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To preserve the technical information it contains, the department is republishing this document. Due to limitations in the CRC's production process, however, its content may not be accessible for all users. Please contact the department's Weed Management Unit if you require more assistance.

best practice management guide

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BEST PRACTICE MANAGEMENT GUIDE FOR ENVIRONMENTAL WEEDS

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General Guidelines

Woody Weed with children. *Photo: Kate Blood*

Bulbil Watsonia is spread by slashers. *Photo: Kate Blood*

Weeds can be spread in roadside gravel. *Photo: Kate Blood*

These guidelines will lead you through a practical common sense approach to the weeds in your area helping you to make the best decisions for your situation.

These guidelines must be adapted to your local situation based on your experience, local observations, information, and intuition.

What to do first?

Historically, the emphasis in most environmental weed management programs has been placed on the chemical or manual 'control' of weed infestations, often with little consideration of the long-term effectiveness of such an approach or of its ecological consequences.

To be effective and efficient, we need to be smarter in our approach and understand the identity and biology of the plant and the ecology of the vegetation in which it grows. It is no longer just a matter of going out and spraying something or pulling it out of the ground.

The step-by-step process outlined below will help to guide you through the 'maze' of environmental weed management. Environmental weed management makes up only one component, although a very important one, of managing any ecosystem. Environmental weeds must be treated as a symptom of a problem and not just the cause; the more fundamental problem is often habitat disturbance or invasion from neighbouring areas. This guide focuses on environmental weeds but other management issues need to be considered at the same time, such as fire, recreational use and pest animals.

Make a start by asking four important questions.

1. *What information do I need to collect?* Define the area you are working in and map it. Maps are very useful in working out where to start. You may want to overlay on an existing map, draw your own or base it on an aerial photograph. A hand-held Global Positioning System (GPS) can be a quick way of plotting points on the ground. This electronic information from the GPS can be downloaded into a computer mapping program. Consider using a computer-based Geographic Information System (GIS) which can be a useful way of reproducing maps quickly. Map public land boundaries, features (both natural and cultural/ historical built features such as buildings, roads, walking tracks and fencing, etc), drainage lines and waterways, access points from adjoining land, utilities/easements, underground and overhead power lines, high and low water mark along waterways, and adjacent land use.

   Mapping the environmental information is the next step. Collect and map (where appropriate) as much information as possible on these issues: environmental weeds, pest animals (potential carriers of weeds), fire history (fire is a disturbance that can either encourage or limit weeds), indigenous flora and fauna (especially significant species and communities that may be threatened by weeds), surrounding land/water use (may influence the weeds on your site and which weeds keep "raining" in) and other values or features that may be threatened by weeds.

   Put together a weed list and pass on weed location information to the Victorian Herbarium and local weeds officers so that your local information can be used by others to work out larger-scale weed attacks for your district.

   Put together information on your day-to-day operational budget and special funding or grants for projects. Include people-power and skills, tools and equipment. This financial and resources information will help you decide how much time and energy you can put into the job.

2. *Who are the players?* Identify who owns and manages the land/water if it is not you. Determine how much of the community is involved in the use, care and management of the area, and their level of awareness and understanding about the issues - they can be your best allies. Cooperate with adjacent land/water owners to maintain

environmental weeds on boundaries and reduce the risk of new infestations from outside the area and to prevent environmental weeds escaping to others. Seek advice from local people such as a local Weed, Pest Plant, Conservation or Catchment Officer, a Ranger, Landcare Coordinator, Land for Wildlife person, Landcare or Friends group member. Plenty of contacts are available in the *Weed Navigator*. (Also available from the Weeds CRC)

3. *What do you want to achieve?* This is probably the hardest question to answer. Establish your goals and objectives early in the process. These will help to determine why and how you are going to tackle the problem. Do you want to encourage local wildlife, restore the area to a pristine wilderness, keep it for the kids to play in, reduce fire risk or keep it as a place to shelter stock in hard times?

4. *What do I want to do?* It is essential to treat the problem before you can successfully treat the symptoms over the long term. Instead of just spraying the same weed each year, consider where it came from, why has it stayed so long, what can it be replaced with? Think about each weed and the place in which it grows. You must be able to adapt to the local situation like the weed. Look over the fence; look at the other issues such as pest animals. These aspects are all linked. Think strategically, use an integrated approach and link it with an ecological understanding of the weed and the place in which it is growing.

Let's get started

Consider the background information you have already collected including maps and lists. You need sufficient information to make the following decisions. Which environmental weeds have the highest priority? How invasive is the plant? What is the likely impact? How far is it going to spread, and how fast? Which are the high priority sites (eg, sites of biological significance) that need initial attention? You may want to rank blocks of the larger area based on their conservation values. Shall I tackle weed species one at a time or do I tackle all the weeds in a small area then tackle another small area?

Writing down your intentions not only helps to keep you on track, it can also allow others who take over the care of an area after you to follow on from your work. Plans are often useful as a way of demonstrating a strategic approach when seeking funding. Prepare a weed calendar as part of your plan. Record flowering and seeding times to help you plan the best times for identification, mapping and treatments. Seek help from others more experienced in weed management to refine your plan.

Developing management principles

- prevention and early intervention - preventing new invasions is invariably cheaper and more successful than eradicating established infestations.
- what will the wildlife use? - before removing weeds, consider the wildlife that may be using them for shelter or food. Establish natural habitat or provide some alternative shelter before removing the weeds.
- correct identification - ensure that you have correctly identified the weed before removing it.

Figure 1. Field guides assist identification. *Photo: K. Blood.*

- economies of scale and treatment - there is debate about the options of treating all weeds within a specific site or concentrating on treating priority weeds on all land/ water on which they are found. Both approaches have merit from the perspectives of conservation and cost-effectiveness.
- identify the cause(s) of the problem - the occurrence of environmental weeds is usually a symptom of another problem - look for the larger problem before putting effort into managing the weeds.
- is your management benefiting the ecosystem? Consider your management techniques in view of the ecosystem as a whole - you may actually be causing more harm (long- or short-term) than good. Are you actually achieving something to benefit the whole ecosystem or do you just feel better because you have done something visible?
- look beyond boundaries - most weeds don't distinguish fences and other boundaries. The weeds and plants that occur in bushland, cropping, pasture and garden areas are all linked. We can no longer treat them in isolation. Weeds were introduced into the bush from surrounding agricultural crops and pastures and gardens. Once in bushland, they are able to re-invade agricultural areas. It is a constant dynamic process backwards and forwards.
- start at the top? - many weed seeds and other plant parts move down into and along catchments through seed roll (gravity) and by being carried by water (down slopes and along watercourses). It is often better to start treatment at the top of the watercourse or catchment so that weeds higher up in the catchment don't keep re-infesting treated areas below.
- hygiene - unknowingly, we often contribute to the problem of spreading weeds. Cleaning weed seeds from tools, equipment, machinery, vehicles (especially tyres), pets, clothing and boots is fundamental to the success of a management program - build it in from the start.

Figure 2. Hygiene is important to prevent the spread of weeds. *Photo: K. Blood.*

- recurrent and diffuse expenditure may be ineffectual - adequate resources must be allocated to carry out and complete on-ground works. Focus on completing a limited number of tasks rather than attempt to spread the effort over numerous tasks indefinitely.
- minimise site disturbance - minimising site disturbance (particularly soil disturbance) will reduce (but not remove) the opportunities for weeds to establish and ultimately save money. Even if all visible weeds are removed from a site, it is likely that the weed seeds and other plant parts will continue to enter the site or exist in the soil waiting for the right opportunity, such as disturbance, to grow.
- monitoring and rehabilitation - monitoring and rehabilitation are integral to the success of a weed management program and should be considered in the design and funding of a program. All treatments should be monitored accurately and records kept for future review. Immediately after treating a site (which usually involves some form of disturbance), the site will be susceptible to re-invasion from the same weed(s) or others. If the ecosystem is unable to self-repair naturally, it may be important to fill the niche just created by the removal of the weed(s) by planting an indigenous species of local provenance or by using a temporary mulch.
- work from least-infested sites or areas - prevention of degradation is cheaper than eventual rehabilitation. Returning heavily invaded sites to their former glory is difficult and very expensive, if not impossible. Lightly infested areas have a better chance of success. It is, therefore, essential that the expansion of any weed population be contained. Where resources are limited, treatment efforts should generally be directed to the least affected areas or outlying populations or individuals. It is necessary to recognise that "natural" systems are dynamic, irreversible alterations may have occurred, and modified systems may have become established or are in the process of becoming so.
- bit by bit - It can be useful to break the area up into blocks - it allows you to divide what might appear to be a huge task beyond your ability into a number of small achievable tasks. Being able to work successfully on a small area and achieve success is much more rewarding than working on a big area without seeing much change. The boundaries could follow established roads or walking tracks, fence lines, vegetation boundaries, water courses, etc. This method is very successful for long narrow areas (eg, water courses, roadside vegetation or coastal strips). Groups or individuals can adopt-a-block and work simultaneously at achieving the same objectives for the whole strip. Put all the blocks together to work out long-term objectives.

Management strategies

ignore some areas - At times, you have to decide to deliberately leave some areas untreated because of a lack of resources or technology or having higher priorities elsewhere.

prevention - The best long-term approach. It is important to keep un-infested areas clear of weeds. Identify and address existing or potential sources of each weed before they invade natural ecosystems. Are there plants in local gardens? Is the plant still being sold in local garden centres or nurseries or promoted in magazines? Encouraging gardeners to use more appropriate garden plants and dispose of garden waste responsibly will reduce weed sources.

Once an infestation is established, preventing its spread into surrounding areas should be a priority. This may include the quarantining of an area to stop movement of seeds and other plant parts in mud on vehicles. Vectors (spreaders) of the seeds or plant parts must be addressed. This may include managing pest animals, restricting vehicle movement or educating site visitors.

Figure 3. Removal of an isolated infestation is easier and cheaper than tackling it when it gets larger. *Photo: K. Blood.*

community awareness and education - A very important and often under utilised management strategy.

enforcement - Enforcement of legislation obliges people to comply or face a penalty. Community education is usually more successful by encouraging people to follow laws voluntarily.

control - The aim of control is to reduce the impact of a species or a number of species in a particular area. Maintenance or restoration of ecosystem stability should be the main objective.

eradication - The aim of eradication is to eliminate a species or number of species from an area. Total eradication of large infestations of environmental weeds is exceedingly difficult, if not impossible, and it is expensive. It requires a commitment of time and resources over many years, dependent on factors such as soil seed life, and whether the plant can be prevented from being reintroduced to the site. Successful eradication is rare and generally only achieved in small manageable infestations such as in the early stages of invasion or with a species that is easily located and destroyed.

containment (weeds and vectors) - Containing a weed or number of weeds in an area may be an option where removing the plant from the infested area is damaging, impractical or beyond the resources and technology available. Ensuring the weed does not spread beyond the containment line can be difficult. Containment would involve concentrating on small outlying populations and individuals while attempting to restrain further expansion of the population by restricting the movement of vehicles, grazing animals and humans as well as inhibiting reproductive capacity (i.e., slashing or burning prior to seed maturation).

quarantine - The aim of quarantining a site is to abandon direct control effort for a species or suite of species within an area and introduce measures to ensure that weed seeds and plant parts do not escape into adjoining or nearby areas. Quarantining a site so that plant parts cannot be moved in or out is a difficult task to perform, particularly when birds, which may carry seed, can fly over barriers.

There are areas where weed invasion has been so rapid or prolonged that the invasion process is now complete and the remaining vegetation is predominantly alien and degraded. Frequently, inadequate resources continue to be squandered on such areas to no long-term effect. Such environments are rarely worthwhile from a conservation perspective (although they may form habitat for a limited number of indigenous organisms); limited human and financial resources may be more productively directed elsewhere.

Treatment options

- mechanical - techniques include the use of a slasher, chopper-roller, whipper-snipper, or mower, digging, grubbing, ripping and hand pulling. Unless the roots are damaged, most environmental weeds will survive such insults.
- chemical - herbicides can be applied in many different ways including foliar spray, wiper, injection, cut stump, drill-and-fill, frilling, basal bark, and bark strip-and-paint. When using chemicals, always read the label and follow all instructions carefully. Consult a specialist for advice on registered chemicals in your particular State or Territory. Herbicide information is available at *www.affa.gov.au/nra/pubcris.html* - the web site of the National Registration Authority. Herbicides have differing selectivities, with some such as glyphosate (e.g., 'Roundup') very effective on some grasses, whereas others (e.g., Triclopyr ('Garlon') and metsulfuron methyl (e.g., 'Brush-off')) are more effective on woody weeds and will leave grasses intact to provide competition against re-establishment of the weeds. Still other herbicides (such as 'Fusilade') are more effective against exotic annual grasses than native perennials.

Figure 4. Herbicides can be selective in what they kill. Dead bitou bush on the NSW coast. *Photo: K. Blood*.

- biocontrol - natural predators or diseases are used to reduce the vigour and/or reduce seed production, and include insects and fungal pathogens. They are not used to eradicate a weed but to reduce the population to a manageable level. Ask local and State weed agencies for information on what biocontrol agents may be available.
- fire - used to manipulate vegetation and weeds, usually trying to favour the indigenous vegetation over the environmental weeds. Fire can be used to germinate some weed seeds in the soil (both heat and the chemicals released in smoke stimulate germination), seedlings of which can then be treated with herbicide or other treatment options.
- heat - other possible heat sources, apart from bush fires, include flame throwers, solarisation, steam and microwaves.
- smothering - various mulches can be used to smother weedy vegetation, ranging from black plastic, carpet underlay, and weed mat, to organic materials such as chipped or shredded plant material.
- selective grazing - by some domesticated stock for short strategic periods may help to suppress some weedy introduced species and advantage desirable indigenous species in the short term.
- moisture manipulation - changing the hydrology of an area can favour some plants over others.
- nutrient manipulation - high nutrient levels often give weeds an advantage over indigenous vegetation. By removing a nutrient source (often associated with water), the balance can be tipped back in favour of the indigenous vegetation.
- scalping - involves removing the top layer of soil to a specified depth. With the soil go the weed seeds, roots, rhizomes, bulbs etc. Many indigenous seeds may also disappear. A radical method to be used with caution and usually only suitable for heavily degraded sites with little indigenous material remaining.

Integrated approach

To achieve the optimal result, it is usually best to combine a number of treatment options. The combination of treatments used will depend on the weed and its biology and ecology, and other factors such as location of the site. The aim is to tackle the different growing stages of the weed, take account of the longevity of seeds or other plant parts in the soil, and the requirements of different treatment options (eg, biological control agents usually require continued plant material to survive, at least in patches; fire needs fuel on which to burn).

Some common examples of integration are the use of fire or slashing to destroy large vigorous plants, followed by herbicide applications to control seedlings when they emerge in large numbers, with continued follow-up over time by hand removal of plants before they can re-seed. Generally, less and less time is needed in follow-up after the first 2 years. Another example is the use of selective herbicides and hard grazing during winter months to suppress exotic grasses, then removal of grazing in summer to allow native species to thrive.

Information on where to find treatment techniques for particular weeds can be found in subsequent numbers of this series and/or from sources listed in the *Weed Navigator*. Muyt (2001) is a good source of information on environmental weed treatment techniques - see references below.

Disposal

If the plant is being removed from gardens, dispose of waste using appropriate home composting techniques or dispose of it through local government kerbside collection or tip facilities. Ensure seeds and other plant parts that can re-sprout are not dropped in transit (as seeds are difficult to destroy, it is advisable to dispose of plants when they are not carrying seeds). Bag seeds. Cover trailers and ensure local tip facilities are following Australian standards for composting and transfer station or tip management best practice. Encourage gardeners to avoid dumping garden waste over back fences or in bushland areas.

Figure 5. Dumped garden waste is a common source of weeds. *Photo: K. Blood*.

In natural ecosystems, isolated non-seeding plants should be pulled out and left where found with roots up-turned. If removed weed material cannot be accommodated on the site (ie, mulched, dried on platforms, hung in trees, covered with plastic and solarised, etc), remove to tip facilities.

Action - do it!

Implement your plan of attack. Look for funding opportunities to help you along. Ask your local Weed, Pest Plant, Conservation or Catchment Officer, a Ranger, Landcare Coordinator, Landcare or Friends group member for advice. Plenty of contacts are available in the *Weed Navigator*. Look after yourself along the way and ensure that you are protecting yourself and co-workers from accidents, repetitive strain injuries, sunburn, allergies, poisonous snakes and insects and other potential threats. Investigate the insurance requirements of volunteer groups to make sure everyone is covered. Avoid burn-out by subdividing the large task into smaller achievable tasks, take a holiday regularly and rest when necessary. Keep group morale up by having lots of fun and socialising along the way. Visit other groups occasionally to share ideas and inspiration. Continue a media presence locally to keep the community informed and hence supporting your endeavours.

Spread the word not the weeds

Remember that we can do a lot by passing on information within our circles of influence. We all have a role to play in letting our families, friends, neighbours and community know about weeds. Chances are, many of us have them in our gardens and what we do in our own backyards can have a big influence on what happens in the bush nearby. Here are messages to pass on:

- replace invasive garden plants with non invasive plants, preferably locally indigenous
- select carefully from nurseries the plants you put in the garden
- dispose of garden refuse responsibly, don't dump it in the bush
- if using indigenous plants for revegetation, ensure they are grown from local seed and cuttings of local provenance
- clean shoes, socks, vehicle tyres, etc. before going bush, whether you are a walker or a worker
- check pets for weed seeds
- reduce disturbance such as driving vehicles off tracks
- watch for, and notify, land and water managers of new weeds and infestations

Many people would like to get involved but don't know where to start. Give them some hints and a helping hand to get them going. There is nothing more frustrating than finding out that you have just spent hours doing something that could have been done in half the time if you knew about a new piece of equipment or new technique. Share information on new weed information, methods and equipment. Avoid "reinventing the wheel", network, publish information, consider conducting field days and workshops. The email discussion group, *Enviroweeds*, is an excellent way of sharing information with a wide range of weed people in Australia and overseas. Contact owner-enviroweeds@adelaide.edu.au for more information.

Figure 6. Share information with others through workshops and training activities. *Photo: K. Blood*.

Consider running activities as part of national Weedbuster Week in October each year to increase local community awareness of the problem. See the web site at *www.weedbusterweek.info.au* for more information.

Not everyone is physically able to remove weeds from the bush. There are many roles for different people to play. Some people may have skills doing displays in shop windows, maintaining a 'weed of the week' vase at the local library or milk bar, giving talks to garden clubs or schools, writing letters to gardening magazines or programs that promote weeds, or doing a regular column in the local newspaper or on community radio. Make use of a wide range of skills within your community.

Keeping an eye on things

Often the biggest failing of weed programs is the lack of follow-up. Leaving a disturbed space after the removal of a weed often results in the same or another weed filling the space. It is important to assist natural regeneration or revegetate a treated area. It is also critical to monitor the site for reinvasion and treat them as they appear. Keep an eye on clean bushland too. Use photo points and keep records and maps of work done, successes and failures and future infestations.

It is best to seek the advice of local flora and revegetation experts for suitable indigenous plants of local provenance for revegetation.

Where weeds are found in the bush or natural areas they should be reported to those managing the area so that infestations can be treated where feasible. If you are uncertain about identification, send a specimen to the State or Territory Herbarium with details on where and when it was found and the contact details of the person who sent the specimen (see the *White Pages* or the *Weed Navigator* for address details of herbaria).

If a weed is being sold in an area where it is prohibited from sale, the garden centre or nursery and local weed management authority should be informed. Let garden centre staff know how weedy it is and the damage it is doing locally. Offer to take them to an invaded or threatened area and encourage them to provide safer alternatives.

Review

Both the passage of time and the gaining of new knowledge will influence how you approach weeds. Learn from success and failure to help review ongoing and new programs incorporate new information and technology when appropriate.

Making a commitment

Environmental weed management is still a developing discipline and much more information is needed to understand individual weeds and their relationships with the areas in which they grow. Of fundamental importance is the need to be integrated and strategic in your management approach and include ecological considerations. Each site and weed needs to be addressed individually and priorities determined depending on the situation and your ultimate objective. Remember to treat the cause, not just the symptom.

If you are really serious about managing the weeds in your area, you have to make a long-term commitment. The problem will not disappear over night, but with careful management it will get easier over a few years.

Further reading

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Buchanan, R.A. (1989) *Bush Regeneration. Recovering Australian Landscapes.* TAFE NSW, Sydney.

Muyt, A. (2001) *Bush Invaders of South-east Australia*. RG and FJ Richardson, Meredith, Vic.

White, M. (1994) *Draft guidelines for environmental weed management*. Department of Conservation & Natural Resources, Vic.

There are a number of management guides on different weeds being published by the Weeds CRC (see contact details below). Other CRC weed publications include the *Weed Navigator,* workshop proceedings, field and management guides, brochures and posters.

Further contacts: Many people interested in environmental weeds communicate regularly through the *Enviroweeds* email discussion group established in Australia. If you would like to join this group free of charge, send an email message to owner-enviroweeds@adelaide.edu.au

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