

# Weed and Pest Management for Revegetation and Remnant Bush Land Sites Best Practice Guide



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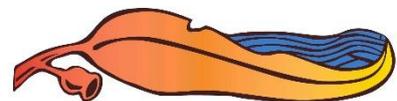
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# Contents

Contents .....	1
1. Context .....	3
2. Integrated Weed and Pest Management .....	3
Integrated Weed Control Techniques .....	3
Integrated Pest Control Techniques .....	4
Vehicles and Machinery Hygiene.....	4
3. Prioritising Control.....	5
4. Western Australia’s Biosecurity Strategy 2016 – 2025 .....	6
5. Weed and Pest Management Monitoring and Evaluation .....	6
Weed and Pest Identification .....	6
Recording Weed and Pest Observations .....	6
6. Creating a Weed and Pest Management Plan.....	7
Common Weeds Control Methods.....	7
Understanding the Mechanism for Survival .....	7
Common Pests Associated with Revegetation and Protecting Remnant Bush Land.....	8
Common Pest Control Methods.....	10
Project Planning .....	11
7. Chemical Safety .....	12
8. Resources.....	13
Weed Identification and Management references.....	13
Pest Identification and Management references .....	13
Ecology management references .....	13



## Context

Blackwood Basin Group has created this document to act as a guide to assist in implementing the best management action to deal with invasive weed and pest species in Bush remnants and revegetation areas. Weed and Pest management is critical to the success of a project and should be implemented before, during and after the revegetation and protecting remnant bush land process. While the goal of this booklet is to aid in the management of weed and pest species in the Middle Blackwood Catchment, it can be used in a wider geographic context. In the South West of Western Australia our natural areas have unique economical, ecological and cultural values of national and international importance. These unique values are being adversely impacted by an ongoing increase of weed and pest species. Weed control can assist regeneration in disturbed areas.

If the user is outside of this region, local information should be substituted with the information outlined to ensure environmentally sound practices are maintained. If the user is ever unsure about weed and pest management please contact the Department of Primary Industries and Regional Development (DPIRD) or local Landcare group for more information and or resources and training.

## 2. Integrated Weed and Pest Management

Integrated Pest Management (IPM) is a long-term management strategy utilising a combination of social, economic and technical approaches that leads to the successful control of weed and pest species, an objective of the Biosecurity and Agriculture Management (BAM) Act 2007.

The principles of IPM include:

- Identify weeds and pests, their spread and resources needed for control before taking action.
- Prioritise the areas and species for management. An ecological survey can be used for asset management prioritization.
- Establish management procedures for each weed and pest animal species.
- Schedule a range of management actions for the weed and pests that targets control a time when they are most vulnerable. Physical, chemical, environmental and biological methods should be considered.
- Evaluate control measures and adjust accordingly to site-specific conditions and available resources.
- Ongoing monitoring, evaluation and sharing of the results.

### Integrated Weed Control Techniques

- Prevent new weeds from establishing, get to know the plants of your bushland (native and introduced) and immediately remove infestations of any new weeds.
- Limit the spread of established weeds by reducing seed and propagule set. Avoid working in areas where weeds are actively shedding seed.
- Clean tools, boots, equipment and machinery between jobs to reduce risk of spread between sites. Avoid working in areas where weeds are actively shedding seed.
- Practise soil hygiene.
- Check materials such as mulches, gravel and potted plants before bringing on to a site for weed seed and try to acquire from accredited clean sources.

- Avoid bringing soil from elsewhere into bushland. The sources of infestations can be from old soil or rubble dumps. Sometimes the only option may be physical removal of these dumps.
- Keep soil disturbance to a minimum. Disturbance brings buried weed seed to the surface thereby releasing dormancy, and creates favourable conditions for the germination of wind dispersed weed seed.
- Post-fire conditions (space, light and high nutrient availability) often favour establishment of weeds. Weed control in the season immediately following fire is highly effective as the area is easy to access.
- Follow up weed control if critical. Systematically checking and control previous control areas before moving on the next area ensures weed is contained.
- Ensure the control options do not negatively impact on co-occurring native flora and fauna.
- The presence of Threatened species makes the weed control more complicated. If unable to spray chemicals, then hand control and localised wipe/spot spraying is recommended.
- Education in your local community can: aid the correct use of plants, share information about where to buy local native species and explain the detrimental effects of garden waste dumping.

## **Integrated Pest Control Techniques**

- Ensure the control options do not negatively impact on co-occurring native flora and fauna.
- Guarding of animals to limit predation. Can include cages or companion animals.
- Reducing excess food for scavenging by pests.
- Limit disturbing areas as is favoured by pests.
- Control in line with animal control guidelines.
- Pre-feeding effectively before starting control
- Use a range of techniques throughout the year to maximise seasonal vulnerability.
- Participate in a group or partnership. Working together a community can achieve common goals and pool resources.

## **Vehicles and Machinery Hygiene**

The movement of vehicles and/or machinery within and between properties has the potential to spread or introduce weeds and disease.

Consider the following in vehicle hygiene:

- Minimise the use of vehicles of tracks and roads. If works can be undertaken on foot without a vehicle, it should be done on foot.
- Provide facilities for the cleaning of vehicles, machinery and equipment.
- Entry and exit points and vehicle movement paths to be established.
- All machinery and vehicles coming onto a property should be free of material (e.g. dried mud) that may contain seeds.
- Consider dieback undertaking a dieback assessment and training such as Greencard.

### 3. Prioritising Control

When controlling weeds and pests, it is impossible to control all the species all the time. Resources for bushland restoration work are generally limited. It is critical that these resources are carefully targeted through strategies that prioritise management actions, based on a knowledge of the bushland area and the weeds that are impacting on it.

Prioritisation of what to control and when is determined by the values and resources associated with the project. The following methods have achieved successful weed and pest management:

1. Working from the outside in. Used in large scale infestations to reduce the spread. In Catchments and smaller run off water areas, start weed control at the top of the catchment or top of the hill for example.
2. Asset driven. Used in areas with threatened species where control is undertaken from the area in most need of protection.
3. Tackling the least affected areas first. Used in disturbed bushland, the control is more effective where the bush is healthy.

#### 4. Bradley method

In the 1960s and 1970s Joan and Eileen Bradley developed a series of weed control and native vegetation recovery techniques through trial and error. The 'Bradley method' involved methodically clearing small areas in and around healthy native vegetation so that the each area was re-colonised by the regeneration of native plants, replacing the weeds. The method places great emphasis on rigorous and timely weed control and follow up during the recovery phase. The process showed that, once native vegetation was re-established, continuing weed control could be achieved with long lasting results.

The Bradley method follows three main principles:

1. Secure the best areas first. They are the easiest to work with the best results. They are the core areas that can then be expanded.
2. Minimise disturbance to the natural conditions.
3. Don't over clear – let the regeneration of the bush set the pace of clearance.

## 4. Western Australia's Biosecurity Strategy 2016 – 2025

Western Australia's Biosecurity Strategy sets the strategic direction for partnership arrangements to manage biosecurity issues affecting agriculture, fisheries, forestry and biodiversity in terrestrial and aquatic environments. The strategy covers pest animal and plant species, as well as diseases. It acknowledges that an effective biosecurity system is needed, to manage risks across the entire biosecurity continuum and emphasises the importance of prevention and early detection of weed, pest and disease incursions within Western Australia.

Biosecurity management in WA is underpinned by three principles:

- Biosecurity is a shared responsibility,
- Effective risk management underpins decision making, and
- Policies and programs are transparent, consistent and evidence based

"Biosecurity is the management of risks to the economy, the environment and the community of pests and disease entering, emerging, establishing or spreading."  
(\*Intergovernmental Agreement on Biosecurity).

## 5. Weed and Pest Management Monitoring and Evaluation

The ongoing monitoring of weeds and pests is essential to ensure that current management practises are effective and to monitor for the presence of new weeds and pests that may impact on biodiversity values. Evaluation of control methods should be ongoing.

### Weed and Pest Identification

There are many avenues for identifying weeds and pests. For example recognition software in some apps can identify most plants, social media networks can link you to experts in the field and the local landcare group can also provide information. DPIRD Pest and Disease Information Service (PaDIS) and DPIRD provides identification services on animal and plant pests, weeds and diseases. DPIRD apps such as Feralscan and MyPestGuide are also useful for identification and mapping. The inaturalist app <https://www.inaturalist.org/> is an international database system used for identification and mapping.

### Recording Weed and Pest Observations

Local knowledge of a particular weeds and pests can be gained by observing and recording the following details:

- When and where is it active? Flowering and seeding for weeds, movements for pests.
- How and when do they reproduce?
- What is the lifespan?
- How does it respond to fire?
- What are the vulnerable times in the life-cycle?
- Is there a preferred time for control?
- Understand the distribution of the weed and pest across the bushland by mapping the spread. Mapping the weed and pest locations and control with GPS or hand drawn maps. The map also provides a monitoring tool that allows you to assess the reduction in population area.
- Keep a record of control programs with date, time and type of control carried out including details of methods used, hours worked, and site conditions.

## 6. Creating a Weed and Pest Management Plan

When undertaking a revegetation, restoration or habitat enhancement project, developing a weed and pest management program will help schedule control times and prepare for resources needed.

### Common Weeds Control Methods

Table 1- Summary of the major weed types and preferred physical and mechanical control methods. Biological control is a good option for all weeds if available.

It is important to research individual weed species to determine the best method of control. Florabase is able to provide control methods and timing for weed control based on best practice in the state. Florabase link: <https://florabase.dpaw.wa.gov.au/>

Weed Type	Examples	Preferred Physical/ Mechanical Control Method
<b>Annual Grasses</b>	Wild oats, Barley grass	Hand Pulling isolated plants, Slashing to reduce seed set, Spraying; Burning and Crash grazing.
<b>Perennial Grasses</b>	African love grass, Perennial veldt grass	Hand digging and spot spraying isolated plants, Slashing to reduce seed set, spraying before flowering.
<b>Rushes</b>	Weed <i>Juncus</i> spp. Bulrush	Hand digging; slashing.
<b>Herbs</b>	Capeweed; Spear Thistle; Wild radish	Hand pulling, Slashing; Spraying; Burning; Crash grazing, steaming/solarisation.
<b>Persistent herbs</b>	Fleabane, Varigated thistle, onion Weed, Blackberry nightshade.	Need more targeted control with spraying and hand removal.
<b>Vines</b>	Dolichos pea; Blue Periwinkle.	Slashing; Spraying;
<b>Shrubs</b>	Broom Bush; Apple of Sodom, Cotton Bush.	Hand pulling; Spraying.
<b>Woody Weeds</b>	Blackberry; Weed Wattle spp. Tagasate	Topping; Ring bark; Hand pull; Cut and paint; Inject.
<b>Annual bulbous/corm weeds</b>	Arum lily, Watsonia, Bridal creeper, Cape Tulip	Spraying with systemic herbicides

### Understanding the Mechanism for Survival

By understanding the mechanism of survival, you will be able to recognise the most suitable method of control and the right time to apply it.

Bulb, corm etc. die back to an underground storage organ over the long dry summer and is extremely effective at surviving fire and long periods of drought. Fire responsive plants are designed to germinate on mass, flowering and seeding prolifically after fire. Fire also provides favourable conditions for seed germination and seedling establishment, fire appears to be one of the major factors facilitating the establishment of many of these weeds into otherwise undisturbed bushland.

Fire creates a window of opportunity for control as the bushland becomes more accessible, control is more effective and seed banks are reduced. Additional resources should always be made available to control weeds following fire.

Physical removal can sometimes be more beneficial than chemical removal, however in an integrated weed and pest plan all options should be applied at the right time. Although hand-removal can be labour intensive and takes up time it can be more cost efficient for small populations in good bushland. Targeting these isolated populations of weeds in good bushland and preventing their establishment and spread is the key to protecting undisturbed plant communities.

Understanding the life-cycle of the weeds over the growing season can mean the difference between effective control and invasive spread. Carrying out chemical and physical control whilst weed is flowering can be ineffective for species that are still able to set viable seed such as thistle.

## Common Pests Associated with Revegetation and Protecting Remnant Bush Land.

Table 3 - Pest species associated with revegetation and protecting remnant bush land.

Common Name	Scientific Name	Reproduction	Impacts
<b>Wild Rabbits</b>	<i>Oryctolagus cuniculus</i>	Wild rabbit populations increase in late winter and spring.	Wild rabbits graze on vegetation resulting in the degradation of revegetated areas and soil erosion.
<b>Feral Pigs</b>	<i>Sus scrofa</i>	Feral pigs breed throughout the year. Peaks in birth often coincide with increases in seasonal food.	Feral pigs graze on seedlings and root stocks which can increase the spread of invasive weed species. They also create wallows, eroding soil and reducing water quality.
<b>Feral Goats</b>	<i>Capra aegagrus hircus</i>	Feral goat populations are able to breed twice in one year if climatic conditions and food resources are favourable.	Feral goats graze on native vegetation, often completely stripping the leaves and bark. Feral goats are susceptible to several livestock diseases, aiding in dispersal.
<b>Feral Deer</b>	<i>Cervus</i> spp	Feral deer can reproduce throughout the year though calves are usually born in March to May.	Feral deer graze on native vegetation and increase soil erosion. They also spread invasive weed species and affect water quality.
<b>Western Grey Kangaroo</b>	<i>Macropus fuliginosus</i>	Kangaroo populations breed seasonally from late November to early February.	Kangaroos graze and trample planted seedlings.
<b>Lerps</b>	<i>Cardiaspina</i> spp	Usually 3-5 generations per year depending on	Lerps are sapsucking insects that cause the defoliation of Eucalyptus species.

Common Name	Scientific Name	Reproduction	Impacts
		the ambient temperature and season.	
<b>Livestock</b>	Various species	Various reproduction rates depending on species.	If revegetation areas aren't sufficiently protected livestock may graze, trample or erode sensitive areas. Livestock also reduce water quality.
<b>Cats*</b>	<i>Felis catus</i>	Wild cats can produce up to 3 litters a year with an average of 4 kittens per litter.	Doesn't directly affect revegetation success but predated on beneficial native species.
<b>European Red Fox*</b>	<i>Vulpes vulpes</i>	Wild fox litters average 4 offspring during August and September each year.	Predates on native species.



Images of pest species found in the Middle Blackwood Catchment from left to right, top to bottom: Western Grey Kangaroo, European Red Fox, Feral Pigs, Feral Deer, Feral Goat and a Wild Rabbit.

## Common Pest Control Methods

Any control method employed must be in accordance with the Animal Welfare Act 2002. Join local pest control groups to provide a good communication channel that allows for whole landscape and cross boundary approaches. Pest succession should be considered when reviewing pest management programs to ensure the practices applied are effectively targeting the situation. An example of pest succession would be the control of foxes using baiting techniques leading to an increase in feral cats which are less likely to consume baits.

Table 4 - Common pest control methods with the advantages and disadvantages of each method (Information taken from DPIRD website, seek current advice from DPIRD prior to undertaking control).

<b>Pest Control Methods</b>	<b>Advantages</b>	<b>Disadvantages</b>
<b>Fencing</b>	Exclude pest species from a small area.	Expensive to build and maintain fences; May require specialists to build; May be impractical to build fences in particularly degraded/sloping sites; Type of fence required depends on pest species, for example fencing must extend below the soil to exclude rabbits.
<b>Plant Guards</b>	Protection from grazing herbivores such as rabbits and kangaroos; Creates a microclimate, protecting seedlings from adverse climatic conditions.	Not as rigid as fencing especially in regard to feral pig control; Not appropriate for plantings close to flowing water/floodways; Time consuming to install and remove; May degrade and generate litter.
<b>Shooting</b>	Ability to target individuals within a population; Often used as a complementary pest control method.	Labour/time intensive; Not effective for large or sparsely distributed populations; Requires licencing.
<b>Trapping</b>	Potential for multiple animals to be captured at once; Non-Target species can be safely released; Different trap designs for different target species.	Expensive to obtain; Labour/time intensive to regularly bait and check traps; Impractical in densely vegetated or remote areas.
<b>Baiting</b>	Useful for remote areas; Effectively reduces some pest species populations; Different bait types for different applications.	Non-target species risks; Requires training and licence to conduct 1080 baiting; Only permitted on large areas (refer to DPIRD).
<b>Biological Control</b>	Useful to remove large populations; Once initial trials have been conducted ongoing costs are small; Compatible with other control techniques.	Some individuals within a population may be immune and pass on immunity to offspring; Expensive initial trials; Suitable agents may not exist for particular species.

## Project Planning

Refer to the resources section of this document for supplementary information regarding the identification and management of specific weed species.

Prior to any revegetation program the site should be assessed. By addressing these points a cost effective and practical plan can be formulated for the revegetation area. To efficiently achieve this the following points should be addressed:

- identify weed pest species and map populations,
- identify the scale of the weed and pest problem,
- understand major features of the landscape,
- understand weather patterns,
- identify potential risks,
- identify local resources on farm and neighbouring properties,
- identify native fauna and flora already present in the area,
- identify appropriate methods of control for the site and consider combinations of beneficial control methods as described in the integrated weed and pest management techniques, and
- create specific goals that you are hoping to achieve and by when you are hoping to achieve them.

It is important to research environmental factors relevant to your site to determine a control plan. For example the wind speed/direction and proximity to water sources is a factor when utilising chemicals. Other considerations may involve the formation of maintenance tracks, these tracks will allow for easy access for management in subsequent years.

It is ideal that a weed-free area of approximately 1m diameter should be maintained around each individual plant or along planting mounds. Maintaining a weed-free buffer zone around each plant will reduce competition for light, water and nutrients. Seedlings benefit from between 1-3 years of weed management, this allows the native seedlings to grow to a size that they begin to shade and outcompete surrounding weed species. Managing weeds for an extended time period will reduce the amount of weed species present in the soils seedbank, reducing their presence in future years.

If the goal of the program is to restore biodiversity to an area rather than mitigate environmental degradation then ongoing weed management is beneficial. Long term weed management practices should be continuously reviewed and analysed to ensure that the most efficient and cost effective control methods are be utilised for the situation.

Picture: Wildlife exclusion fencing at Perup Natures Guesthouse for Tammar Wallaby Habitat



## 7. Chemical Safety

Herbicide application needs to be done by experienced operators with the correct equipment, knowledge of herbicides and an understanding of bushland and of the native flora.

A chemical course should be undertaken to understand the legal guidelines associated with chemical use. In Western Australia, state and local government workers, consultants, contractors and volunteers who use herbicides are all bound by legislation governing pesticide use (The Health (Pesticides) Regulations 1956). These regulations are in place to protect the applicator, public and environment from the misuse of herbicide. A contractor with a provisional licence can carry out spraying as long as a person holding a full licence supervises them. Any person operating a pesticide spraying company must hold a full licence.

There is some concern about contractors entering the field with insufficient training in the application of herbicides within bushland situations. Contractors unsympathetic to bushland conservation are more likely to damage native plants through trampling, misidentification, or over-spraying. The contractor you select should have knowledge of the flora and an interest in bushland flora and fauna as well as an understanding of the chemicals used, the way they work and the weeds they control. They should be willing to use your preferred equipment such as backpacks, hand held sprayers, or wiping devices.

To get the most for your money and the best job done, it is important to have weed maps and a contract. The contract outlines the work to be done and ensures that if the job is not done satisfactorily you are in possession of a written agreement. Maps are multi-purpose, they allow you to show the contractor the location of the weed populations; walk around the bushland with the contractor and relate populations to those on the map. By supplying the contractor with the map before the job, they are more easily able to relocate each population. The contractor should be able to provide a GPS based map on where they have controlled.

## 8. Resources

### Weed Identification and Management references

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