants and remove any that readily spread and are likely to invade remnant vegetation on your property.
- Choose local native plants. These plants occur naturally in your local area. Sometimes plants from the eastern Australia are referred to as 'native' but are not native to WA and may be invasive (such as many weedy wattle species that have been planted extensively in the Margaret River region and are now spreading).
- If using non-native species choose non-invasive plants for your garden and landscaping. Choose safe alternatives, including sterile forms of species that would otherwise set seed.
- Dispose of garden waste responsibly. Dumping plants is one of the key 'escape' routes. Never dump garden waste over the back fence, on roadsides or in remnant vegetation. Cover your trailer when transporting garden waste to the tip to avoid weeds and cuttings falling off and invading roadside bushland.
- Treat weeds when present in small number and before they become established. Early detection and control before a species becomes well established is highly recommended.

Plan a control program for emerging and established weeds

A plan will improve the likelihood of a successful weed control. It will help you determine priorities, organise your work and monitor success. A plan can be as simple as a weed map and list of management actions including timing and control method.

To determine priorities it is suggested that you map priority weed species on your property, assess the condition of the remnant vegetation in which they are present, determine your weed control priorities and develop a plan of action as outlined briefly below. See [Nature Conservation Information Sheet: Biodiversity Management Plans](#) for more information.

Step 1: Map presence and density of priority weed species

Priority species includes weeds that are: obviously invasive, become dominant, have long lived seed, and have a major impact on the vegetation community. See Tables 2 and 3 at the end of this Information Sheet for weeds that are recognised as a priority for control in the Margaret River region.

Step 2: Determine management priorities

Have a close look at your remnant vegetation, creeks and wetlands and use the information in Table 1 to help you determine their condition. It is unlikely that the area you are assessing will fit neatly into one of these categories. The lists provide factors for you to consider when assessing condition and you will need to decide which of the three conditions is the best fit.

Protection of excellent and good condition vegetation and control of very invasive weeds are the highest priority. For example, a small outbreak of an invasive weed in an area of good quality vegetation is a serious threat requiring urgent attention. A larger patch of a less invasive weed in a more degraded area poses less of a risk to biodiversity values and is a lower priority.

Step 3: Work out a plan of action

Prioritise the protection of excellent and good condition areas of vegetation and focus on priority weed species.

Table 1: Factors to assist assessment and determination of vegetation condition		
Excellent	Good	Degraded
The native tree cover remains largely intact. Very minimal, if any, signs of tree clearing and related damage	Some tree clearing has occurred – eg. trees logged for firewood, bush poles, fence posts, timber. Many native trees remain.	The tree cover is partly or completely cleared
The trees have a healthy foliage	Some trees are showing signs of dieback	The trees show signs of dieback
There is a reasonably diverse and abundant cover of native understorey plants	Understorey plants remain but are limited in number and diversity	Little to no understorey plants remain
Very few weeds and exotic grasses are present. If present, very localised only.	Weeds and/or exotic grasses are present but not dominant	Weeds and/or exotic grasses are the dominant understorey
Regeneration of trees and other plants is occurring	Some regeneration of young trees and other plants is evident	Little to no regeneration of young trees and other plants
There are old trees with hollows	There are obvious signs of disturbance from clearing, logging and grazing	Active erosion occurring
There are fallen logs and timber	There are old trees with hollows	Introduced tree species may be present
Leaf litter is present	Leaf litter is present	
There may be some small areas of localised disturbance where the soil is exposed and there are some weeds.	There are fallen logs and timber	

Undertaking weed control

When developing control strategies consider the biology of the weed species: when is it actively growing; when is it flowering and seeding; how long does seed stay viable in the soil; how does it respond to fire; is there a preferred time for physical or chemical control. Control methods include:

Physical

Manual pulling

Hand-pulling of individual weeds may be suitable when:

- the bush is in very good condition, with only a few small and localised areas of weed infestation
- the bush to be weeded is close to the house and frequently visited
- the weed species is easily removed by pulling
- rare and endangered plants are closely associated with the weed and could be damaged by other methods
- a weed new to the area is first detected in small numbers.

When hand weeding, the whole of the plant needs to be removed including bulbs, corms, rhizomes or tubers. If possible collect all seed pods or capsules. Remove from the site. Hand pulling can create soil disturbance and favourable conditions for further weed invasion.

Felling and ringbarking

Suitable for trees and shrubs that do not resprout or sucker, so correct identification is essential.

Mowing and slashing

Mowing and slashing are appropriate where areas are dominated by grasses and there are no desirable native species. This should be done before seed sets as it does not kill the weeds; indeed it may shake off and spread the seed. If seed set is to be prevented, slashing would have to be repeated several times during the growing season. Slashing can be very useful when used on densely tufted grasses such as African lovegrass, fountain grass or tambookie, as the dense growth of old leaves impedes the efficient penetration of herbicide. Fresh growth after slashing will be more susceptible to herbicide control.

Chemical

Used with care, chemicals can be a very effective method of managing weeds. They should be applied when the plant is actively growing, at a time of day when transpiration is most rapid (early morning or late afternoon) and when the plant is not under stress (eg. extreme heat or cold). Chemicals should not be applied in wet or windy weather. Follow safety precautions when using herbicide.

Herbicides can be applied by: blanket spraying, spot spraying, wiping, stem injection, painted on to a cut stump, and basal barking (sprayed or painted on to lower 60 cm bark with herbicide and penetrant – usually diesel). They should be applied in a way that minimises impacts on surrounding vegetation.

More information on how to use these control methods, and the best methods of control for specific species is available at www.herbiguide.com.au, [Woody Weeds of the Cape Naturaliste to Cape Leeuwin Region](http://www.florabase.dpaw.wa.gov.au/weeds/), <https://florabase.dpaw.wa.gov.au/weeds/> and Brown, K & Brooks, K (2002) *Bushland Weeds A practical guide to their management*. Environmental Weeds Action Network at https://www.natureconservation.org.au/wp-content/uploads/2019/03/Bushland_Weeds_Book.pdf

We recommend that you use these resources to find out the most up to date advice for control before you begin.

Follow up and on-going maintenance is essential to successful weed control.

Restoration of the native plant community

Where weeds occurs sparsely or in isolated patches in good quality native vegetation, the gap created by removal is small and quickly colonised by native species. However, where the weed is widespread and/or dense removal will leave an area susceptible to invasion by other weeds. Control of these weeds may help facilitate establishment of native plants. Consideration should also be given to direct seeding or revegetation with local native species.

Table 1: Emerging and established weeds that are very high priority for control in the Margaret River region

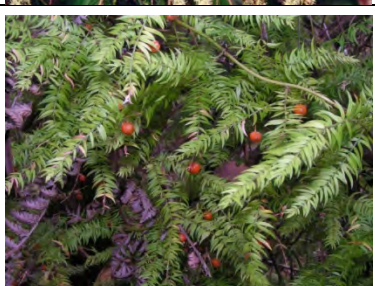
Scientific name	Comments
	Flinders Range wattle (<i>Acacia iteaphylla</i>) is a bushy, spreading, often weeping shrub to 5 m high with simple 'leaves' (phyllodes) that are silvery blue-green in colour. It has pale yellow to lemon yellow globular flowers in autumn to spring. Flinders Range wattle is native to SA. It has been widely planted and is spreading in roadsides and undisturbed bushland. It has enormous potential to spread further. It has explosive germination after the death of the parent plant, fire or disturbance. Plants are short lived but seeds are long lived and germinate readily. It can form dense thickets and inhibits the regeneration of local native species.
	Sydney golden wattle (<i>Acacia longifolia</i>) is a small tree to 10 m high with simple 'leaves' (phyllodes) that are bright green or dark green in colour. The phyllodes are elongated to linear in shape with 2-4 prominent longitudinal veins. It has yellow, rod-like flowers in July to Sept. Sydney golden wattle is native to NSW and Vic. It has been widely planted and is spreading in roadsides, creeklines and undisturbed bushland. Seeds are long lived and germinate readily. It can form dense thickets and inhibits the regeneration of local native species.



Blackwood (*Acacia melanoxylon*) is a tall, erect tree or shrub to 40 m high with dark green leaves. It has cream/yellow flowers in August, Sept. It is a hardy tree, tolerates shade, invades bushland, shades out and excludes local plants, dominating the vegetation. Suckers aggressively and coppices. Long lived with long seed viability. Excellent timber and firewood after removal. Germinates readily and suckers, massively after fire/disturbance. Widely planted on farms, bush blocks, rural residential blocks and roadsides.



Madeira vine (*Anredera cordifolia*) is native to South America and a garden escape in parts of WA. It grows rapidly, blanketing and smothering both shrubs and trees and causing irreversible damage to the invaded ecosystem. It has been declared a Weed of National Significance in Australia. Currently limited in our region. Known only from Yallingup and Yelverton areas.



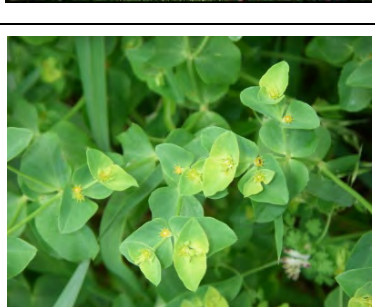
Asparagus fern or climbing asparagus (*Asparagus scandens*) is a perennial twining vine. It has fine fern-like leaves, white flowers in late winter and spring, and green berries turning orange/red through spring and summer. Birds eat the berries and disperse the small seeds. It is an aggressive plant, producing underground tubers which form dense, impenetrable mats. It is shade tolerant preferring moist sites. It competes with native plants preventing seedling regeneration and strangling or smothering soft barked plants. It has been declared a Weed of National Significance.



African feather grass (*Pennisetum macrourum*) is a highly invasive clump forming perennial grass. It has the ability to spread rapidly due to a vigorous rhizome system. It can form dense infestations that out compete all other plants. Large infestations present a significant fire hazard, reduce biodiversity and block access to waterways. Limited in extent in the Margaret River region at the moment. Present in Burnside area and along the lower Margaret River.



Dolichos pea (*Dipogon lignosus*) is a perennial, robust climber with alternate leaves divided into 3 broadly triangular leaflets each 2-7 cm long. It flowers in spring and early summer and has many clusters of large pea flowers that are white or pink to purple and 8-15 mm long. Seed is viable for many years, and germination can be stimulated by disturbance or fire. It has perennial, spreading, underground rhizomes. Originally from South Africa it is commonly grown in gardens and is now spreading into roadsides and bushland. It grows rampantly smothering shrubs and trees as well as native groundcover plants.



Geraldton carnation weed (*Euphorbia terracina*) is a Mediterranean shrub-like herb to 1 m high. It grows rapidly, forms dense thickets and seeds prolifically. Seeds are spread in limestone used in road and path construction as well as in water, and carried by animals and machinery. Geraldton carnation weed can invade areas of healthy bushland out competing native species for space, light and nutrients.



Common fig (*Ficus carica*) is a large, spreading, deciduous, shrub or small to 10m. It has smooth grey bark, 3-5 lobed large leaves. Fruit 3–5 cm, green - purple. Sap of tree irritant to human skin. Serious weed of waterways and rivers. Widely planted tree with many existing around old settlements and orchards.



Montpellier (*Genista monspessulana*) and **flax-leaf broom** (*Genista linifolia*) are yellow-flowered shrubs 1-3 m tall. Montpellier broom leaves are on short stalks and consist of three rounded leaflets. Flax-leaf broom leaves consist of three narrow, pointed leaflets. Leaf undersides and young stems have woolly, grey hairs, which can give plants a silvery look from a distance. Montpellier broom flowers in winter/spring, sometimes late summer/autumn. Flax-leaf broom flowers mainly in spring. The pea-like seed pods are narrowly oblong and hairy.

Brooms grow quickly, produce large amounts of seeds and can tolerate diverse environmental conditions. They establish rapidly after disturbance, such as fire or grazing, but can also invade relatively undisturbed bushland areas. They are listed as Weeds of National significance.



Victorian teatree (*Leptospermum laevigatum*) is a tall, bushy shrub or small, twisted tree to 6m. Leaves are grey-green, obovate, to 2 cm. Flowers white in spring/early summer. Hardy species, widely planted especially for hedging and coastal windbreaks. Weedy throughout SW WA and much of Australia and overseas. A serious pest especially in coastal areas. It is allelopathic – ie. inhibits the growth of surrounding plant species.



Myrtle leaved milkwort or **butterfly bush** (*Polygala myrtifolia*) is a shrub to 2.5 m high with crowded light green elliptic leaves that are 1.5 cm long. It has pea like magenta and white flowers in clusters much of the year, followed by circular fruit capsules. Native to South Africa, it is a garden escape now invading bushland. It can form dense, mixed-aged thickets preventing most other species establishing. It is a serious weed throughout Australia.



European olive (*Olea europa*) is a hardy, drought tolerant, very long lived species that is planted throughout the Margaret River region. Seeds are dispersed by birds and mammals. It is a serious bushland weed in South Australia where it forms mixed age thickets that virtually preclude native plant recruitment. Young olive trees are increasingly being found in bushland, waterways and roadsides in our region. Every effort should be made to prevent this species becoming an environmental weed in the south west.



Sweet pittosporum (*Pittosporum undulatum*) is a spreading small tree to 8 m. It has large green glossy oval leaves, strongly perfumed attractive creamy flowers in spring followed by bright orange fleshy fruits highly attractive to birds. It is native to south eastern Australia. It has escaped garden plantings and is invading creeklines, forest and woodland areas. It is a shade tolerant species which out competes local native species, forming exclusive thickets.

	<p>English blackberry (<i>Rubus anglocandicans</i>) is a semi deciduous, perennial shrub with scrambling, arching, prickly stems (canes) that may form dense, tangled thickets to 4 m high. The stems take root where they touch the ground, often forming dense thickets. The succulent and delicious fruits are an aggregation of numerous tiny fruitlets that are initially red but turn black as they mature. Native to England, English blackberry is a declared plant and a serious weed of creeklines, spreading into forest and woodland along water courses. It flowers in late spring and summer.</p>
	<p>Watsonia (<i>Watsonia</i> spp.) is a hairless, tufted herb with erect, flat, sword shaped leaves to 1 m in length which are produced annually from a corm. The flowering spike is usually unbranched and up to 2.5 m high with many large, trumpet shaped flowers. It reproduces from a large, fibre covered, underground corm and many cormels on the flowering stem and at the base of the leaves. Native to South Africa, it is now common in the south west and serious weeds of roadsides, watercourses and railway lines, often invading bushland. They flower in spring and early summer.</p>
	<p>Arum lily (<i>Zantedeschia aethiopica</i>) has a tuft of dark green, shiny, somewhat succulent leaves arising annually from perennial tuberous roots. It is easily recognised by its conspicuous large, white, funnel-like 'flower' about 100 mm across, which has a central, orange, pencil-like column of minute male and female flowers. In fruit, the tiny female flowers at the base of this column are replaced by orange-yellow berries. Native to South Africa, arum lily is a common and widespread serious weed of pasture and bushland, particularly of damp areas but also invading drier sites. It flowers mainly in late winter and spring and the berries are spread by birds. It is poisonous to stock, pets and humans.</p>

Table 3: Some common weed species known from the Margaret River region			
Scientific name	Common name	Scientific name	Common name
<i>Acacia elata</i>	Mountain cedar wattle	<i>Gomphocarpus</i> spp.	Cottonbush
<i>Arundo donax</i>	Giant reed	<i>Histiopteris incisa</i>	Bat's wing fern
<i>Asparagus asparagoides</i>	Bridal creeper	<i>Homalanthus novoguineensis</i>	Bleeding heart
<i>Cenchrus clandestinus</i>	Kikuyu, Kikuyu grass	<i>Hyparrhenia hirta</i>	Tambookie grass
<i>Centranthus ruber</i>	Valerian	<i>Hypericum perforatum</i> var. <i>angustifolium</i>	St John's Wort
<i>Chamaecytisus palmensis</i>	Tree lucerne, Tagasaste	<i>Ipomoea indica</i>	Blue morning glory
<i>Chasmanthe floribunda</i>	African cornflag	<i>Kunzea baxteri</i>	Kunzea
<i>Cyathea cooperi</i>	Rough tree fern	<i>Lavender</i> spp.	Italian/French lavender
<i>Echium fastuosum</i>	Pride of Madeira	<i>Leptospermum laevigatum</i>	Victorian teatree
<i>Echium plantagineum</i>	Paterson's curse	<i>Lonicera japonica</i>	Japanese honeysuckle
<i>Ehrharta calycina</i>	Perennial veldtgrass	<i>Melaleuca armillaris</i>	Bracelet honey-myrtle
<i>Ehrharta longiflora</i>	Annual veldtgrass	<i>Moraea flaccida</i>	One-leaf cape tulip
<i>Eragrostis curvula</i>	African love grass	<i>Paspalum dilatatum</i>	Paspalum
<i>Eucalyptus citriodora</i>	Lemon-scented gum	<i>Pinus radiata</i>	Radiata pine
<i>Eucalyptus globulus</i>	Blue gum	<i>Psoralea pinnata</i>	Taylorina, Psoralea
Gladiolus undulatus	Wavy Gladiolus	<i>Vinca major</i>	Blue Periwinkle

Acknowledgements

Photos courtesy of John Moore, www.herbiguide.com.au, Department of Agriculture and Food WA, NSW Department of Primary Industries, M Baker and Tasmanian Herbarium.

References and further information

- Brown, K & Brooks, K (2002) *Bushland Weeds A practical guide to their management*. Environmental Weeds Action Network. Available at https://www.natureconservation.org.au/wp-content/uploads/2019/03/Bushland_Weeds_Book.pdf
- HerbiGuide www.herbiguide.com.au - *Detailed information about 600 weed species and control methods*.
- Hussey, B.M.J. and Wallace, K.J. (1993) *Managing Your Bushland*. Department of Conservation and Land Management, Como, Western Australia.
- Hussey, B.M.J., Keighery, G.J., Cousens, R.D., Dodd, J. and Lloyd, S.G. (1997) *Western Weeds: A Guide to the Weeds of Western Australia*. Plant Protection Society of Western Australia, Victoria Park, Western Australia.
- Florabase <https://florabase.dpaw.wa.gov.au/weeds/>- *Detailed information about weed species and control methods*.
- Moore, J & Wheeler, J (2008) *Southern Weeds and their control*. Department of Agriculture and Food WA.



MANAGING STREAMS AND WETLANDS

Nature Conservation Information Sheet



Stream vegetation is valuable

Rivers, streams and wetlands have an important drainage function and support a wide range of unique and wonderful plants and animals. Unfortunately they face many threats in a cleared and modified environment. In this Information Sheet we outline actions you can take to protect and restore your valuable wet areas.

An important principle for management of streams and wetlands is:

- ✓ conserve the best areas first;
- ✓ move on to those areas showing signs of recovery; and
- ✓ then treat the more degraded parts of the system.

Following this principle will save you money, time and effort, and increase your chances of success.

Riparian vegetation

The rich soils associated with a stream valley support a diverse suite of plants including trees, shrubs, sedges and rushes. **This riparian vegetation has many values and its importance in maintaining healthy streams and wetlands cannot be overemphasised.**

Riparian vegetation slows the water, holds the banks together and reduces erosion. It collects sediment and nutrients and protects water quality. It shades the water and keeps water temperature low, reducing the risk of algal growth and maintaining suitable conditions for aquatic fauna. The leaf litter, woody debris and insects from riparian vegetation provide food and habitat resources for many animals, and riparian vegetation often provides a corridor linking remnant vegetation in the landscape.

Management issues and actions

Stock access

Unrestricted stock access causes vegetation damage through grazing, trampling, the introduction and spread of weeds, ringbarking, trunk damage, erosion and soil compaction. Stock also negatively impact on water quality.

The control of livestock access is the most important management tool in the protection and restoration of streams and wetlands, and fencing is the best method to achieve this. Include as much of the wet area in the fence as you can allow. A broad area of riparian vegetation will be more resilient and provide better habitat. It will be less susceptible to vegetation loss from wind, insect damage and tree decline. Fencing will also be less expensive without the need for many strainer posts at stream meander points.

Fencing and control of stock access may lead to an increase in weeds and weed control may be required for a few years to assist natural regeneration. Keep a close eye on the area and control invasive weeds early before they become widespread and established.

The provision of off-site or restricted stock watering points may be required if stock previously accessed the area for water. See <http://www.water.wa.gov.au/water-topics/waterways/managing-our-waterways2/water-notes> for Water Note 7: Livestock management: watering points and pumps.

Fire management

Riparian vegetation does not respond well to fire. Native vegetation will be slow to recover and the burnt area will provide an ideal environment for weeds which will often grow rapidly resulting in an increased fire hazard and degraded native vegetation community.

If possible, streams and wetlands should not be burnt. If these systems are within remnant vegetation, try and leave them unburnt by burning out from their edge towards surrounding upland vegetation. Excluding controlled burns from these fire sensitive vegetation communities however, needs to be balanced against any damage that would be caused by the need to create a fire break or access track to enable the burn to be contained.

Environmental weeds

Weeds grow well in wet areas where soils are rich and there is plenty of water. Disturbance from clearing, grazing, erosion and modification of the stream channel intensifies weed growth and spread. Weed control principles to keep in mind in regard to wet areas include:

- Weeds thrive in disturbed areas and areas of bare ground.
- If weed control is carried out, revegetate to prevent further weed invasion in the bare soil.
- Aggressive perennial weeds that spread rapidly are the highest priority for control, for example, blackberry, arum lily, watsonia, African cornflag, Sydney golden wattle, sweet pittosporum, giant reed, blackwood, olives and figs. Tree ferns and batswing fern are increasingly common on streams in the region and are also priority for control.
- Removal or control of weeds in riparian areas needs to consider the potential for erosion after weed control.
- Some native plants look and act like weeds. Do not begin weed control until you are sure a plant is a weed.
- Chemical control of weeds in wet areas requires careful consideration and careful application. It is important to consider the effects of the herbicide on native flora and fauna, and on water quality. If you decide to use a herbicide, choose one that has a modified surfactant to reduce impact in wet areas
- Never spray directly over a waterbody. When you are working near the edge of a waterbody, direct the spray away from the waterbody where possible. Spray only to the extent of covering foliage with droplets. Spray when weather is calm; strong winds may carry herbicide drift into waterbodies. Use a flat fan nozzle and a low pump/spray

pressure to reduce the likelihood of spray drift. Do not spray when rainfall is forecast within four hours as herbicide can be washed off the pest plant into aquatic ecosystems.

For more information see [Nature Conservation Information Sheets: *Managing Environmental Weeds*](#) and [Nature Conservation Information Sheet: *Arum Lily Control*](#)

Erosion and sedimentation

Stock access and loss of vegetation often result in bank erosion. Sediment from erosion and from the surrounding cleared catchment flows in to the stream and accumulates in pools and other areas. Erosion results in further vegetation loss as trees and large shrubs are undermined and fall in to the stream channel.

Strategies for controlling erosion include control of stock access, allowing grasses to colonise to provide bank stability, revegetation with native species and/or construction of riffles to slow water velocity.

For detailed information go to Stream Stabilisation at <http://www.water.wa.gov.au/water-topics/waterways/managing-our-waterways2/river-restoration-manual>



Introduced animals

The control of rabbits, foxes and cats is recommended to protect vegetation and native wildlife. For further information go to <https://www.agric.wa.gov.au/pests-weeds-diseases/pests/pest-animals> and [Nature Conservation Information Sheet: *Fox Control*](#).

Assisted natural regeneration

In areas that still retain native trees and understorey, assisting natural regeneration is the cheapest and easiest revegetation option. Control of stock access to the area is essential. Judicious control of weeds to allow native seed to germinate and seedlings to grow will also be necessary.

Regeneration can be assisted using brushing which involves laying seed bearing parts of appropriate local native species on the ground in the fenced area, allowing seeds to fall from them. Species suitable for this technique are those that retain seed on the plant, but shed it when the plant dries out. This includes many of the myrtaceous species (peppermints, tea trees, *Melaleucas* and *Eucalypts*). Brushing is easy to combine with other revegetation techniques such as direct seeding and planting tubestock, and provides shelter to seedlings, increasing seedling survival rates.

Revegetation

Areas that have been more heavily grazed and cleared generally contain more weeds and have a diminished seed bank. Options to re-establish vegetation in these areas include: direct seeding, brushing, planting tubestock, dividing and transplanting rushes and sedges. The riparian zone should be planted in a wide band with a diverse range of species. This not only improves the habitat value, but also provides a matrix of different root structures that will improve bank stability and assist erosion control.

Revegetation projects require planning and organisation. Plants need to be ordered in the summer before winter planting and site preparation will be required prior to planting.

Weed control before and after revegetation is crucial to success. Control of perennial grasses may be best undertaken in late summer prior to autumn/winter planting.

Plant selection and planting density. To maximise ecological benefits revegetation should include all layers - trees, shrubs, herbs (non-woody plants), groundcovers, rushes and sedges. A common mistake is to plant too many trees and too few understorey plants. When planting try and mimic natural areas. A rule of thumb is a planting ratio of 1 tree to 10

shrubs/herbs plus rushes and sedges. Plant many more rushes than the number of shrubs (as these need to be planted in groups of 5-6 seedlings per m² to allow them to establish). With the larger sedges such as *Lepidosperma* spp. include a similar number to shrubs/herbs in the mix. Suggested planting densities are included in Table 1.

Table 1: Suggested planting densities for revegetation	
Type of plant	Planting density
Trees	1 tree/3-5 m ²
Shrubs	1 shrub/m ²
Herbs such as <i>Conostylis</i> & <i>Patersonia</i>	4 plants/m ²
Rushes	5-6 rushes /m ²
Large sedges such as <i>Lepidosperma</i> spp	1 sedge/ 2 m ²

A list of plants suitable for revegetating streams, dams and wetlands is included in [Nature Conservation Information Sheet: Revegetation with Local Natives](#)

Division and transplanting of rushes and sedges. Many rushes and sedges propagate very well by vegetative division – plants can be split into individual plants every two months or so under good condition. An appropriate easily accessible wet site can provide a good nursery area for propagation of rushes and sedges.

Planting. Rushes and sedges should be planted in spring when the water table is beginning to fall and the soil is still moist. Other seedlings should be planted when the soil is moist and follow up rain is likely (usually May to July).



Aim to get the seedlings in the ground with the minimum disturbance. Before planting, seedlings should be well watered. Damage to roots should be avoided at planting. However, if seedlings are root bound excessive root growth should be removed prior to planting. Root-bound seedlings will die or suffer reduced growth if left untreated. Seedlings should be firmly planted in so they cannot be lifted out by their foliage and there are no air pockets around the seedlings. Rain in the days following planting will benefit survival and vigour. If no rain is expected shortly after planting an initial watering-in is recommended to settle soil around the roots and minimise stress.

Post-planting maintenance. Plants will often need to be protected from rabbits and kangaroos with tree bags or fencing. On-going weed control is important to reduce competition and will be needed for some years after planting.

References and further information

EPA South Australia (2007) *Safe and effective herbicide use: A handbook for near-water applications*. Environmental Protection Authority, Adelaide, SA

Detailed information on management of streams and wetlands at:

<http://www.water.wa.gov.au/water-topics/waterways/managing-our-waterways2/river-restoration-manual>

Pen, L.J. (1999) *Managing Our Rivers*. Water and Rivers Commission, East Perth, Western Australia.



DAMS FOR BIODIVERSITY

Nature Conservation Information Sheet



Converting dams to living wetlands

Dams provide an excellent opportunity to create habitat and enhance biodiversity on your property. This Information Sheet provides an overview on ways you can improve the habitat value and water quality of your dam. It also outlines what you can do to minimise the impact of your dam on downstream ecology.

IMPROVING HABITAT VALUES

Shape and depth. To maximise habitat, the ideal shape and depth for a dam is gently sloping banks, the longest possible shoreline, and a variety of depths including shallow areas. This provides a diversity of environments for plant establishment and wildlife habitat.

Established steep sided dams can be modified by earthworks to create shallow areas and/or planting shelves.

Habitat elements. Adding elements such as native plants, logs, rocks, open areas, islands and nesting boxes to your dam and surrounding environment will provide habitat and resources for many fauna species. These habitat elements are briefly discussed below.

Plants

Using plants that are native to the area is highly recommended. These plants are adapted to our soils and climate, valuable to local wildlife and will not become a weed problem in the future. Use a broad range of species and types of plants. Revegetating using all layers including trees, large and small shrubs, groundcovers, rushes and sedges will improve habitat values. Diversity will also create a complex food web which encourages natural pest control.

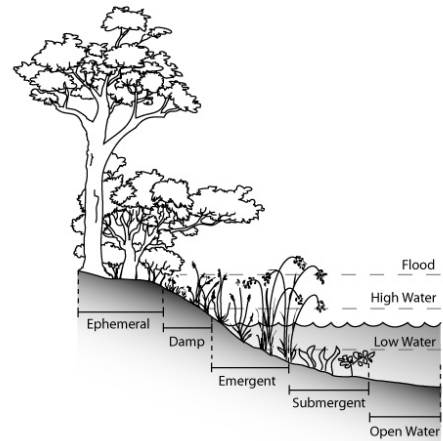
It is important to plant rushes and sedges as they are a key component of wetland ecosystems. They provide food and habitat for a wide range of aquatic species, assist with aeration of the sediments, and protect water quality by filtering and binding pollutants, particularly nutrients.

When undertaking revegetation you should also think about what to plant where. Dams are made up of different zones defined by the level of inundation and plants need to match the area in which they are being planted. Zones include:

Shallows (*Emergent*) supports plants which have their roots submerged beneath the water for at least some of the year, but extend their leaves and stems above the water surface. This area can range from 1 m deep in winter to damp in the driest part of summer. This zone is very important for many fauna species, providing shelter and food along the shallow edges. It is also an important area for erosion control, and nutrient and sediment removal.

Seasonally Wet (*Damp*) is permanently damp or damp at the surface for most of the year, without having standing water, except for flood events. Almost all of the rushes and sedges can live happily in this zone.

Upper Banks (*Ephemeral*) is quite dry for much of the year and may only become wet in flood events. The upper banks are the interface between the bushland and the riparian zone.



IMPORTANT NOTE: Deep-rooted plants such as trees and tall shrubs should not be planted on constructed dam walls as they can cause cracks, leaks and structural instability. Constructed dam walls can be safely planted with a variety of rushes, sedges, groundcovers and shrubs.

See [Nature Conservation Information Sheet: Revegetation with Local Natives](#) for a list of suitable plant species.

Logs, rocks

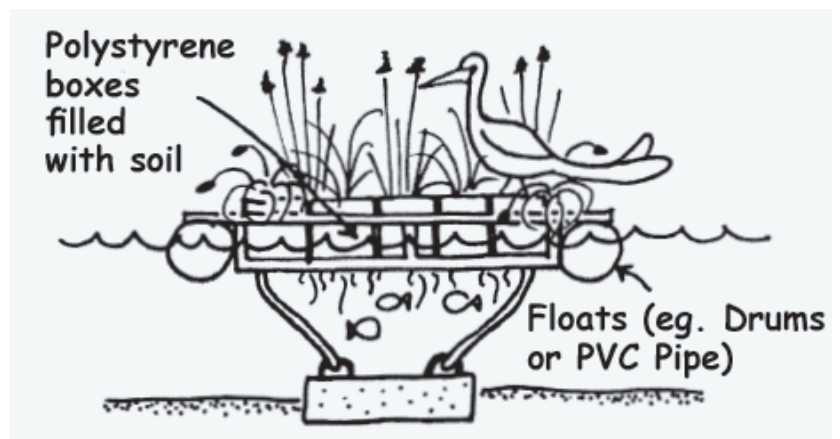
The inclusion of fallen timber into your site will provide habitat for a range of insects, birds, fish and lizards. Logs can be positioned within the dry margin around the dam, on the dam banks and within the water. Having logs extending from within the water up on to dry land provides perching sites for birds. Timber on the edges of the dam may need to be secured to ensure it doesn't float and move when water levels vary.

Open areas

Some areas of bank should be kept open to provide varied habitat and safe entry points to the water. These areas could be lined with sand or gravel or planted with short native grasses and groundcovers.

Islands

Islands provide a refuge for birds to nest safe from foxes and cats. Floating islands are easy to build. There are a variety of designs. The figure to the right shows an island made from a polystyrene box filled with soil, perforated to allow for drainage and root growth, and attached to floats.



A raft can also be made of PVC pipes (with watertight joints), covered with a double layer of wire netting or shade cloth filled with straw.

The islands can be planted with rushes and an assortment of wetland plants and should be anchored in place with enough rope to allow for water level changes.

Nesting boxes

Installing nesting boxes around the dam will provide birds, mammals and bats with somewhere to nest. Hollows can take over 80 years to form, so if there are no old remnant trees to provide hollows naturally, then providing a variety of nest boxes will help to encourage local wildlife. Go to www.birdlife.org.au for information on nesting boxes for birds. For nest box designs for possums go to www.possumcentre.com.au/Pages/nestbox_1.html and <https://geocatch.asn.au/wp-content/uploads/2018/01/Nest-Boxes-for-Native-Animals.pdf>

Introducing fauna

Use only local native fish and crustacean species if stocking dams. Avoid stocking dams with introduced species such as yabby, red-fin perch, trout and gambusia (mosquito fish). These introduced species out-compete local species as they prey on them and reproduce more vigorously. It is illegal to release introduced species into the natural environment.

MANAGEMENT

Weed control

Dams often provide an ideal environment for weed growth. Weed control will be needed prior to planting and for a number of years after planting to ensure the best chance of success.

Invasive priority weeds around the site should also be controlled where they compete with native plants or are likely to spread into remnant vegetation or revegetation areas.

Fencing

Control of stock access to the dam is essential to enable establishment of native vegetation, and to prevent erosion and negative impacts on water quality. When fencing, consider including an adequate area of land around the dam to ensure enough space for planting vegetation and to be an effective filtering strip to catch nutrients, effluent and sediment. Ideally this margin will be a minimum of 10m from the high waterline.

The provision of off-site or restricted stock watering points may be required if stock previously accessed the area for water. See <http://www.water.wa.gov.au/water-topics/waterways/managing-our-waterways2/water-notes> for Water Note 7: Livestock management: watering points and pumps.

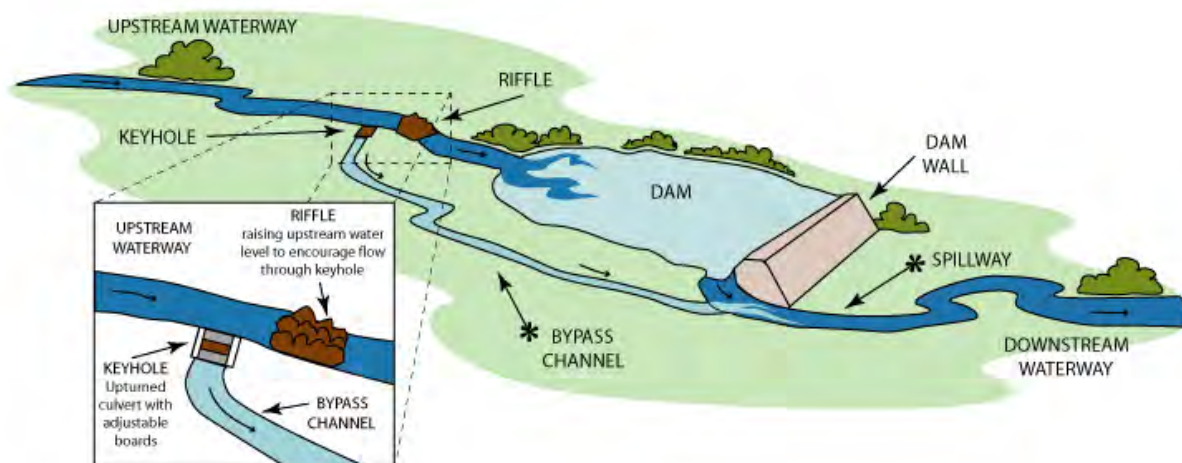
MINIMISING IMPACTS ON STREAM ECOLOGY

Dams built on streams (gully-wall dams) can have a significant impact on the ecology downstream. This is a result of the dam impeding both any streamflow that may occur from heavy rainfall events in summer and/or the early flows at the beginning of the rainy season. These low stream flows are important to downstream ecosystems and play a role in retaining riparian vegetation, providing cues for breeding migrations of native fish, and providing habitat for aquatic insects and crustaceans, waterbirds and the larval stages of some terrestrial insects.

The following dam management practices can reduce the potential impacts of gully-wall dams on downstream ecology and protect water quality in dams.

- The correct use of underwall pipes or bypass valves. The valve should be opened at the start of the rainy season (as soon as water is flowing into the dam). The dam will still fill over the winter months, and once it is full to overflowing, the bypass valve can be closed. Releasing early flows ensures that the ecosystem downstream of the dam receives water when it is meant to. Any salt or sediment that has built up in the dam over summer will safely be diluted by the rest of the flows.
- If an existing dam does not have an underwall pipe a siphon system can be installed to achieve the same objective. A length of piping can be laid over the top of the dam wall extending into the deepest part of the dam (secured via a weight) and down the dam wall past the level of lowest water depth. A tap can be placed at the end of the pipe and be turned on and off as required. If the tap is turned off (but the pipe left in place) once the dam has overflowed, water will be retained in the pipe and there will be no need to prime the siphon in subsequent years.

- The ideal situation is for dams to have a low flow bypass system such as the one in the diagram below. This system allows flows to automatically bypass the dam so that the downstream ecosystem doesn't need to wait for the dam to fill and overflow. The bypass can be an earth channel as in the diagram but could also be a pipe. A bypass system is most easily constructed when a dam is being built. However, it is also possible to retrofit one to an existing dam.



References and further information

EPA South Australia (2007) *Safe and effective herbicide use: A handbook for near-water applications*. Environmental Protection Authority, Adelaide, SA

DWER, Water quality protection note no. 53 June 2018 Dam construction and operation in rural area

Detailed information on management of streams and wetlands at:

<http://www.water.wa.gov.au/water-topics/waterways/managing-our-waterways2/river-restoration-manual>

REVEGETATION WITH LOCAL NATIVES

Nature Conservation Information Sheet



Planting for biodiversity

To plant or not to plant?

As a general principle the highest priority is to protect existing vegetation first, encourage natural regeneration next and lastly undertake revegetation.

Protecting and enhancing natural regeneration is the most cost efficient and effective way to revegetate a site. Successful regeneration requires the control of grazing and weeds, and can be enhanced by small pile burns and the introduction of seed through direct seeding and brushing.

In areas where natural regeneration is unlikely to occur revegetation can be used to improve the condition of bushland, streams and wetlands and to establish corridors between areas of remnant vegetation.

Plant selection and spacing

Using plants that are native to your area is highly recommended. These plants are adapted to our soils and climate, valuable to local wildlife and will not become a weed problem in the future.

To maximise ecological benefits revegetation should include all layers - trees, shrubs, herbs (non-woody plants), groundcovers, rushes and sedges. A common mistake is to plant too many trees and too few understorey plants. When planting try and mimic natural areas. A rule of thumb is a planting ratio of 1 tree to 10 shrubs/herbs. In wet areas a mix of rushes and sedges should also be included. Plant many more rushes than the number of shrubs (as these need to be planted in groups of 5-6 seedlings per m² to allow them to establish). With the larger sedges such as *Lepidosperma* spp. include a similar number to shrubs/herbs in the mix. Suggested planting densities are included in Table 1.

When planting trees think carefully about the long term impact - will they shade your house or cause a fire risk once they reach their full size?

Table 1: Suggested planting densities for revegetation

Type of plant	Planting density
Trees	1 tree/3-5 m ²
Shrubs	1 shrub/m ²
Herbs such as <i>Conostylis</i> , <i>Patersonia</i>	4 plants/m ²
Rushes	5-6 rushes /m ²
Large sedges such as <i>Lepidosperma</i> spp.	1sedge/ 2 m ²

Choose species that are suited to the site. A list of local native species that are usually available at native plant nurseries is included in Table 2 at the end of this Information Sheet. A list of plant nurseries that stock local native plants is also included below.

Order plants well in advance. If buying plants in tubes or cells it is advised to order them in the summer prior to planting.

Site preparation

For a large scale revegetation projects in cleared areas you may want to consider **ripping and/or mounding**. All farmland will have some degree of compaction and ripping will improve conditions for absorption and retention of soil moisture and root growth. Sandy soils will need to be ripped to a minimum of 450 mm and heavy clays to 250 mm. Maximum shatter of the ground and soil aeration will be achieved by ripping in summer and autumn when the subsoils are at their driest. Little is achieved by ripping clay soils when they are wet. To prevent erosion ripping should be on or close to the contour and not across waterways. If there is a risk of waterlogging rip lines should be mounded.

Successful **weed control** is the most important aspect of site preparation to ensure plant establishment and rapid early growth. The aim of weed control is to provide weed-free conditions adjacent to plants for the first year and preferably longer. The mortality of plants with inadequate weed control relates to direct competition for moisture, particularly in the first spring and summer. Any competition for resources slows the growth of plants and this in turn makes them more susceptible to damage from animals and insects.

Rabbit control is also an important pre-planting operation. It is recommended to undertake rabbit control in late summer when rabbit numbers are decreasing and feed is limited. See <https://www.agric.wa.gov.au/baits-poisons/rabbit-control-options/> for detailed information.

Planting

Seedlings should be planted when they are actively growing, the soil is moist, and follow up rain likely. Plant early in the season in sandy areas as these sites will dry out fastest when the winter rains finish. In wet areas rushes and sedges should be planted in spring, when the water table is beginning to fall and the soil is still moist.

Aim to get the seedlings in the ground with the minimum disturbance. This includes during their transport to the site – an enclosed vehicle and watering prior to transport are recommended. If the plants need to be stored before planting ensure they are out of the wind, near a watering point, and safe from stock, kangaroos and rabbits.

Before planting, seedlings should be well watered. Damage to roots should be avoided at planting. However, if seedlings are root bound excessive root growth should be removed prior to planting. Root-bound seedlings will die or suffer reduced growth if left untreated.

Seedlings should be planted with the top of the root ball 3 cm below the ground. In sandy soils it may be advantageous to plant lower than this. Planting within a shallow concave depression that holds water will significantly help with watering plants in sandy sites.

Seedlings should be well heeled in when planted so they cannot be lifted out by their foliage and there are no air pockets around the seedlings.

Rain in the days following planting will benefit survival and vigour. If no rain is expected shortly after planting an initial watering-in is recommended to settle soil around the roots and minimise stress.

Post-planting maintenance

Plants will often need to be protected from rabbits and kangaroos with tree bags or fencing.

Mulch will benefit seedling growth as it helps retain soil moisture, increases soil biota, suppresses weeds, and improves soil fertility. It is important to ensure that mulch is weed free.

Watering may be needed in the first year after planting particularly on sandy sites. Occasional deep watering is preferable to more frequent, shallow watering.

On-going weed control is important to reduce competition and will be needed for some years after planting.

NATIVE GARDENS

Many local native species make excellent garden plants. They are beautiful to look at and provide habitat, food and shelter for local wildlife such as small mammals, birds, insects, frogs and lizards. They are also low maintenance and require little to no watering. By using local native plants you reduce the risk of introducing plants that 'jump the fence' and become environmental weeds.

When planting native gardens give careful consideration to your plant choices and density of planting so that fire risk is minimised and on-going management reduced. Consider the potential height, width and spread of plants and plant at a density that will suit future growth. Low density planting, non-flammable mulch, gravel paths, and pruning of dead plant material and lower tree branches will reduce fire risk.

You should be aware that some local natives such as some *Acacia* and *Hakea* species are prickly and can be difficult to prune and weed around. Having a few of these plants in the garden can however provide valuable bird habitat.



Planting for bird diversity

Planting guidelines to attract and sustain a diversity of bird species include:

- Don't start by planting the bigger, longer flowering plants such as the hybrid Grevilleas. Because of their long flowering period and large blooms, they will attract the bigger and more aggressive honeyeaters such as red wattle birds and New Holland honeyeaters. As a result of the constant availability of copious high-energy nectar, the honeyeaters are able to stop their natural dispersive habit of travelling to different food sources, and will take up

permanent residence on your property. Their strongly territorial instincts will see them fighting off other smaller honeyeaters such as western spinebills and brown honeyeaters.

- Instead plant small flowered, long tubed plants for nectar such as kangaroo paws, *Hakea* sp, *Chorilaena quercifolia*, *Adenthanos* sp, *Calothamnus* sp, *Beaufortia sparsa*, *Darwinia citriodora*, *Diplolaena dampieri*, *Melaleuca lateritia*, *Templetonia retusa*, and *Banksia* sp. The nectar reward is less in these smaller flowered plants, but worthwhile for smaller birds which are able to be far more opportunistic, taking small doses where they can.
- Build up on the smaller plants trying to create all layers, from ground covers to small shrubs to a few carefully chosen and placed trees.
- Reduce the size and amount of open space in your garden or revegetation area. Smaller birds are justly fearful of predators and will often not cross open areas. Plant clumps of smaller, and preferably some prickly, plants (though be aware these can be difficult to prune and weed around). Many small birds need plants under a metre in height for nesting and habitat.
- Don't forget the insect and seed eaters such as robins, wrens and native pigeons. Plant *Melaleuca* sp, *Agonis* sp, *Taxandria* sp, *Kunzea* sp. and *Acacia* sp. for them.
- **Please don't feed the birds. Put out water for them instead.** Studies have shown many negative impacts from artificial feeding of birds, from birth defects to liver damage to de-calcification of bones. If you give them the habitat they need they will feed themselves and stay healthy into the bargain. Water will always be appreciated.

Local nurseries:

Tube Nursery

8 Blond St, Cowaramup
Phone: 9755 5509 / 0417 936 946
Email: tube_nsy@bigpond.net.au
www.tubenursery.com.au

Geographe Community Landcare Nursery

366 Queen Elizabeth Ave, Ambergate
Phone: 0429 644 885
Email: gcln@westnet.com.au
www.geographeplants.com

Boyanup Botanicals

Lot 14 South West Highway, Boyanup
Phone: 9731 5470
www.boyanupbotanical.com.au

References and further information

- Brown, K & Brooks, K (2002) *Bushland Weeds A practical guide to their management*. Environmental Weeds Action Network. Available at https://www.natureconservation.org.au/wp-content/uploads/2019/03/Bushland_Weeds_Book.pdf
- www.herbiguide.com.au - Detailed information about weed species and control methods.
- Hussey, B.M.J. and Wallace, K.J. (1993) *Managing Your Bushland*. Department of Conservation and Land Management, Como, Western Australia.
- <https://florabase.dpaw.wa.gov.au/weeds/> - Detailed information about weed species and control methods
- <https://florabase.dpaw.wa.gov.au/> - Detailed information about native species
- Land for Wildlife Queensland Note G3, *Bushland Management Planning*
- Moore, J & Wheeler, J (2008) *Southern Weeds and their control*. Department of Agriculture and Food WA.
- Scott, J and Negus P (2013) *Wildflowers of Southwest Australia, Augusta-Margaret River Region*. Cape to Cape Publishing, Fremantle, WA.

TABLE 2: NATURE CONSERVATION MARGARET RIVER RECOMMENDED NATIVE PLANTS FOR GARDENS & REVEGETATION

Most of the species in this table will grow well in gardens across the region.
For revegetation projects choose plants according to their natural habitat as listed in the table below.

TREES and TALL SHRUBS

Botanical Name	Common Name	Potential height (m)	Flower time	Flower colour	Natural habitat					Notes
					Wetland/riparian	Coastal	Jarra-marri	Granite	Karri	
<i>Acacia cyclops</i>	Coastal wattle	6	Sep-May	Yellow		X				Dense tall shrub
<i>Acacia saligna</i>	Orange wattle	6	Aug-Oct	Yellow						Can become weedy
<i>Allocasurina fraseriana</i>	Sheoak	5-15	May-Oct	Rusty red			X			Leaf litter smothers weeds.
<i>Agonis flexuosa</i>	Peppermint	10	Oct-Dec	White	X	X	X		X	Important for ringtails, insects
<i>Banksia attenuata</i>	Candle banksia	10	Nov-Jan	Yellow			X			Flowers attract mammals, birds and native bees
<i>Banksia grandis</i>	Bull banksia	10	Oct-Jan	Yellow			X			Flowers attract mammals, birds and native bees
<i>Banksia littoralis</i>	Swamp banksia	10	Mar-May	Yellow	X					Flowers attract mammals, birds and native bees
<i>Callistachys lanceolata</i>	Native willow	8	Sep-Jan	Yellow	X					Tall, weeping habit
<i>Corymbia calophylla</i>	Marri, redgum	40	Feb-Apr	Cream pink			X			
<i>Chorilaena quercifolia</i>	Chorilaena	5	Aug-Dec	White, green, red		X			X	Attracts small nectar feeding birds
<i>Eucalyptus calcicola</i>	Hamelin Bay mallee	8	Apr-Jun	Cream		X	X		X	
<i>Eucalyptus cornuta</i>	Yate	2-25	Jul-Nov	Yellow	X			X		
<i>Eucalyptus diversicolor</i>	Karri	40	July-Feb	White	X				X	Carefully consider where you plant this very tall, fast growing tree
<i>Eucalyptus marginata</i>	Jarra	30	Sep-Dec	White						
<i>Eucalyptus megacarpa</i>	Bullich	25	May-Aug	White	X					
<i>Eucalyptus patens</i>	Yarri Blackbutt	45	Nov-Feb	White	X					Carefully consider where you plant this very tall, fast growing tree
<i>Hakea lasianthoides</i>	Willow hakea	5	Aug-Nov	White	X					

Botanical Name	Common Name	Potential height (m)	Flower time	Flower colour	Natural habitat					Notes
					Wetland/riparian	Coastal	Jarrah-marri	Granite	Karri	
<i>Hakea oleifolia</i>	Frog or olive hakea	6	Aug-Oct	White		X				Sturdy, erect large shrub or tree
<i>Melaleuca cuticularis</i>	Saltwater paperbark	7	Oct-Dec	White	X	X				Tolerates salt water and salty winds
<i>Melaleuca lanceolata</i>	Moonah, Rottnest teatree	8	Jan-Mar	White		X				Lovely summer flowers
<i>Melaleuca preissiana</i>	Modong, Stout paperbark	9	Nov-Feb	Yellow, cream, white	X	X				Lovely summer flowers Suitable for seasonally wet areas in wetland/dam planting
<i>Melaleuca raphiophylla</i>	Swamp paperbark	10	Jul-Jan	White, cream	X	X				Suitable for seasonally wet areas in wetland/dam planting
<i>Spyridium globulosum</i>	Basket Bush	5	Jun-Nov	White		X				
<i>Taxandria linearifolia</i>	Swamp peppermint	4	Oct-Jan	White	X					Valuable for insects and birds Suitable for seasonally wet areas in wetland/dam planting
<i>Taxandria juniperina</i>	Wattie	12	Dec-Mar	White	X					
SHRUBS										
<i>Acacia alata var. alata</i>	Winged wattle	1	Jul-Oct	Cream, yellow	X		X	X	X	
<i>Acacia divergens</i>		2	Aug-Nov	Cream, yellow	X					Prickly
<i>Acacia extensa</i>	Wiry wattle	2	Aug-Oct.	Yellow			X			
<i>Acacia myrtifolia</i>		3	May-Jan	Cream, yellow,			X			
<i>Acacia pulchella var. pulchella</i>	Prickly mooses	1	Jul-Sep	Yellow			X			Prickly plant. Good for bird nesting but prickly to manage in garden
<i>Acacia urophylla</i>	Net-leaved wattle	2	Sep-Nov	Yellow			X		X	
<i>Adenanthos barbiger</i>	Hairy jug-flower	1	Jul-Nov	Red			X			Small, spreading shrub
<i>Adenanthos meisneri</i>		1.5	Jul-Apr	Red, pink, purple, cream			X			Dense shrub. Attracts small birds

Botanical Name	Common Name	Potential height (m)	Flower time	Flower colour	Natural habitat					Notes
					Wetland/riparian	Coastal	Jarrah-marri	Granite	Karri	
<i>Adenanthos obovatus</i>	Basket flower	1.5	May-Dec	Red, orange			X			Attracts birds
<i>Allocasurina humilis</i>	Dwarf sheoak	2	May-Nov	Rusty red			X	X		
<i>Alogyne huegelii</i>	Lilac hibiscus	2.5	Jun-Jan	White, cream, red, blue, purple,		X				Flowers for many months of the year.
<i>Astartea scoparia</i>	Common astartea	1.8	Jan-Jul, Oct-Dec	White, pink,	X					Summer flowers Suitable for seasonally wet areas in wetland/dam planting
<i>Atriplex isatidea</i>	Coast Saltbush	2	Mar-Jun			X				Suitable for exposed coastal positions
<i>Banksia dallanneyi</i> (was <i>Dryandra lindleyana</i>)	Couch honeypot	0.5	Aug-Sep	Yellow, brown				X		Prostrate, ground hugging shrub
<i>Beaufortia sparsa</i>	Swamp bottlebrush	3	Jan-Apr, Sep-Nov	Red, orange	X					Attracts small nectar feeding birds Suitable for seasonally wet areas in wetland/dam planting
<i>Boronia alata</i>	Winged Boronia Coast Boronia	3	Jul-Dec	Pink, white		X				
<i>Boronia megastigma</i>	Scented boronia	1	Jul-Oct	Brown, yellow, green	X					Prefers damp, shaded situation
<i>Bossiaea linophylla</i>		2.5	Jul-Dec	Yellow, red,			X			Slender, weeping habit
<i>Bossiaea ornata</i>	Broad leaved brown pea	1	Jul-Nov	Yellow, brown, red,			X			
<i>Calothamnus sanguineus</i>	Silky-leaved blood flower	2	Mar-Nov	Red		X				Spreading shrub. Attracts small nectar feeding birds
<i>Chorizema cordatum</i>		1.5	Jul-Dec	Yellow, orange, red, pink			X			Erect, straggling or climbing shrub
<i>Chorizema ilicifolium</i>	Holly flame pea	0.5	Jul-Oct	Yellow, orange, red			X			
<i>Darwinia citriodora</i>	Lemon-scented Darwinia	1.5	May-Dec	Yellow, green, red				X		Erect, spreading shrub. Attracts small nectar feeding birds

Botanical Name	Common Name	Potential height (m)	Flower time	Flower colour	Natural habitat					Notes
					Wetland/riparian	Coastal	Jarrah-marri	Granite	Karri	
<i>Diplolaena dampieri</i>	Southern Diplolaena	2	Jul-Nov	Red, orange		X				Attracts nectar feeding birds
<i>Eutaxia epacridoides</i>		1	Apr-Oct	Yellow, red, brown	X					Erect or spreading, slender shrub
<i>Eutaxia myrtifolia</i>		2	Feb-May July-Dec	Yellow, orange, red, brown			X			Prostrate to erect shrub
<i>Hakea lissocarpha</i>	Honeybush	1.5	Jun-Sep	Cream, pinkish			X	X		Prickly plant. Good for habitat but prickly to manage in garden
<i>Hakea linearis</i>		3	Sep-Jan	White, cream	X		X	X		
<i>Hakea ruscifolia</i>	Candle Hakea	2-3	Feb-May	White			X			Beautiful late summer flowering
<i>Hakea trifurcata</i>	Two-leaf Hakea	3	Jul-Oct	White, cream				X		Wide, spreading tall shrub. Prickly to manage in garden
<i>Hibbertia cuneiformis</i>	Cutleaf Hibbertia	3	Jan-Mar, Jun-Nov	Yellow			X		X	
<i>Hovea elliptica</i>	Tree Hovea	3	Aug-Dec	Purple			X		X	Slender, weeping habit
<i>Hypocalymma angustifolium</i>	White Myrtle	1	Jun-Nov	White, pink			X			Erect, compact shrub
<i>Hypocalymma cordifolium</i>		1	Sep-Feb, May-Jul	White, pink	X					Spreading shrub
<i>Hypocalymma robustum</i>	Swan River Myrtle	1	Jun-Nov	Pink, red,			X			
<i>Kunzea ciliata</i>		2.5	Oct-Nov	Pink				X		
<i>Kunzea recurva</i>		2.5	Aug-Dec	Pink, purple	X					
<i>Lechenaultia biloba</i>	Blue Leschenaultia	0.8	Jul-Dec	Blue			X	X		
<i>Leucophyta brownii</i>	Cushion Bush	1	Nov-Feb	Yellow		X				Small, compact shrub
<i>Melaleuca huegelii. subsp. huegelii</i>	Chenille Honeymyrtle	5	Nov-Feb	Pink, white		X				Small to tall shrub. Flowers in summer attract butterflies, native bees and many insects. Often wind pruned to 1 to 2 m
<i>Melaleuca incana</i>	Grey honeymyrtle	5	Jul-Nov	White, cream, yellow	X					

Botanical Name	Common Name	Potential height (m)	Flower time	Flower colour	Natural habitat					Notes
					Wetland/riparian	Coastal	Jarrah-marri	Granite	Karri	
<i>Melaleuca lateritia</i>	Robin Redbreast	2.5	Sep-Apr	Red, orange	X			X		Long flowering - spring to autumn. Attracts small nectar feeding birds
<i>Melaleuca viminea</i>	Mohan	6	Jul-Nov	White, cream	X					
<i>Myoporum insulare</i>	Blueberry Tree	3 (rarely a tree to 5)	Oct-Dec	White		X				
<i>Olearia axillaris</i>	Coastal Daisybush	2	Apr-Jun	White, cream, yellow,		X				Best in full sun
<i>Pericalymma ellipticum</i>	Swamp Teatree	3	Nov-Jan	White, pink	X					Suitable for seasonally wet areas in wetland/dam planting
<i>Pimelea ferruginea</i>	Pink Rice-Flower	1	Aug-Feb	Pink		X				Dense, dome shaped shrub. Best in full sun.
<i>Pimelea rosea subsp. rosea</i>	Rose Banjine	1	Jul-Dec	Pink			X			
<i>Rhagodia baccata subsp. Baccata</i>	Berry Saltbush	2	Feb-May Oct-Dec	Cream, yellow, green		X				Berries eaten by birds and bobtail lizards. Attracts butterflies
<i>Ricinocarpos glaucus</i>	Wedding Bush	1	Jul-Dec	White			X			
<i>Taxandria parviceps</i>							X			
<i>Templetonia retusa</i>	Cockies Tongues	3	Apr-Nov	Red, white, yellow	X	X				Attracts birds
<i>Thomasia paniculata</i>			Sep-Mar	Pink, purple	X					
<i>Thryptomene saxicola</i>	Rock Thryptomene		Feb-Nov	White, pink		X		X		Small, spreading shrub. Excellent cut flowers
<i>Tremandra stelligera</i>			Jan-Dec	Pink, purple, blue			X			
<i>Tymalium floribundum</i>			Jul-Dec	White, cream, yellow, green	X				X	
<i>Verticordia plumosa var. plumosa</i>			Aug-Jan	Pink, purple, white				X		

Botanical Name	Common Name	Potential height (m)	Flower time	Flower colour	Natural habitat					Notes
					Wetland/riparian	Coastal	Jarra-marri	Granite	Karri	
<i>Viminaria juncea</i>	Swishbush		Oct-Jan	Yellow	X					
<i>Xanthorrhoea gracilis</i>	Graceful grass tree		Jan-Nov	White, cream			X	X		
<i>Xanthorrhoea preissii</i>	Grass tree, Balga		Jan-Nov	white, cream,			X	X		
GROUNDCOVERS										
<i>Carpobrotus virescens</i>	Coastal pigface	0.3	Jun	Purple, pink, white		X				Take care to plant this local species rather than the introduced <i>Carpobrotus edulis</i> which has yellow flowers
<i>Dampiera linearis</i>	Common Dampiera	0.6	Jul-Dec	Blue			X			
<i>Dichondra repens</i>	Kidney weed	0.3	Sep-Oct	White, green, yellow	X					
<i>Hemiandra pungens</i>	Snakebush	0.5	Jan-Dec	White, blue, purple, pink			X			
<i>Hibbertia grossulariifolia</i>		0.4	Aug-Dec	Yellow			X	X		Prefers shade. Attracts butterflies
<i>Scaevola calliptera</i>		0.4	Sep-Jan	Blue, purple			X			
CLIMBERS										
<i>Billardiera floribunda</i>	white-flowered billardiera		Nov-Feb	White	X		X			
<i>Billardiera fusiformis</i>	Australian bluebell		Jan-Dec	Blue	X		X			Sturdy climber or twining shrub. Much loved by nesting small birds
<i>Billardiera variiflora</i>			Dec-May	Blue, purple	X		X			
<i>Clematis pubescens</i>	common clematis		Mar-May	White, cream				X		
<i>Hardenbergia comptoniana</i>	native wisteria		Jul-Oct	Blue, purple, white			X			Very hardy. Best pruned after flowering to keep from becoming woody

Botanical Name	Common Name	Potential height (m)	Flower time	Flower colour	Natural habitat					Notes
					Wetland/riparian	Coastal	Jarrah-marri	Granite	Karri	
<i>Kennedia coccinea</i>	coral vine		Aug-Nov	Orange, pink, red, purple			X			
<i>Thysanotus manglesianus</i>	fringed lily	2	Aug-Nov	Purple			X			Twining leafless perennial
GRASSES, RUSHES, SEDGES & other STRAP-LEAVED PLANTS										
<i>Anigozanthus flavidus</i>	Tall Kangaroo Paw	2	Nov-Jan	Red	X					Attracts nectar feeding birds
<i>Anigozanthus manglesii</i>	Mangles Kangaroo Paw	1	Aug-Nov	Green, red						
<i>Anigozanthus viridis</i>	Green Kangaroo Paw	1	Aug-Oct	Green	X					
<i>Baumea juncea</i>	Bare Twigrush	1	Oct-Mar.	Brown, grey	X					Suitable for the shallows and seasonally wet zones in wetland/dam planting
<i>Baumea rubiginosa</i>		4	Aug-Mar	Brown	X					Suitable for the shallows and seasonally wet zones in wetland/dam planting
<i>Baumea vaginalis</i>	Sheath Twig Rush	1.5	Oct-Nov	Brown	X					Suitable for the shallows and seasonally wet zones in wetland/dam planting
<i>Conostylis aculeata</i>	Prickly Conostylis	0.5	Aug-Nov	Yellow			X			
<i>Conostylis candicans</i>	Grey Cottonhead	0.5	Jul-Nov.	Yellow			X			
<i>Dianella revoluta</i>	Blueberry Lily	1.5	Aug-Jan/Apr	Blue, purple, violet		X				Attract seed eating birds. Flowers attract native bees
<i>Ficinia nodosa</i>	Knotted Club-Rush	1	Nov-Mar	Brown	X	X				Attractive evergreen clumping plant Suitable for seasonally wet areas and dry banks in wetland/dam planting
<i>Lepidosperma effusum</i>	Spreading Sword-sedge	2.5	Apr-Jun/Sep-Nov	Brown, dull grey	X					Feature plant in garden but grows very big and dense Suitable for seasonally wet areas in wetland/dam planting
<i>Lepidosperma gladiatum</i>	Coast Sword-sedge	1	Nov-May	Brown	X	X				Suitable for seasonally wet areas in wetland/dam planting
<i>Lepidosperma</i>		1	Mar-Nov	Brown	X		X	X		

Botanical Name	Common Name	Potential height (m)	Flower time	Flower colour	Natural habitat					Notes
					Wetland/riparian	Coastal	Jarrah-marri	Granite	Karri	
<i>squamatum</i>										
<i>Lepidosperma tetraquetrum</i>	Square Sedge	2-3	Nov-Mar	Brown	X					Suitable for seasonally wet areas in wetland/dam planting
<i>Meeboldina scariosa</i>	Velvet Rush	1	Nov-Feb	Brown, rusty red	X					Good in winter wet areas, shallow ponds and pots
<i>Microlaena stipoides</i>	Weeping Grass	0.75	Aug-Nov	Green, purple	X					Rhizomatous, perennial, grass
<i>Orthrosanthus laxis</i>	Morning Iris		Aug-Nov	Blue	X		X			Attracts native bees
<i>Orthrosanthus polystachyus</i>	Many Spike Orthrosanthus	1	Oct-Dec	Blue	X		X			
<i>Patersonia occidentalis</i>	Purple Flag	1	Apr/Sep-Jan.	Blue, violet, purple	X		X			Suitable for upper banks in wetland/dam planting
<i>Thysanotus multiflorus</i>	Many-flowered Fringe Lily	0.5	Oct-Jan	Purple			X			



This Information Sheet is funded by the Australian Government's National Landcare Program

BUSHLAND AND FIRE

Nature Conservation Information Sheet



Fire and biodiversity

Planned burns are used in remnant vegetation to reduce fire risk and/or encourage regeneration. An understanding of the ecological impacts of fire will enable land managers to plan and implement burns in a way that will minimise negative impacts on the ecosystem and hopefully result in improvements in condition. Fire ecology is complex and it isn't possible to give broad prescriptions on best practice. Hopefully the information and links in this document will help you make decisions that suit your objectives and protect the biodiversity values of your remnant vegetation.

Fire is culturally significant to Indigenous Australians. The use of fire by many Indigenous Australians to shape the landscape is widely acknowledged. As we learn more from Indigenous Australians about traditional burning practices recommendations on how to burn whilst protecting biodiversity are likely to change.

Effects of fire on remnant vegetation

The effect of fire on native vegetation communities depends on many factors. The primary considerations are: the frequency, seasonality and patchiness of burning; the type of vegetation community and species present; and the condition, size and connectivity of the remnant vegetation. These factors are discussed briefly below.

- 1. Frequency.** The frequency of fire will have a significant impact on the vegetation community and ecosystem. Whilst some species may benefit from frequent fire (e.g. native grasses, annual and biennial herbs, some re-sprouting shrubs, kangaroos, some fungi and invertebrates), others need longer intervals between fire to reach maturity and set seed, and to provide habitat and resources for fauna that prefer mature vegetation.
- 2. Seasonality.** The season in which a burn is conducted influences the way that fire behaves, and its effects on plants, animals and other features of the environment. Points to consider in regard to the seasonality are included in Table 1. No matter what season you plan to burn in it is important to take in to consideration the actual conditions

that year before going ahead. For example, rapid early drying in spring, or warm dry conditions extending into late autumn will have significant implications for a planned burn.

Table 1: Points to consider in regard to timing of fires	
Season	Considerations
Summer/early autumn	Not recommended as summer fires are potentially difficult to manage and very risky.
Late autumn (April-May)	<p>Some generalisations about autumn burning include:</p> <ul style="list-style-type: none"> • dry conditions may result in hot, intense, fast moving fires that consume most leaf litter and logs, and may burn down mature trees; • generally result in more extensive areas of mineral ashbed from burnt logs; • the dry soil conditions and heating of the soil to a greater depth triggers germination of buried seed; • can favour obligate seeders especially legumes such as acacias and peas; and • fire is often followed by winter rain and this encourages good regeneration. <p>Note: Autumn burns, particularly in the early part of the season, can be dangerous and difficult to control. They are not recommended for most landholders to attempt without the support of local brigades. Very late autumn fires carried out after first autumn/winter rains will likely have reduced intensity.</p>
Winter	<p>Winter burns may be useful for safely reducing fuel loads in higher risk instances or reducing specific elements of the fuel load such as grasstrees in order to facilitate subsequent spring or autumn burns. Winter burns are generally not preferred for regeneration. Some generalisations about winter burning are that these:</p> <ul style="list-style-type: none"> • are generally low intensity, low, slow burns; • can be very hard to get started and can be patchy; • often fail to achieve desired fuel reductions; • are often not hot enough to break the dormancy of buried seeds; • can promote introduced grasses where these are present; • can disrupt the life cycle of flora and fauna - annual species reliant on setting seed each year can be particularly vulnerable; and • they often focus on some of the higher risk/fuel load elements of a piece of bushland such as grasstrees.
Spring	<p>Control burning is generally not achievable during early spring. However, mid to late spring is often favoured for fuel reduction burns due to reduced intensity and increased predictability. The soil and litter layer will normally be wet and will dry from the top downwards with the onset of warm, dry weather. Logs on the ground and areas of organic soil will also be damp following winter rains, and therefore less prone to catching alight during planned burns. Although spring is the breeding season and spring burns can impact breeding of many species, some birds will have already raised their first clutches by mid October and spring burns generally burn patchily, leaving pockets of unburnt vegetation as wildlife refuge. Spring burns:</p> <ul style="list-style-type: none"> • are generally of moderate intensity depending on the vegetation type; • are good for breaking dormancy of surface and shallow seed but not for buried seed; • can promote native plant species that have evolved to respond to spring burns.; • can disrupt and harm animals and birds during breeding; • can provide a competitive advantage to resprouting plants due to the extent of growth they can achieve prior to reseeders germinating with the first rains of the following autumn; • can eliminate or seriously reduce that year's flowering (with subsequent impacts on nectar and pollen feeders) and subsequent seeding; • can trigger spring germination that can then be lost to the following dry summer.

3. Patchiness of burning. Best practice is to burn remnant vegetation in sections over time so there is a mosaic of vegetation of differing ages. This will maximise the resources for fauna, provide a seed source from unburnt areas and increase the resilience of the bushland. In larger areas of bushland it may be possible to leave some patches unburnt, particularly areas of fire sensitive vegetation communities such as wetlands, creeks and granite outcrops.

- 4. The type of vegetation community and species present.** Different vegetation communities and species vary in their response to fire. Some are quite resilient to frequent fire and re-establish to their pre-fire state relatively quickly, while sensitive vegetation communities may take decades to return to a mature condition. Fire sensitive species are most often associated with less flammable parts of the landscape including seasonal wetlands, watercourses and stream banks, exposed coastal dunes, sand plains and granite communities. These systems can tolerate only infrequent fire at greater than 20 year intervals. They are best left unburnt where possible by burning out from their edge towards surrounding vegetation. Excluding controlled burns from these fire sensitive vegetation communities however, also needs to be balanced against any damage that would be caused by the need to create a fire break or access track to enable a contained burn.

Table 2 at the end of this Information Sheet provides suggested fire regimes for different vegetation types within the Margaret River region. A range is provided for the suggested frequency or fire interval period. The lowest end of the range is only recommended where fuel load needs to be reduced due to other risk considerations. The higher end of the fire interval range would be required for some specialist plants and animals but would increase the risk of high intensity fires. A decision on fire frequency will need to balance both the need to minimise fuel loads and the protection of biodiversity.

- 5. The condition, size and connectivity of the remnant vegetation.** The condition of the remnant vegetation being burnt also affects the response to fire. Degraded bushland may not regenerate well following a fire. Regeneration of native species may be limited as the seed bank is likely to be diminished and weeds may increase as many weed species regenerate strongly after fire.

The effect on flora and fauna populations will be less if the remnant is connected to or near other bushland, is burnt in sections over time so that some unburnt habitat remains, and logs and hollows are protected from fire if possible through the removal of surrounding debris.

Management after fire

Management of environmental weeds, Phytophthora dieback, grazing and feral animals before and after a fire, as outlined below, will result in the best biodiversity outcomes for your remnant vegetation.

- 1. Weeds.** Most priority environmental weeds in the south west regenerate strongly after fire. Without management it is likely that a fire will result in an increase in weed extent and density. Tips and considerations for managing weeds after fire are:
 - Map weeds in your bushland so you know what species and areas need targeting following a fire. Be aware that new species may also emerge from the soil seed bank or be transported into the area by animals, wind or water.
 - Weed and native seedlings and new growth can sometimes be difficult to identify with confidence. Your identification needs to be accurate to ensure that native species are not removed and that your control methods target the invaders. Help is available from Florabase (<http://florabase.dpaw.wa.gov.au>) and 'Western weeds: a guide to the weeds of Western Australia'.
 - Commence monitoring soon after a fire and start planning to take advantage of some of the opportunities described below – they may not present themselves but if they do you want to be ready. If the burn occurred during dry conditions, first germination will be triggered by following rain.
 - Fire can kill weeds. Whilst most priority weed species in the south west respond well to fire (either through resprouting or reseeding) a limited number of species are fire sensitive and can be managed using fire. For

example, seedlings and even larger plants of sweet pittosporum (*Pittosporum undulatum*), which is native to rainforest areas of the eastern states, can be killed by warmer burns.

- Fire can facilitate removal of large, mature plants.
- Fire will generally thin out much of the understorey. This can provide rare but short windows of opportunity to control weeds in areas previously very difficult or impossible to access (eg, blackberry thickets, weeds among dense native vegetation).
- Where weed species germinate or reshoot quicker than natives, selective control can be undertaken.
- Fire can provide an opportunity to control almost the entire soil seed bank of some species (eg weedy wattles such as Sydney golden wattle and Flinders Range wattle) which would otherwise gradually germinate over a decade or more.
- The young fresh shoots and regrowth of weed species following fire are more receptive to chemical uptake than the old hardened foliage (eg, tambookie grass).
- Young weed seedlings can be particularly susceptible to herbicide and early control can reduce the amount of herbicide required.

2. **Phytophthora dieback and fire.** The root rot plant disease Phytophthora dieback is widespread through the Margaret River region and impacts up to 40% of south west plant species. It spreads throughout the landscape by movement of contaminated soil or water. Phytophthora dieback can be introduced and spread by firebreak creation and maintenance, and during fire control. Hygiene is critical. Remember that once introduced, dieback can't be eradicated from bushland – only managed. Refer to information available via the Dieback Working Group: www.dwg.org.au
3. **Grazing post fire.** Remnant vegetation is susceptible to grazing and browsing following a fire. Grazing of newly germinated seedlings and resprouting plants by domestic stock, rabbits and kangaroos can severely impact on regeneration. To protect and encourage regeneration ensure that stock are not able to access regenerating areas, and assess kangaroo and rabbit pressure prior to planned burns and undertake management where necessary to keep numbers down for at least two years. For small patches of high value vegetation, fencing out rabbits and kangaroos may be an option.
4. **Feral animals.** Feral predator control is important for conservation of wildlife at all times but especially following burns. Foxes and feral cats can sniff out a fire and travel long distances to predate upon animals fleeing a fire. Animals remaining are also vulnerable to predation without the protection afforded by vegetation. Feral animal control post fire may help protect surviving wildlife.

Fire as a regeneration tool


As discussed above, fire can result in regeneration of native vegetation communities. Where regeneration rather than fuel reduction is the primary objective it is worth considering alternative regeneration techniques that trigger germination such as rake and pile burns and creating of ash beds. Rake and pile burns involve raking up leaves, large twigs and branches in a cleared or degraded area in bushland, preferably where there is no overhanging trees, and burning on a cool, fine day in winter. Provided there is a seed bank in the soil, natural regeneration should occur in the ash bed the following spring/summer. Smoke may also trigger germination in the surrounding bush. Weed control and protection of the area from grazing will improve regeneration.



Monitoring and adaptive management




There will always be uncertainty and risks surrounding the outcomes of planned fire regimes. These can be reduced by adopting an adaptive management approach that includes some simple actions:



- Prepare a long-term ecological fire management plan using all of your site knowledge and drawing on expert assistance available in the community.
- Prepare a plan for each burn based on a check-list including preparatory and follow-up actions.
- Keep records of when and how fire was used (eg. weather conditions, pattern of lighting, flame height, ease of control).
- Monitor the outcome of burning and post-burn management (eg. photographic points, notes about plant and animal response, any loss of large trees).
- Review whether your objectives were achieved, and adapt your plan as required.



Table 2: Suggested fire regimes for vegetation communities of the Margaret River region

Vegetation Type	Suggested Fire Regimes for Ecological Maintenance
<p>Peppermint woodland: dense or open woodland of <i>Agonis flexuosa</i> found on sandy coastal limestone soils and sheltered parts of the ridge. Important habitat for the endangered western ringtail possum which is sensitive to widespread hot fires</p> 	<p>Frequency: 5-15 year intervals Season: Early spring and late autumn Intensity: Low intensity, slow spreading fires with flames less than 1 m tall Comments Mature <i>Agonis</i> woodlands with large old trees can be maintained by mild fires that do not scorch the crowns of the trees. Intense fires will kill mature trees back to ground level and result in dense thickets of young trees that will be sensitive to fire for several decades.</p>
<p>Banksia woodland: woodlands dominated by <i>Banksia attenuata</i> or <i>Banksia ilicifolia</i> on sand.</p> <p>These communities are already being heavily impacted by Phytophthora dieback. Nectar and seed from mature trees are important food sources for wildlife including black cockatoos and honey possums.</p>	<p>Frequency: 5-15 year intervals Season: Early spring and late autumn Intensity: Low intensity, slow spreading fires with flames less than 1 m tall Comments Banksia woodlands typically occur on sandy soils that dry rapidly following rain, and often have an understorey of shrubs that may burn readily. Low intensity fuel reduction burns help protect mature trees from wildfire. An occasional hot, summer burn is needed to establish a new generation of trees from seed; with such fires hopefully limited in extent by maintaining low fuel.</p>

Vegetation Type	Suggested Fire Regimes for Ecological Maintenance
 <p>Karri forest: tall forest of <i>Eucalyptus diversicolor</i> often with a dense shrub understorey. Confined to river valleys and sandy loam soils over deep limestone.</p> <p>Karri forests of the Leeuwin-Naturaliste Ridge are associated with a range of endemic flora and provide habitat for a range of significant mammal and bird species, some of which rely on old trees with hollow and long unburnt understorey.</p> 	<p>Frequency: Vary intervals between 7 – 20 years in a patchwork that maintains some areas at the middle to higher end of the range</p> <p>Season: Autumn</p> <p>Intensity: Low to moderate intensity fires with flames less than 1.5 m</p> <p>Comments Karri forest typically has a deep layer of leaves and twigs that will not dry sufficiently to burn until early summer (December), and opportunities to burn safely in spring will be limited in most years.</p> <p>Large old trees with hollow butts may fall if they catch fire. Removing the fuel around the base of large hollow butt trees by raking or using a small machine can minimise the risk of trees catching alight.</p>
<p>Jarrah-marri forest: our most common vegetation community with a very diverse range of understorey species depending on soil, fire history, hydrology and topography.</p> <p>Important habitat for black cockatoos and a range of important flora and fauna.</p>	<p>Frequency: 5-15 year intervals</p> <p>Season: Spring and autumn</p> <p>Intensity: Low intensity, slow spreading fires with flames less than 1 m</p> <p>Comments: The height and density of the understorey shrub layer in jarrah-marri forest will influence the amount of fuel present and the rate at which it dries after rain. Grazing by cattle and sheep has altered the understorey of some remnant jarrah-marri forest on agricultural land, with annual grasses replacing shrubs in heavily grazed remnants.</p> <p>The shortest fire interval can promote native ‘fire weeds’ of the pea family which grow rapidly, set seed then die off, re-establishing a high fuel load. A longer burning interval can break this vicious cycle if the fire weeds are replaced by slower-growing, less fire promoted understorey species.</p> <p>Some wildlife of the jarrah-marri forest is confined to long</p>

Vegetation Type	Suggested Fire Regimes for Ecological Maintenance
	<p>unburnt vegetation. Ideally, patches of forest and stream-zones should be protected from burning for as long as possible, with surrounding patches maintained at lower fuel levels to prevent extensive fire if a wildfire occurs.</p> <p>Large old trees with hollow butts may fall if they catch fire. Removing the fuel around the base of large hollow butt trees by raking or using a small machine can minimise the risk of trees catching alight.</p> <p>Fallen branches and woody debris may be piled and burnt to create ashbeds that will favour regeneration of eucalypt and some shrub seedlings. In late autumn it may be possible to burn individual piles under moist conditions when fire will not spread in the leaf litter layer.</p>
<p>Sheoak woodland: Woodlands of common sheoak with or without jarrah or banksia on sandy soils over granite</p> 	<p>Frequency: 5-15 year intervals Season: Early spring and late autumn Intensity: Low intensity, slow spreading fires with flames less than 1 m Comments: Sheoak woodlands typically occur on sandy soils that dry rapidly following rain, and often have an understorey of shrubs that may burn readily. Low intensity fires can maintain a low fuel load that helps maintain a habitat of mature trees and prevent intensive, extensive wildfire.</p>
<p>Granite communities: A unique suite of species suited to withstanding both inundation and extreme drying in summer.</p> <p>Important habitat for reptiles and a number of unique and threatened flora species.</p> 	<p>Frequency: Only as required to meet specific conservation management objectives Season: Late autumn Intensity: Very low intensity, slow spreading fires with flames less than 0.5m Comments: Granite outcrops often have a sparse vegetation cover and little or no leaf litter to carry fire. Patches of vegetation and wildlife inhabitants close to this fire barrier will often be spared from burning, thus providing a survival refuge from an intense, extensive bushfire. Periodic low intensity burning of forest or woodland surrounding granite outcrops can reduce the potential for intense summer bushfires that can spread onto granites under very dry and windy conditions.</p>
<p>Sand plains: These areas of sandy/ peaty soils over clay are often damp in winter and generally support heathland vegetation.</p>	<p>Frequency: Only as required to meet specific conservation management objectives Season: Early spring and late autumn Intensity: Fires in heathland vegetation may not sustain and spread under mild conditions, but can burn with high rate of</p>

Vegetation Type	Suggested Fire Regimes for Ecological Maintenance
	<p>spread and intensity under dry windy conditions.</p> <p>Comments: If substantial areas of peat or organic soil are present then fire should be restricted to periods when the peat is moist and unlikely to ignite.</p>
<p>Coastal Heath: Dense shrubland ranging up to 3m or more in height. The dense nature of this community can provide excellent habitat for a range of bird and mammal species</p> 	<p>Frequency: 5-15 year intervals Season: Dry periods during winter, early spring and late autumn Intensity: Fires in heathland vegetation may not sustain and spread under mild conditions, but may burn with high rate of spread and intensity under dry windy conditions.</p> <p>Comments: To burn safely and effectively in coastal heath it may be necessary to establish a low fuel buffer strip (eg. 20-30 m wide) by slashing or other mechanical treatment. Burning against a paddock of green grass in spring, or an eaten out paddock in autumn can also provide a secure boundary.</p> <p>If the heath contains dense thickets of grass trees and has not been burnt for some time, spells of fine weather during the winter months can provide an opportunity for selective burning of individual grass trees to reduce the amount of dense thatch suspended on the tree. This can reduce the intensity and flame height during subsequent planned burns.</p> <p>Note: Rottnest Teatree present in patches along the Leeuwin Naturaliste coast is a recognised as a Priority Ecological Community and is very fire sensitive and requires specific consideration to enable very low intervals between fire.</p>
<p>Winter wet swamps and wetlands: These areas typified by winter inundation but with minimal flow and are generally dominated by a diverse range sedges and rushes</p> 	<p>These systems can only tolerate infrequent fire at greater than 20 year intervals. Generally avoid/ minimise control burns within these systems by burning out from the edge to surrounding vegetation.</p>
<p>Watercourses and stream banks: Wet areas at the bottom of the landscape with flowing water and dense vegetation</p>	<p>These systems can only tolerate infrequent fire at greater than 20 year intervals. Generally avoid/ minimise control burns within these systems by burning out from the edge to surrounding vegetation.</p>

Vegetation Type	Suggested Fire Regimes for Ecological Maintenance
	
<p>Coastal Dunes: This dynamic and harsh coastal environment is dominated by low often open communities critical in stabilised mobile soils and reducing wind and wave erosion.</p> 	<p>Do not burn - fire sensitive. Burn out from the edge to surrounding vegetation where necessary to minimise fire incursion.</p>

Acknowledgements

This information was compiled from the Cape to Cape Catchments Group Fire and Biodiversity Landholder Kit. People that contributed to the Landholder Kit include: Cherie Kemp, Lachie McCaw and Dr Neil Burrows, Department of Biodiversity, Conservation and Attractions; Dr Sean Molloy, ECU; Professor Don Bradshaw, UWA; Dr Boyd Wykes and Drew McKenzie, Nature Conservation. The project was funded by LotteryWest.

References and further information

- Brown, K & Brooks, K (2002) *Bushland Weeds A practical guide to their management*. Environmental Weeds Action Network. Available at https://www.natureconservation.org.au/wp-content/uploads/2019/03/Bushland_Weeds_Book.pdf
- Dieback Working Group: www.dwg.org.au
- HerbiGuide: www.herbiguide.com.au - Detailed information about weed species and control methods
- Hussey, B.M.J. and Wallace, K.J. (1993) *Managing Your Bushland*. Department of Conservation and Land Management, Como, Western Australia.
- Hussey, B.M.J., Keighery, G.J., Cousens, R.D., Dodd, J. and Lloyd, S.G. (1997) *Western Weeds: A Guide to the Weeds of Western Australia*. Plant Protection Society of Western Australia, Victoria Park, Western Australia.
- Moore, J & Wheeler, J (2008) *Southern Weeds and their control*. Department of Agriculture and Food WA.
- <https://florabase.dpaw.wa.gov.au/weeds/> - Detailed information about weed species and control methods
- Scott, J and Negus P (2013) *Wildflowers of Southwest Australia, Augusta-Margaret River Region*. Cape to Cape Publishing, Fremantle, WA.



This Information Sheet is funded by the Australian Government's National Landcare Program

ARUM LILY CONTROL

Nature Conservation Information Sheet



Why control arum lilies?

Arum lily (*Zantedeschia aethiopica*) is native to South Africa and was introduced to Australia as an ornamental garden plant. It has become a serious weed in the south west of Western Australia in both pasture and bushland, particularly in damp areas but also invading drier sites. Arum lily is spread by birds and invades areas of good quality native vegetation. Often forming dense monocultures it out competes native understorey species reducing biodiversity and decreasing habitat and food resources for native animals.

Arum lily is poisonous to most stock, pets and humans. Symptoms can include swelling of the lips, tongue, and throat, stomach pain, vomiting and severe diarrhoea. Ingestion of the plant may be fatal. The toxicity is due to sequestering of calcium oxalate crystals and possibly other toxic compounds by the plant.

Arum lily is listed as a Declared Plant under the Biosecurity and Agriculture Management Act 2007.

Understanding the plant biology

Arum lily is a perennial plant. Each year the above ground part of the plant dies back to an underground tuberous rhizome. New leaves begin to regrow in autumn and flowering generally occurs from August to December. The plant then dies back in summer.

As well as reproducing via seed, arum lily reproduces vegetatively. Vegetative propagation is by small rhizomes, which are produced on the sides of the main tuber. A 2 cm tuber can produce 25-30 small rhizomes in a year. Even very small rhizomes are capable of producing new growth or new plants if they are detached or the tuber dies.

Plants produce large amounts of seed towards the end of the flowering season. The seeds are held within succulent berries and birds are the main vectors of dispersal. Seed rarely remains viable in the soil for more than four months.

Planning and monitoring arum lily control

Arum lily control will be most effective if it is coordinated across the landscape to reduce re-infestation. Go to natureconservation.org.au to register with the Arum Lily Blitz and contact your neighbours to discuss your control program with them.

Step 1: Understanding the distribution

Mapping the extent and density of the arum lily infestation is recommended. This will enable a targeted control strategy to be developed and will also allow monitoring of success over time.

Step 2: Developing a control plan

Where to begin? Protect areas of good quality native vegetation. Keep uninfected areas clear and remove isolated infestations within bushland before they spread. Consider working from intact bushland out towards more disturbed areas to limit the spread – especially where the infestation cannot be controlled in one concentrated effort. Develop a plan to be implemented over time if the infestation is extensive and a number of years spraying will be required.

Step 3: Monitoring effectiveness of control

To evaluate the success of the control program you may wish to record information about the extent of the arum lily infestation. Monitoring methods including mapping and photo monitoring are explained below.

Step 4: Undertaking an on-going control program

Physical Control: Hand removal of the plant is only effective if the tuberous rhizome and daughter rhizomes are removed. The resulting soil disturbance may encourage germination and establishment of other weeds. Removal of flowers will prevent birds spreading seeds.

Chemical control: Correct application of the appropriate herbicide is very effective at killing arum lily and is expected to result in a 90% kill rate. However, the small rhizomes attached to the main arum lily tuber are not always killed by the herbicide application that kills the parent plant. **Follow up spraying is therefore essential. Plants growing from the surviving daughter rhizomes are not usually visible until two years after the initial spraying.** The likelihood of reinfestation from surrounding areas also requires an on-going program of control.

Photo monitoring

The aim of photo monitoring is to take photos of the same sites regularly to enable comparison.

- Mark on a map the photo locations so that you return to the same locations.
- Include a recognisable feature in the photo.
- More is not necessarily better – stick to a few good locations and take good photographs.
- Take photographs on a cloudy but bright day – try to avoid shadows.
- Take a copy of the previous photographs with you to ensure the new photographs will be taken the same way.
- Do not use a wide angle or telephoto lens as this alters the perspective of the photograph and makes it difficult to repeat.
- Sometimes an elevated position, such as standing on the back of a vehicle, can give a better result, especially if you wish to show understorey density.



August 2013



August 2014

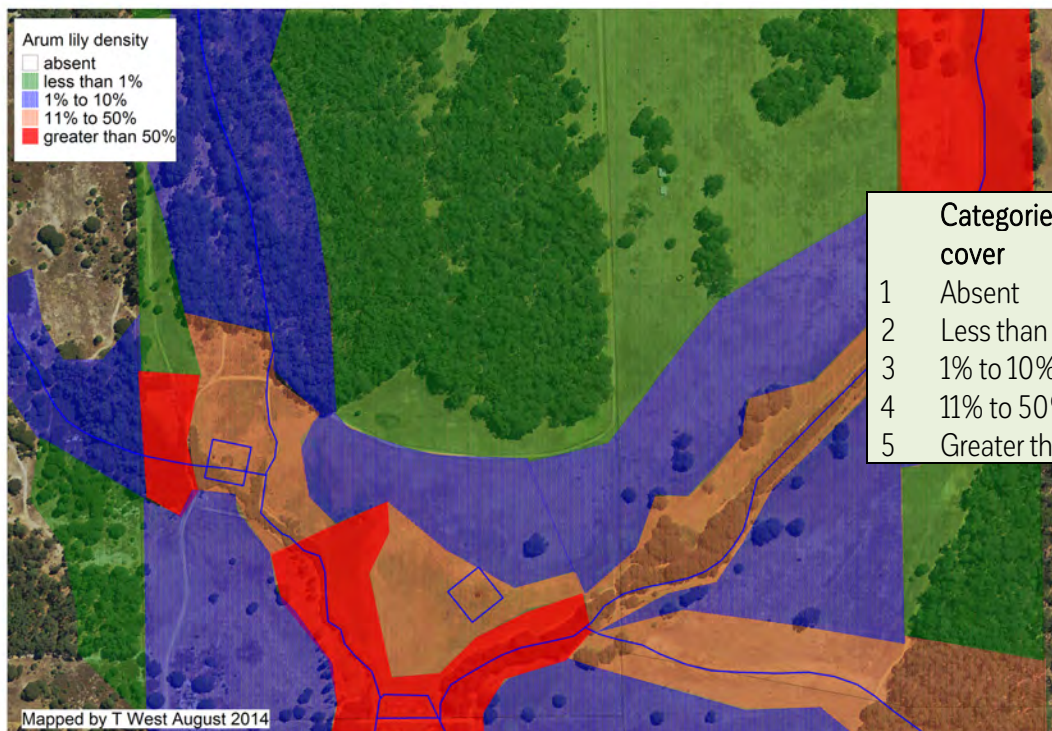
Weed mapping

Mapping the arum lily infestation prior to undertaking control and then in subsequent years will demonstrate the effectiveness of the control program. The location and the density of the weed should be mapped.

When weed mapping, try enlarging an image of the area to A4 so it can be used with a standard clipboard. A clear overlay can be placed over the map. A grid pattern drawn on the overlay will be helpful. Label and date the map. The date is essential if the map is to be used as a monitoring tool.

Start at one edge and walk across the site at regular, parallel, intervals. The intervals can be around 10 to 50 metres apart depending on the vegetation type and the visibility of the weed. A compass may be helpful. If the site is dissected by paths, roads or creeklines mapping within the sections of the property created can be more accurate.

Suggested categories of percentage cover are included in the table below. Different colours or symbols can be used to represent each category. Importantly, be consistent and use the same categories and colours each year.



	Categories of % cover	Colour code
1	Absent	clear
2	Less than 1%	green
3	1% to 10%	blue
4	11% to 50%	orange
5	Greater than 50%	red

Chemical control

The herbicide chlorsulfuron provides good control. It should be applied when the plants are actively growing between July and late October. The optimum time to spray is when at least 50-70% of flowers are present but spraying is effective as long as applied before the flowers start to wither in late spring/early summer. Rhizomatous tubers that begin actively growing later in the season will be missed if spraying occurs too early in the season. In winter wet areas, spray before the water levels have risen or after they have fallen.

Use a mixture of 1 gm of chlorsulfuron per 10 L water plus 25 mL of a penetrant such as Pulse, Sprinta or Brushwet. Spray leaves to the point of runoff. Off-target species can also be killed so it is important to apply the herbicide carefully to the arum lily leaves only. Chlorsulfuron is a very slow acting chemicals. Be aware that the plants may not yellow and die until months after they are sprayed. **Glyphosate (Roundup) is ineffective in killing arum lilies.**

Correct application of the appropriate herbicide is very effective at killing arum lily and is expected to result in a 90% kill rate. However, the small rhizomes attached to the main arum lily tuber are not always killed by the herbicide application that kills the parent plant. **Follow up spraying is therefore essential. Plants growing from the surviving daughter rhizomes are not usually visible until two years after the initial spraying.**

Always wear appropriate protective clothing when using herbicides. After mixing in the spray unit, use spray within a maximum of 24 hrs to ensure the herbicide is still effective. If left to stand for an extended period re-agitation of the mix may be required.

Restoration of the native plant community

Where arum lily occurs sparsely or in isolated patches in good quality native vegetation, the gap created by removal is small and quickly colonised by native species. However, where arum lily grows as a dense monoculture removal will leave an area susceptible to invasion by other weeds. Control of these weeds may help facilitate establishment of native plants. To improve biodiversity you can direct seeding or revegetate with local native species.

Management actions

- Contact Nature Conservation and neighbours to develop a neighbourhood wide control program.
- Map the arum lily infestation and take photos to enable evaluation of the success.
- Spot spray small populations or isolated plants.
- Target infestations in good vegetation before they spread. These areas are often quickly recolonised by natives.
- Develop a plan for control of large infestations.
- Apply the appropriate herbicide between July and late October – when plant is actively growing. **Glyphosate (Roundup) is not effective at killing arum lily.**
- Assess regeneration of native species and undertake seeding or planting of local native species if needed.
- **Do follow up control** – don't waste your efforts and herbicide use by failing to follow up in subsequent years.

References and further information

- Brown, K & Brooks, K (2002) *Managing Weeds in Bushland – Arum Lily*. Environmental Weeds Action Network
- Moore, J & Wheeler, J (2008) *Southern Weeds and their control*. Department of Agriculture and Food WA.
- HerbiGuide www.herbiguide.com.au - *Detailed information about weed species and control methods*.
- Brown, K & Brooks, K (2002) *Bushland Weeds A practical guide to their management*. Environmental Weeds Action Network.



FOX CONTROL

Nature Conservation Information Sheet



Controlling foxes to protect wildlife

Foxes (*Vulpes vulpe*) are common and widespread in the Margaret River region. They are efficient predators hunting and eating medium-sized mammals, reptiles, frogs, birds and insects as well as lambs, domestic poultry and rabbits. They compete with native carnivores for prey. Their impact on native animal populations is well established and they are a significant threat to biodiversity in the region.

Foxes live solitary lives for much of the year, roaming and hunting over several square kilometres. However, in winter they mate and cooperate to construct a den, often in an abandoned rabbit burrow, where the young will be born. A litter of four or five cubs is born in spring. By early summer the cubs are able to venture out of the den with their mother and by mid-January they disperse. Both males and females become sexually mature in their first year.

Principles of fox control

Landscape scale control. Fox control will be most effective if undertaken across a large area. This will reduce the problem of re-infestation and will result in the best outcomes for native wildlife. A coordinated control program across as large an area as possible is recommended.

When. Regular, frequent, on-going control is required to reduce the impact of foxes on native wildlife.

Fox control in spring results in the most effective outcome. At this time of year foxes are rearing young so they are less mobile and food demands are high. Adults will be susceptible to baiting and control will also reduce reproductive success.

Another important control period is when cubs are dispersing from mid-January to April. There is increased fox movement across the landscape at this time so shooting is likely to be an effective control method.

Control will only temporarily reduce numbers, as new animals will move in to replace resident animals that have been killed. Further control will be needed at other times of the year to remove reinvading foxes.

If foxes are being controlled to reduce impacts on lambs, control should occur prior to lambing.

How often. The frequency of fox control will depend on the objective, for example, are foxes being controlled to reduce lamb losses, protect domestic poultry and/or reduce impacts on native wildlife? It will also depend on the size of the area over which control is being undertaken. Advice varies on how often fox control is required to protect wildlife. The Department of Biodiversity, Conservation and Attraction's Western Shield program baits four times a year and it is probably a good idea to use this frequency as a guide.

Secondary baiting. In areas where rabbits and foxes are present it is recommended to control rabbits with 1080 first. Foxes are often poisoned after eating rabbits killed by 1080.

Foxes and other animals, especially birds, can move baits, so following the recommended procedures to minimise this risk is essential. In some areas it will not be possible to use baits as the risk to humans and other animals will be too high.

Combination of control methods. A combination of appropriate control methods will likely result in maximum effectiveness.

Methods of fox control

Baiting

Baiting with 1080 is the most cost effective and efficient means of reducing fox numbers, particularly over large areas. 1080 or sodium fluoroacetate is a naturally occurring toxin found in high concentrations in gastrolobium plants of south west WA. Native animals have evolved a tolerance to its effects but non-natives such as the fox and feral cat have a very low tolerance to 1080 and the ingestion of low concentrations is fatal. Non-target animals such as pets are also susceptible to 1080 poisoning, and the use of 1080 is highly regulated by the Department of Primary Industries and Regional Development.

A landholder wishing to control foxes using 1080 has two options: using a licensed contractor to lay the baits or becoming accredited and obtaining a permit to lay the baits themselves. Licenced contractors that work in the region are listed at the end of this Information Sheet. Go to www.agric.wa.gov.au/invasive-species/1080-landholder-information to find out how to become accredited to use 1080 baits.

Canid pest ejectors

Canid pest ejectors (CPEs) are a newly approved method of deploying 1080 to wild canids (foxes and wild dogs) in Western Australia. CPEs are spring-activated baiting devices that use a piston to propel the contents of a 1080 capsule directly into the mouth of a wild dog or fox as it pulls the bait placed on the head of the ejector. More information at www.agric.wa.gov.au/invasive-species/canid-pest-ejectors

Fumigation

Fumigation is only an effective control method when cubs are present in the den. Carbon monoxide poisoning is a humane method of dealing with foxes, causing unconsciousness and death without pain. The cartridge is lit, inserted into the den and the den entrance covered in soil. Fox cubs are only fully susceptible to carbon monoxide effects from the age of 4 weeks so fumigation prior to this should be avoided. DEN-CO-FUME is the only fumigate product registered for use on foxes in Australia, including Western Australia. The use of any other fumigate product or gas is unlawful in Australia.

Den destruction

Where the den is accessible to appropriate machinery, deep ripping can destroy it. However, this would not be appropriate where the den is within native vegetation.

Shooting

Shooting can be effective in reducing fox numbers locally.

Trapping

Soft catch jawed traps and cage traps are sometimes used to control particular problem foxes. Under the Animal Welfare (General) Regulations 2003 metal jaw traps can only be used if the jaws are padded or otherwise modified so that any captured animal is unlikely to suffer significant injury. Captured foxes must be disposed of humanely. Under the Biosecurity and Agriculture Management Regulations 2013 a permit is required to use jaw traps or snares for the capture of foxes in built-up areas (urban areas) and land zoned as special rural zone as defined in the *Planning and Development Act 2005*. See www.agric.wa.gov.au/mechanical-physical-and-cultural/animal-pest-trapping-urban-areas

Exclusion fencing

Foxes are agile animals and can penetrate various types of fences. Wire netting with mesh size not exceeding 80mm (about 3 inches) will prevent foxes passing through a fence. The netting should be 1.2-1.9m high and buried at least 450mm deep. An apron of netting angled outwards for 200mm at the base of the fence provides an added deterrent to digging under the fence. Electrification of outriggers or closely spaced plain wires can also discourage foxes from climbing over or through fences. Wire netting enclosures roofed with netting or other material will protect poultry from foxes.

Monitoring the success of fox control

It is not feasible for a control program to eradicate all foxes in an area. The aim is to reduce the size of the fox population so that the impact on native wildlife, lambs or poultry is significantly reduced.

To monitor the success of a control program it is important to assess two factors:

1. The effectiveness of the control method. Are the 1080 baits being taken? Are the baits set in the best location? Would a different bait type work more effectively? Is shooting effective at reducing numbers? Assessing these basics allows improvements to the control program to be made.
2. The impact the control program is having on native species, lambs or poultry. Are populations of native species increasing? Is predation of lambs or poultry reducing?



Methods for monitoring foxes and/or native wildlife are outlined below. PestSmart (The Centre for Invasive Species Solutions) has made a number of useful short videos on monitoring techniques including camera trapping, spotlighting, scat collection and sand pads. They can be viewed at www.youtube.com/playlist?list=PL83733E09E287264C&feature=view_all

Digital motion sensitive cameras

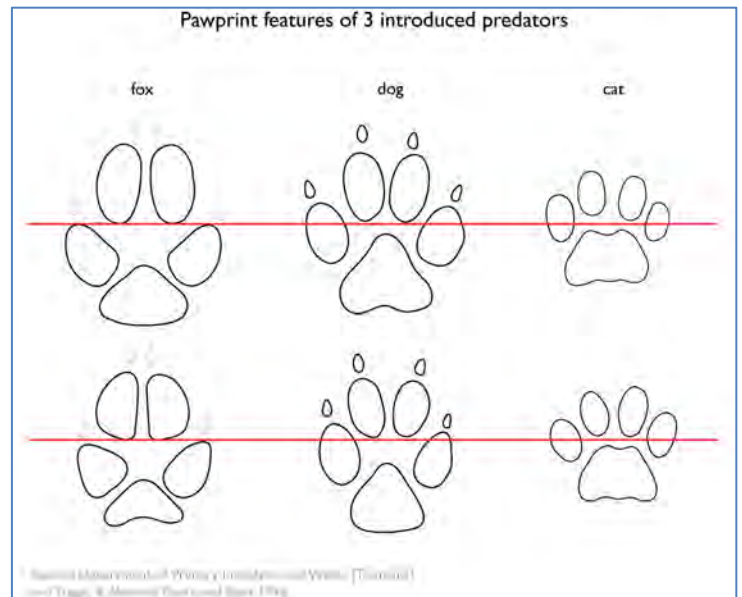
Motion sensitive cameras can be set up and left on site to collect information on foxes and native fauna. Detailed information on the use of cameras for monitoring is available at <https://www.pestsmart.org.au/act/act-step-4/camera-trapping/>

Spotlight counts

Although the reliability of information collected by spotlighting is low, it is a quick and simple method. For foxes it is most useful in areas of open grassland and woodland where visibility is best. Fox sightings during the day should also be counted. Sightings can be common in January and February when young foxes are dispersing. Spotlighting can also be used to monitor the presence of native species. For tips on spotlighting to monitor native wildlife go to [Western Ringtail Possums Self Guided Spotlighting Tips](#)

Sand pads

This technique entails creating a series of square plots of sand and placing a bait or lure at the centre of each plot to entice animals on to it so that they can leave identifiable tracks in the sand. A sand pad is usually about 1 m², with the bait covered or buried in the ground to a depth of 5–10 cm. Tracks are most identifiable in clean, firm and slightly damp sand. Toxic or non-toxic baits can be used. This monitoring method can be part of a control program if toxic baits are used. Use a field guide to help identify the tracks and scats. Details below.



Fox control contractors:

Animal Pest Management

Freecall: [1800 842 199](tel:1800842199)

Phone: [08 97262537](tel:0897262537)

Email: enquiries@animalpest.com.au

Jock Salkeld, Licenced Pest Management Technician (Licence: 9743)

Border Protection

Phone: 0439976240

Email: jocksalkeld@hotmail.com

References and further information

- Triggs, Barbara. 1996. *Tracks, scats and other traces: a field guide to Australian mammals*. Oxford University Press, Melbourne.
- www.pestsmart.org.au/
- www.agric.wa.gov.au/pests-weeds-diseases/pests



MARRI DECLINE

Nature Conservation Information Sheet



What is marri canker disease?

A severe canker disease caused by the fungal pathogen *Quambalaria coyrecup* is contributing to the decline in marri trees (*Corymbia calophylla*) in the Margaret River region. The fungus enters through wounds or cracks in the bark and results in the death of areas of bark and the cortex tissue below. The infected area develops an unsightly canker which often exudes a large amount of kino (gum), staining the branch or trunk red. Cankers can occur on the trunk, branches or twigs of the trees and can result in limb fall and even death of the whole tree if the canker ringbarks the limb or trunk.

A second fungal pathogen *Quambalaria pitereka* is also known to cause leaf, shoot and flower blight in marri trees in the Margaret River region. This fungus affects the leaves, flower buds, flowers and fruit.

Native trees do best when growing in healthy bushland. They rely on complex interactions with the soil and other plants and animals. When these interactions are disturbed trees are more susceptible to attack from insects and plant pathogens. An accumulation of environmental stress factors such as climate change, drought, loss of native understorey, fire, changes to soil composition and structure, overabundance of insect pests, and other plant pathogens means marris are more susceptible to disease.

The diseases also affects other *Corymbia* species including amenity planted red flowering gum (*Corymbia ficifolia*).

Researchers at Murdoch University's Centre for Excellence for Climate Change, Woodland & Forest Health are currently undertaking research to improve understanding about the underlying causes and practical management solutions to marri decline in south west WA. Their research includes:

- The establishment of treatment trials to investigate the efficacy of fungicide and nutrient treatments in controlling disease development; and
- Provenance trials to select disease resistant strains of marri for future plantings.

Canker disease can be recognised by the following identifying symptoms



The bark surrounding the affected area cracks and is eventually shed. Large amounts of kino (gum) are produced, staining the limb or trunk dark red.



Large target-like lesions are formed as a result of a progressive 'tug-of-war'. The tree produces a defence response that 'walls off' the diseased region, but with time the fungus manages to penetrate this barrier and reinvades.



The pathogen *Quambalaria coyrecup* is sometimes observed sporulating on the diseased area. This contains many, millions of spores that can be spread by rain splash, wind, insects and pruning.



Once the disease has progressed to the point of girdling the host, it has effectively ringbarked the tree resulting in the death of the affected limb or the entire tree if the trunk has been girdled.

Look-alike symptoms

Damage to marri trees may not always be a fungal related canker. Marri trees also ooze red kino from wounds, insect damage and branch stubs. They often have small cracks that ooze kino, and while in some cases these cracks can develop into cankers, in many instances the tree will callus these off, and all trace of them eventually disappears. Borer damage caused by Eucalyptus long-horned borer (*Phorocantha semipunctata*) and Bullseye borer (*P. ancanthocera*) can resemble a canker, but on closer inspection you may see frass or evidence of an emergence hole. Extensive borer damage that has led to branch and tree death is easily determined by the presence of borer galleries that become visible as the bark drops.

What you can do

There is currently no definitive recommendations on management to protect trees from marri decline. Undertaking management that will protect and enhance the environmental conditions surrounding affected marri trees may help. This includes restricting stock access, planting understorey species, mulching and watering where appropriate. Fungicide and nutrient treatments, as outlined below, can also be used to boost the defences of marri trees.

Phosphite is a systemic, biodegradable fungicide that protects plants against disease by boosting the plant's own natural defences. Phosphite is environmentally safe, inexpensive and has a very low toxicity to animals. Phosphite needs to enter a plant's water transport system in order for it to be effective. This can be done by injecting phosphite into trees, or spraying the leaves of understorey plants. Go to <https://www.natureconservation.org.au/wp-content/uploads/2019/03/Phosphite-injection-using-chemjet-syringes.pdf> for instructions on using phosphite. Depending on how it is applied, phosphite can provide protection for vulnerable plants to disease for up to five years.

Medicap nutrient implants provide the tree with a slow release nutrient that benefits the tree over a long period of time, with the aim of improving plant vigour and general health. The nutrient implants are delivered directly into the tree and are designed to remain safely within the tree with the contents delivered systemically throughout the tree with sap flow. Medicap nutrient implants can be purchased from <http://arborcarbon.com.au/services.html>



RAT CONTROL & LOCAL WILDLIFE

Nature Conservation Information Sheet



Take care who you kill

Rat and mice poisons, known as rodenticides, are a convenient, effective way to control harmful rodents. However rodenticides can also harm and kill local wildlife and pets through direct and secondary poisoning.

Worldwide, wildlife and pets have been shown to be at risk from rodenticide poisoning.¹ Research by Edith Cowan University's Mike Lohr has now confirmed that Australian birds of prey such as owls and likely many other wildlife are similarly taking up harmful, often lethal doses of rodenticides.²

Anticoagulant rodenticides cause an animal to die by excessive bleeding. They are effective at killing rodents but other animals can also be attracted to the baits and, since the rodents take several days to die, native animals may eat dead and readily-captured dying rodents.

Anticoagulant rodenticides can be divided into two classes.

First Generation Rodenticides containing the active ingredients Warfarin (Ratsak Double Strength) and Coumatetralyl (e.g. in Racumin). First generation rodenticides work more slowly and break down more quickly.

Owls and other wildlife are unlikely to die from secondary exposure to Ratsak Double Strength or Racumin.

Second Generation Rodenticides containing the active ingredients Brodifacoum (most Ratsak brands), Bromadiolone (some Ratsak products) and Difenacoum (Talon, Mortein, Ratsak Fast Action, Pestoff Rodent Bait 20R, Klerat).

These rodenticides should be avoided!

¹ Riley *et al.*, 2007; Robertson, Leggoe, Dorling, Shaw, & Clark, 1992

² Lohr, MT, 2018

How can I safely control rats and mice?

Organisations such as Birdlife Australia are tackling the rodenticide issue at a national level to have appropriate controls on the sale of second generation rodenticides.

At the local level, Nature Conservation has formed a Rodenticide Action Group. The objective is to limit use of the second generation rodenticides that are killing off our Boobooks, Masked Owls and likely many other nocturnal wildlife. The Group is mounting a campaign to get distributors on board to restrict sales and get the message out to customers – pest controllers, householders and agriculturalists.

Ideally, we should be using traps rather than baits to control rats and mice. A wide variety of traps, including electronic traps, is available. Careful positioning is necessary to be effective and reduce harm to non-target species. Old fashioned snap traps baited with peanut butter are also effective if placed along edges of walls and corners where rodents travel. A homemade rat poison can also be made using baking powder. Find the recipe here-https://www.wikihow.com/Make-Rat-Poison#Flour.2C_Sugar_and_Baking_Soda_sub.

If you must use baits, choose first generation rodenticides such as **Ratsak Double Strength** and **Racumin**.



If employing a licensed pesticide company, choose one that does not use second generation rodenticide products.

There are other ways you can reduce the need for rat control:

- keep your garden or property clean and tidy
- clean up brush piles and rubbish
- secure compost heaps
- keep pet food indoors
- use chicken feeders which prevent spillage
- pick up fallen fruits from beneath your fruit trees
- seal holes and other potential entry points in buildings and enclosures.

Other ways to help:

- Take sick and injured wildlife to your local vet or wildlife carer.
- Donate to the work of Nature Conservation's Rodenticide Action Group.
- Support wildlife rescue organisation such as FAWNA.

References

Lohr, M.T., 2018. Anticoagulant rodenticide exposure in an Australian predatory bird increases with proximity to developed habitat. *Science of the Total Environment* 643:134–144.

Riley, S. P. D., Bromley, C., Poppenga, R. H., Uzal, F. a., Whited, L., & Sauvajot, R. M. (2007). Anticoagulant Exposure and Notoedric Mange in Bobcats and Mountain Lions in Urban Southern California. *Journal of Wildlife Management*, 71(6), 1874–1884. <http://doi.org/10.2193/2005-615>

Robertson, I., Leggoe, M., Dorling, P., Shaw, S., & Clark, W. (1992). A retrospective study of poisoning cases in dogs and cats: comparison between a rural and an urban practice. *Australian Veterinary Journal*, 69(8), 194–195.