

Looking for weeds: name and notify guide

A guide for identifying weeds at the early stage of
invasion on public land in Victoria



2nd Edition

Photo credit

Cover photo: Photographing invasive Asparagus Fern (*Asparagus scandens*) and Sweet Pittosporum (*Pittosporum undulatum*) beyond its natural range at Wye River, September 2013 (Photo by Kate Blood).

Other publications in this series:

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White, M., Cheal, D., Carr, G. W., Adair, R., Blood, K. and Meagher, D. (2018). Advisory list of environmental weeds in Victoria. Arthur Rylah Institute for Environmental Research Technical Report Series No. 287. Department of Environment, Land, Water and Planning, Heidelberg, Victoria. ISBN 978-1-76077-001-3 (pdf/online).

Panetta, F. D. (2016) Environmental weed risk screen for Victoria: background and development. A report prepared for the Department of Environment, Land, Water and Planning, Vic. ISBN 978-1-76047-017-3 (Print); ISBN 978-1-76047-018-0 (pdf/online).

Victorian environmental weed risk database (2018), search online for 'early invader weeds'.

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About this guide

As we travel around our local patch, we become familiar with the common weeds. Occasionally, something new or unfamiliar catches our eye. This guide has been designed to assist in finding out what an unfamiliar plant is. It may be a weed at the early stage of invasion in your area.

Invasive species management is an integral component of any landscape or reserve scale conservation program. This includes weed management.

Increasingly around the world, the benefits of preventing and ‘nipping new weeds in the bud’ before they become widespread are being appreciated.

About WESI

The Weeds at the Early Stage of Invasion (WESI) Project was created to promote these benefits and enable Department of Environment, Land, Water and Planning (DELWP) and Parks Victoria public land managers adopt this approach.

The WESI project focuses on high risk invasive species at the early stage of invasion that threaten biodiversity. We work with DELWP and Parks Victoria staff looking after public land anywhere in Victoria.

WESI is funded through the Weeds and Pests on Public Land Program. Project information and tools are available at: www.environment.vic.gov.au/invasive-plants-and-animals/early-invaders

Working within a framework

The WESI project has developed a decision making framework that guides public land managers through the process of dealing with invasive plants at the early stage of invasion (see Figure 1). This guide describes in detail a component of the larger framework.

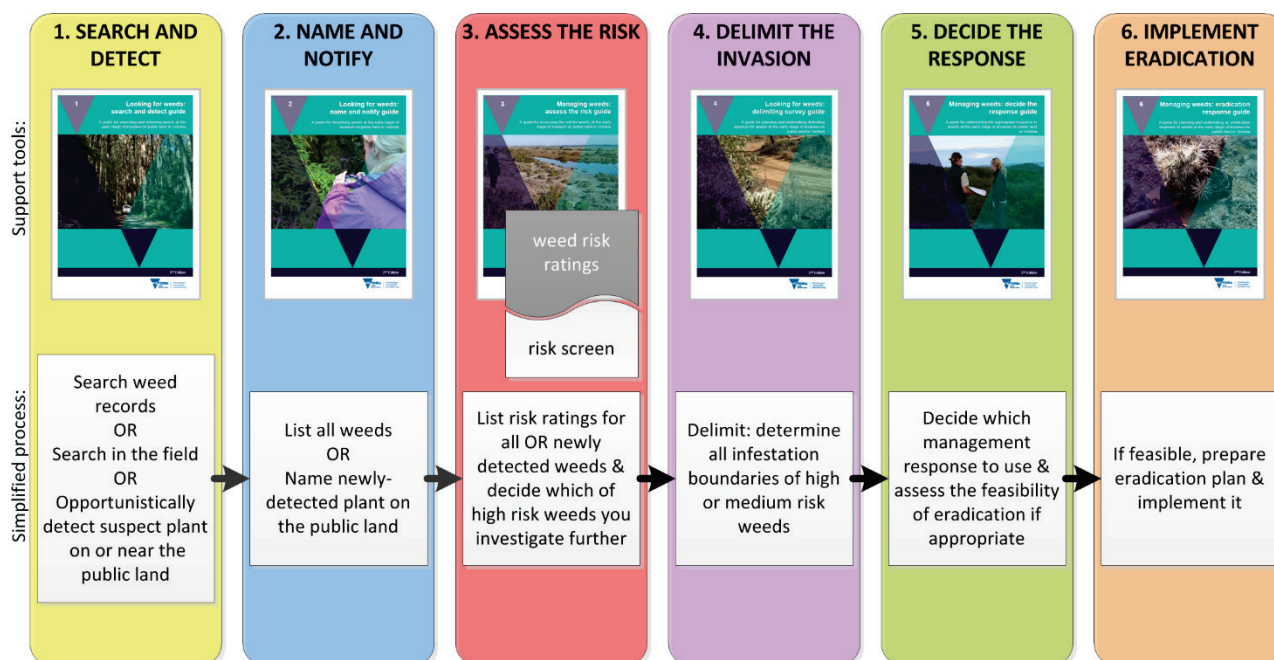


Figure 1 - This is the WESI decision making framework that guides the process for dealing with weeds at the early stage of invasion. There is an enlargement of the framework with scenarios in Appendix 1.

The guide series

Through research and trialling different approaches in the field, there is a growing amount of information about prevention and early intervention for weeds.

This document draws on that research and experience to offer a guide for public land managers, whether they do the work in the field, design the work or authorise the delivery of the work.

By using all the guides in this series, public land managers can improve their decision making about what are the highest risk weeds, how to search for and identify them, determine where the infestation boundaries are, work out which management approach is best and where feasible, respond with local eradication.

The early invader guide series is one of a number of tools available through the WESI project. The series provides step-by-step guides to plan and undertake the following work:

- Search and detect
- Name and notify
- Assess the risk
- Delimit the invasion (comprising all infestations present)
- Decide the response
- Implement eradication (if appropriate)

A summary of the guide series is available with all the blank templates in “Early invader manual: managing early invader environmental weeds in Victoria” (Blood *et al.* 2019). The tools are available at: www.environment.vic.gov.au/invasive-plants-and-animals/early-invaders

Weed management including eradication

Weed activities fall into four broad categories: prevention, eradication, containment and asset-based protection. By better understanding these different management approaches, public land managers can make better decisions, invest resources more wisely, and have better biodiversity outcomes.

Eradication is the elimination of every single individual (including propagules e.g. seeds and buds) of a species from a defined area in which recolonisation is unlikely to occur (Panetta 2016).

There is no denying that eradication is hard to achieve, can take a long time and should only be undertaken for candidates that have a good probability of success. Using these guides will help you make better decisions.

Weed management should not simply be dismissed as ‘too hard’, but, through some careful planning and a continued and sustained response, can achieve great benefits for biodiversity.

What is ‘in the early stage of invasion’?

There is ongoing debate about what area and number of infestations could be classified as eradicable. In reality, the answer depends on the weed and the situation because of the wide variation in the biology and ecology of weeds and the many different environments in which they grow. As a consequence, the relationship between the infestation area and the effort needed to achieve eradication will also vary (Panetta and Timmins 2004).

Through this guide series, we refer to ‘weeds at or in the early stage of invasion’. The shortened term is ‘early invaders’.

Early invaders are plants that have naturalised and have started to spread. Naturalised plants are non-indigenous species that sustain self-replacing populations for several life cycles without direct intervention by people, or despite human intervention. When spread has just begun, such plants are not at all widespread and are generally encountered only by chance, unless specifically targeted by search efforts. Co-ordinated management intervention, i.e. eradication or containment,

is at its most feasible for plants at this stage of invasion, owing to their highly restricted distributions (Panetta 2016).

The aim of this guide

The aim of this guide is assist users with the process of identifying weeds at the early stage of invasion, such as the plant in Figure 2. This guide supports the 'Name and notify' step in the framework shown in Figure 1. Use Figure 3 to help you navigate your way around this guide and the others in the series.



Figure 2 - Stopping to look at a plant that is not familiar to you may turn out to be a weed at the early stage of invasion in your area. This is a *Sparaxis* species, a member of the Iris family Iridaceae, that is becoming invasive in some parts of Victoria. Image by Kate Blood, DELWP.

Before you start

These guides are full of different 'tools' and hints to help you through the weed management process. You may want to start at the beginning and work your way through step-by-step or browse for ideas in your topic of interest. Managing public land involves balancing many requirements of which weeds are only one. Decisions about which weeds to manage must be made in this broader context.

These guides lead you through the process to eradication of early invaders, but generally eradication will not be the aim for most weeds. It is essential to be aware of the guides' limitations, as well as the ongoing need for their modification in light of experience, intuition and local knowledge. Effective environmental weed management comes through long-term observations, learned skills and being able to make decisions based on the local conditions. These guides are to help, not substitute for, these important skills (Blood *et al.* 1996).

What is this weed?

So you think you may have found a weed at the early stage of invasion in your patch. Here is the process to follow to work out what it is and what to do next.

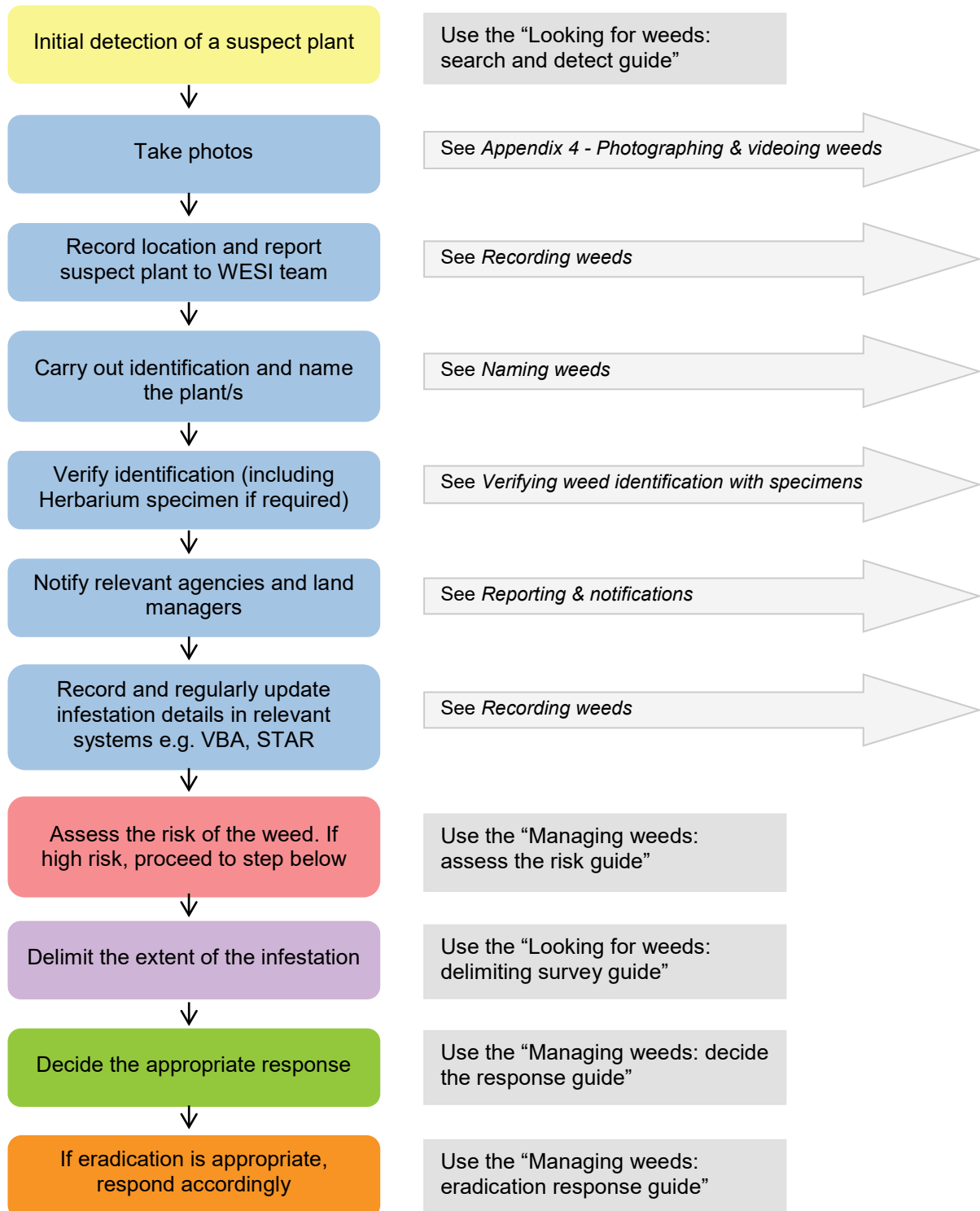


Figure 3 - How to use this guide.

Recording weeds

“Spot, stop and take a shot”.

Once a weed is located, it is important to accurately and promptly record its details. It is particularly important when dealing with plants at the early stage of invasion, as it allows the source, extent and spread of infestations across a landscape to be determined.

If at first the identity of the plant is unknown, it is important to record the location and date as a minimum so the location can be found again. Taking a number of photographs can assist with both identification and relocating the plant. The sooner information is entered into a digital format the better. Enter it once when you find the plant so information processing is not delayed.

Information to collect

WESI has minimum data standards built into this guide series and the minimum recording requirements for weed infestations are included in Appendix 2. A field collecting template is provided in Appendix 3. Spatial and visual information is covered in the following sections.

Images and video footage

Photos and videos are very useful to assist with weed identification and for recording points in time that can be looked at in sequence to see change, for example during monitoring. It is easy to take poor photos and not much harder to take good ones that are a lot more useful. There is a guide on taking photographs and video footage in Appendix 4. This includes geotagging digital images.

What to record where

Weeds at the early stage of invasion are recorded in the Victorian Biodiversity Atlas (VBA). The VBA is where location and related information should be lodged.

As you move towards treatment of individual sites, the Spatial, Temporal, Activity Recorder (STAR) is the place to record treatment activity and follow-up monitoring.

It is also important that previous weed records kept in notebooks or filing cabinets be digitised into Departmental (DELWP and Parks Victoria) databases in order for them to become accessible to others and more useful to you.

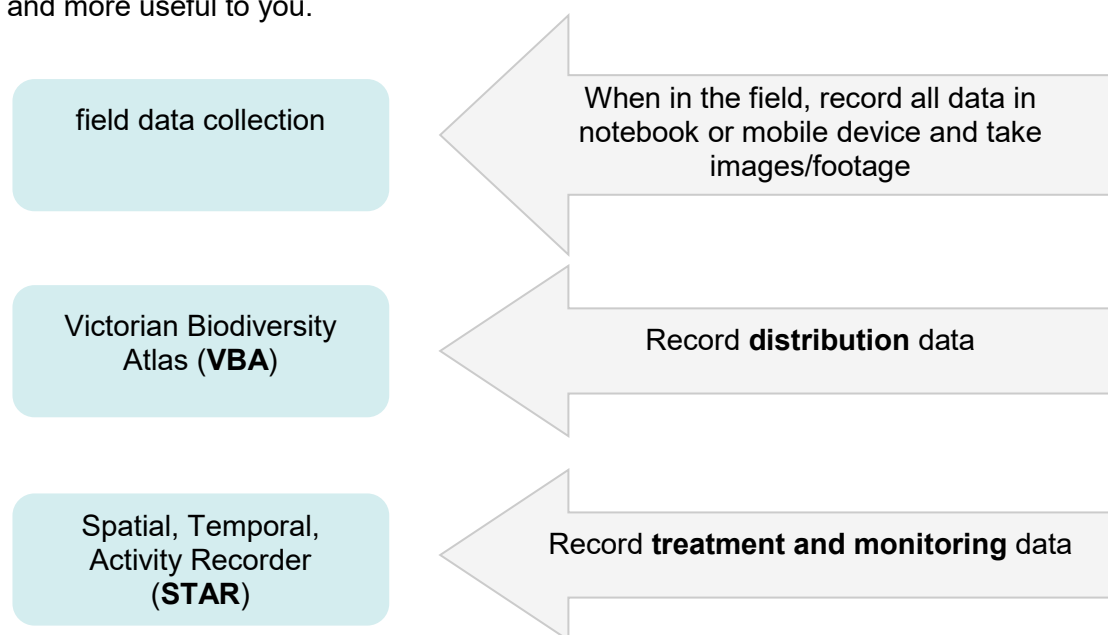


Figure 4 - Where to record data.

Victorian Biodiversity Atlas (VBA)

The [VBA](#) is DELWP's web-based information system that stores information on the distribution and abundance of indigenous and naturalised species in Victoria. It includes all plants, animals and fungi known from Victoria (but not farm animals and exotic garden plants that are not invasive).

Distribution data can be created for sites as points, polygons or lines. You can also do your area searches using polygons, buffered points/lines (hand drawn, pre-defined or using a shapefile).

The VBA is not an identification service. All contributors are expected to be competent in identifying the species they submit information about.

The VBA can be accessed via your web browser and you need to be registered to login. Further information can be obtained by emailing vba.help@delwp.vic.gov.au

<https://vba.dse.vic.gov.au/vba/#/>

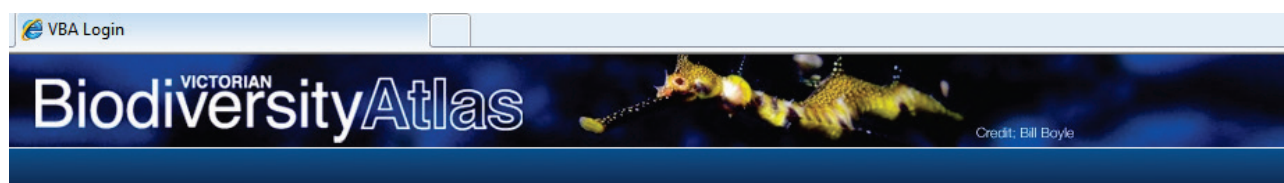


Figure 5 - Victorian Biodiversity Atlas.

Spatial, Temporal, Activity Recorder (STAR)

STAR is web-based and accessible to all DELWP staff (and staff from other agencies or organisations where required). It provides information to support operations, enable decision making, and help improved accountability and reporting to Government. It supports different aspects of environmental management in a dynamic and interactive way. It covers assessment, treatment and engagement, using polygons for geographic data.

STAR is the place to record management activities related to early invader cases. As the various optional early invader templates are completed, they can be attached to projects in STAR so you and future land managers can follow the history of cases and why decisions were made.

Weed names used by STAR are consistent with the VBA, and weed distribution records entered into STAR will be copied to the VBA once verified.

Mapping

There are a number of different reasons for mapping plants, including weeds. Weeds are mapped during the identification and reporting process, when delimiting an infestation (i.e. determining its boundaries), during treatment activities and when monitoring the success of treatment works. More detail on the mapping for these different purposes are included in the accompanying guides in this series. Consistent mapping standards are used through all these processes.

When creating a map with the points, polygons or lines you have collected, it is important to be aware that there are certain standards that need to be followed. DELWP has produced a "Map style guide" (available on DELWP's intranet – search for 'GIS Help Desk' on Ada/intranet) that has been developed to provide guidelines and tools to assist staff in creating well designed map products which meet map accessibility standards.

Other useful mapping guides include "A field manual for surveying and mapping nationally significant weeds" (McNaught *et al.* 2008) and the "Tasmanian weed mapping guidelines" (Welsh 2000).

Spatial information

Where possible polygon, point or line information should be collected using a Global Positioning System (GPS), since this will ensure the most accurate recording of the location of infestations, points of interest etc.

The Geographic Information System (GIS) Help desk on the DELWP intranet provides a wealth of information on GIS software, spatial information and 'how to' guides. A number of useful guides on the use of a GPS are listed below (available to DELWP's intranet users. In Ada, go to > maps > tools and templates):

If you are new to using a GPS there is document titled "Guide to users" which provides a good introduction to GPS.

For standards, specifications and best practice field guide for a GPS refer to the "Global positioning system handbook".

For techniques in collecting data using a GPS refer to "Using a GPS for spatial data collection".



Figure 6 - Record geographic information with a GPS or other device in the field. Image by Kate Blood, DELWP.

List of weeds on public land

If you are working out the highest priority early invaders on or outside the public land (scenarios A and C in the decision making framework), it can help to have a weed list for the public land. Ideally, you should have a complete plant list including indigenous flora and weeds.

If you do not have a list to start with, you can copy the "Advisory list of environmental weeds in Victoria" or the "Victorian environmental weed risk database" (see "Managing weeds: assess the risk guide" for more information) and remove the weeds not relevant to your public land and add weeds as they are identified. There are a number of data sources of existing records to build your weed list (see Appendix 5).

Weeds around public land

If you are working out the weeds around your public land that have not yet been recorded, try these techniques:

- Look at distribution data sources (as above).
- If you have spatial mapping skills, draw a buffer around the public land boundary. Generally, larger buffers are suitable for large areas of uniform vegetation, and smaller buffers for small blocks of variable vegetation. Then interrogate the spatial layers to determine species records for the area within the buffer strip.

Don't forget to consider the islands of private land within larger areas of public land.

Naming weeds

The differences may be subtle but it is important to clarify the differences between weed 'recognition' and weed 'identification'.

Weed recognition

Recognition is the ability to be able to instantly recognise a plant, whether it is a weed or indigenous, possibly even be able to name it. It is the ability to know that a plant fits within the context in which you are viewing it. You may not be able to recall its full botanic name, even its common name, but you know that you have seen it before.

Over time, we build up an image library in our heads of the plants we have learnt to recognise. There are some that we remember from our Grandparent's or parent's garden that we now see invading in the local park. Some we have learnt through our work with the help of other staff, local volunteers and through training courses.

As we look at information sources on weeds, we see pictures of high risk weeds but have never seen them in the field. Even watching gardening programs on television or looking through gardening books and magazines helps to build up an image library in our heads.

Getting the 'GIST' of a weed

As we become more familiar with a weed, we form a picture in our head of its general impression of size and texture – its 'GIST'. As we travel through the areas we are responsible for, we scan the vegetation. It is possible to scan vegetation at 100 km/hour from a moving vehicle if the plants fit our familiar GIST. It is when something that we are not familiar with is spotted that we need to stop and have a closer look.

To be an effective land manager, it is important to become familiar with the plants, both indigenous and introduced to your area. Even if you cannot name them all, know which ones belong and which ones are introduced. As your skills of recognition improve, you will be able to determine more of the plants.

Weed identification

Accurate identification of an unknown plant is an important step to determining whether a plant is in its early stage of invasion. Identification is the process of naming a plant, if not instantly from your knowledge, then through a more structured process, either by using a botanical key or other reference in a book or electronic source e.g. through the internet or mobile application (app).

Until a plant identification has been verified through the collection and submission of a specimen (see recording template in Appendix 6) to the [National Herbarium of Victoria](#) (Herbarium), a proposed or preliminary name can only be called a 'provisional' identification.

Plants can be difficult to identify with certainty and misidentification is common. Take time to do it well and seek advice from others. There may be look-alikes that are easily confused. Always double check identifications you have assumed in the field.

There are many information sources to assist with the correct naming of plants, either in the field or once back in the office. If further assistance is needed, there are staff in DELWP and Parks Victoria that can offer help. Contact the WESI team for information. How do you like to work out what a plant is?

Look at pictures and read descriptions:

- See a range of information sources in Appendix 5.

Work through a botanical key:

- There are many botanical keys in books including the [Flora of Victoria](#) series. These are now updated and available online at VICFLORA: <https://vicflora.rbq.vic.gov.au/>

- VICFLORA – will allow users to select an area and create a flora list and botanical key for that area: <https://vicflora.rbq.vic.gov.au/>
- It helps to have a pictorial glossary on hand to understand what the [botanical terms](#) mean including one available at VicFlora: <https://vicflora.rbq.vic.gov.au/>
- Other botanical keys are available on the internet e.g. [Lucid](#) is an easy-to-use key.

Get help from others:

- Send pictures you have taken to others via email or post on social media requesting assistance – the WESI team can assist.
- Show people e.g. colleagues or field naturalist, pictures that you have taken on your camera or mobile device.
- Take people to the site where the plant grows (see hygiene notes in Appendix 7).

Apart from public land managers making an identification themselves, it is encouraged that they seek assistance from local and experienced people in plant identification, or other botanical experts across DELWP, Parks Victoria, Melbourne Water etc. to double check the identity of the plant.

Verifying weed identification with specimens

For authoritative identifications, specimens can be collected with the guidance of the WESI project team and submitted to the National Herbarium of Victoria. Seek advice before collecting specimens. See Appendix 8 for more information. For more information on wellbeing, safety and hygiene when handling or collecting weeds for identification see Appendix 7.

Verifying the identification of a plant can be done by a person with a high level of skill and knowledge in plant identification, such as a botanist at the Herbarium. They verify that your identification is correct or make a correct identification if otherwise. Botanists usually refer to this formal process as ‘determination’ (Spencer *et al.* 2007).

Is it a ‘new’ weed?

Once you have verified the name of the weed, you can work out whether it is new to your patch (an early invader), if it is new to Victoria and if it is declared under legislation in Victoria. There may be a legal requirement to do something about it. The WESI team can assist with finding information on these.

Is it new to my patch?

Check reserve, park or forest flora lists to see if the species has already been recorded. Local flora lists are available in the Victorian Biodiversity Atlas (VBA). If you have local survey information that has not been included in the VBA, contact the VBA or your local biodiversity officer for advice. Updating the VBA now with your local reserve records will help you make better decisions about weeds at the early stage of invasion.

Is it new to Victoria?

All the recorded weeds in Victoria are listed at VICFLORA <https://vicflora.rbq.vic.gov.au/> maintained by the National Herbarium of Victoria (see Appendix 5). If the weed does not occur on VicFlora and is not recorded as present in the State in the VBA, then WESI will make enquiries with the Herbarium, VBA and inform biosecurity staff at Agriculture Victoria at Department of Economic Development, Jobs, Transport and Resources (DEDJTR) (to be replaced by Department of Jobs, Precincts and Regions (DJPR) on 1 January 2019) (see notifications section in this guide).

What is its legal status?

To check to see if the weed is declared in Victoria under the *Catchment and Land Protection Act 1994*, go to the Agriculture Victoria website and search for ‘[invasive plant classification](#)’. You will be able to see the list of weeds declared in the different categories in Victoria.

Correct weed names

WESI follows the naming conventions of the [National Herbarium of Victoria](#) which in turn are used by the Victorian Biodiversity Atlas (VBA) and the Spatial, Temporal, Activity Recorder (STAR). WESI follows the botanic names listed in VICFLORA <https://vicflora.rbq.vic.gov.au/> (see Appendix 5 for more information).



Figure 7 - Blue Periwinkle (*Vinca major*) is relatively easy to identify when it is flowering as there are not many confusing look-alikes. Although widespread in the State, it is still moving into new areas. Image by Kate Blood, DELWP.

Writing weed names

When writing weed and plant names, WESI follows the standards of the National Herbarium of Victoria. Some basic tips on writing weed and plant names are included below and more detailed tips in Appendix 9. "Plant names. A guide to botanical nomenclature" (Spencer *et al.* 2007) provides lots of further detail on understanding plant names:

Common names

It is recommended that common names are spelt with capital letters (but conventions differ within and between agencies), for example:

White Spanish Broom

Berry-flower Heath

Many weeds have more than one common name. This can be very confusing when searching for information in books or on the internet. The same common name can be used for different weeds. It is always better to use botanical names whenever possible.

Botanical names

The two words that make up the species name (genus and specific epithet) are written in italics, and a species can sometimes be broken into smaller categories: subspecies, variety or form, or cultivar, for example:

Ferraria crispa

Erica discolor subsp. *andreseanthus*; or *Erica discolor* ssp. *andreseanthus*

Fallopia japonica var. *compacta*

Zantedeschia aethiopica 'Green Goddess'

The genus, e.g. *Ferraria* above, is spelt with a capital for its first letter; the specific epithet (sometimes simply called 'species') e.g. *crispa* above, is with lower case. See Appendix 9 for more tips on writing weed and plant names.

Learning the names of weeds

When you are starting out in the area of weeds, learning names can be overwhelming – there are so many to learn. Don't be daunted, you just have to start and keep going. Repetition, practice and persistence are key. Here are some ideas:

- Start with the ones you are familiar with, build your confidence and work from there.
- Regularly flick through weed and gardening books, newsletters, magazines, nursery catalogues and mobile phone applications and look at the images and read the names.
- Put a weed poster in the tearoom or toilet.
- Look through website image galleries and watch [YouTube](#) videos on weeds, or put weed images on your computer screen-saver or on an electronic Digi-frame or tablet to scroll through repeatedly.
- Create a scrap book or folders of articles and images (hard copy and/or electronic) or an electronic pin board e.g. on [Pinterest](#).
- Be disciplined about labelling or tagging digital photographs you take with the botanical and common name.
- Collect a small specimen library (personal herbarium) of pressed specimens – a safer (see notes on hygiene in this guide) and easier-to-maintain alternative is scanned or photographed specimens kept in a folder to flick through.
- Go out into the field with other staff, volunteers or botanists, and visit nurseries and botanic gardens where plants are labelled.
- Make a point of learning both the common names and scientific (botanical) name.
- Use word, rhymes or other associations to help you remember the names e.g. *Arundo donax* sounds like *Arundo* 'gonads', *Nassella* has two 's' and two 'l', and rehearse and repeat the name in your head.
- Compare confusing look-alikes to work out the finer details of telling them apart and commit to memory or keep a cheat-sheet on your mobile device.
- A weed a week. Each week, try to learn a new weed. Have a document-stand on your desk and each week flip to another page in a field guide and leave it open – practise writing the name or doodle-draw features of the plant, summarise the main points about the weed.

Reporting and notifications

Once information is captured and recorded, the relevant information needs to be shared and passed on to others who may need to act further on it. Follow this guide:

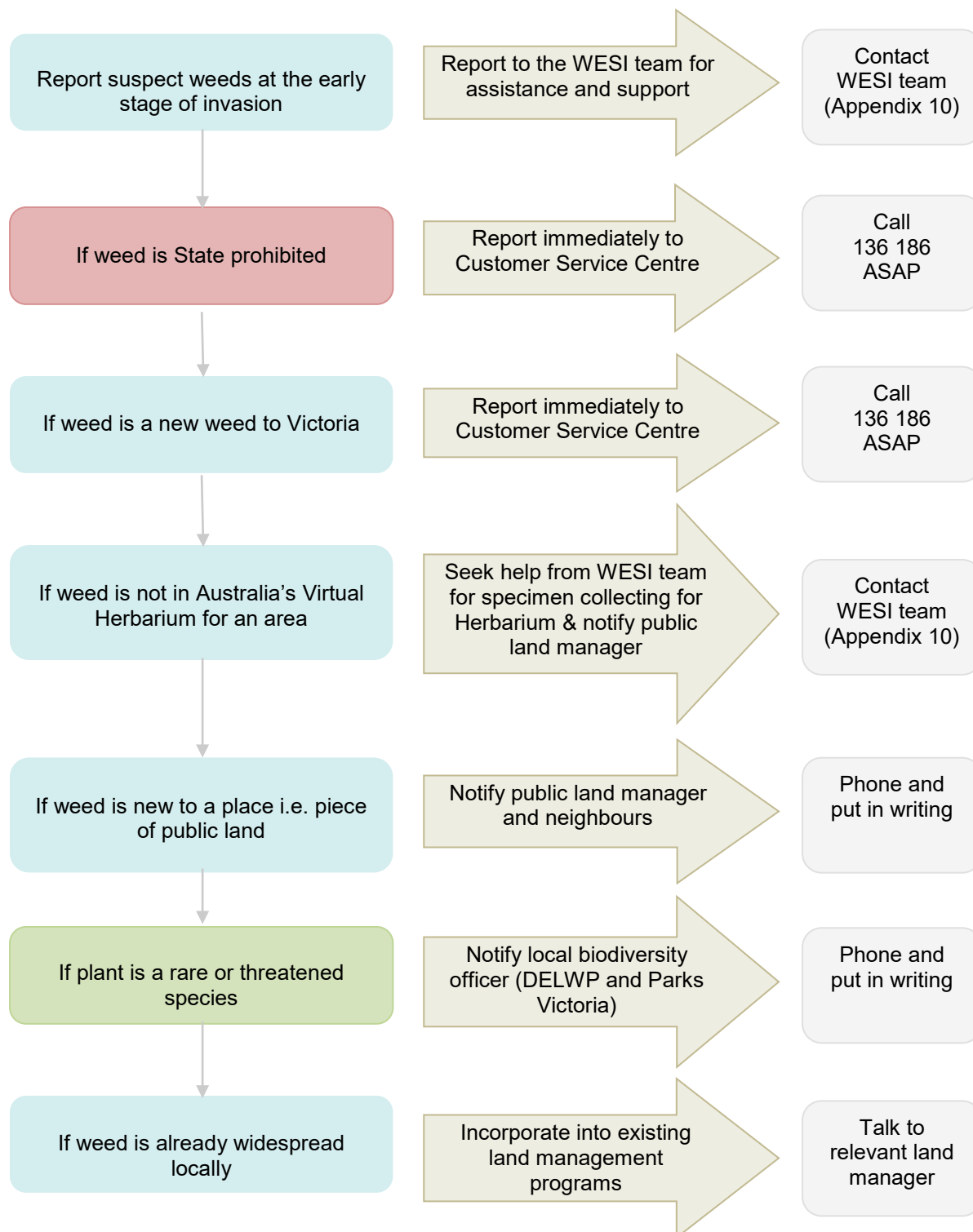


Figure 8 - Who to notify about early invaders.

What next?

Where are you up to?

At this stage you would be confident in the identification of the suspect plant(s), notified relevant agencies and land managers (where appropriate) and recorded the infestation in a relevant system.

Planning what to do next

The next step is to assess the risk of suspect plant(s). Use the following guides with the help of the WESI team:

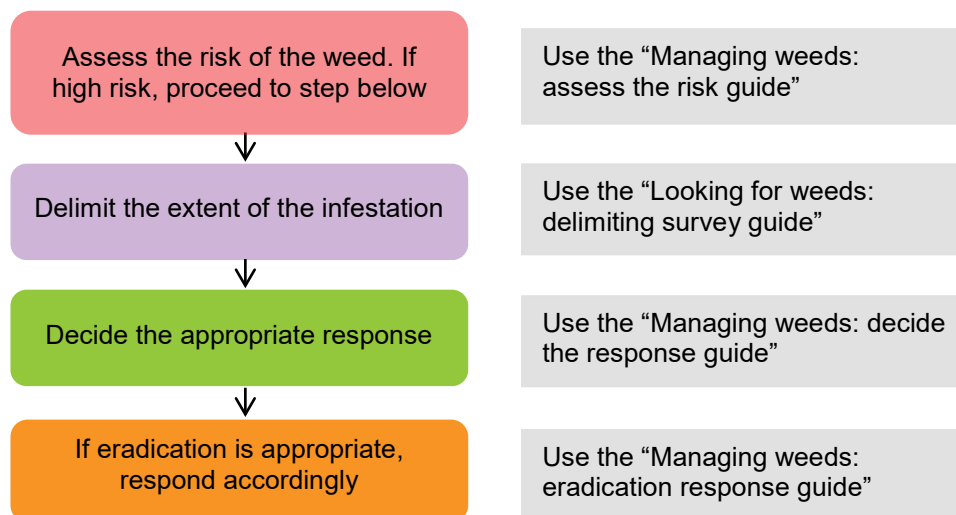


Figure 9 - Planning what to do next.

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Victorian Government (2010) Invasive plants and animals policy framework. Department of Primary Industries, Melbourne. ISBN 978-1-74217-878-3 (print); ISBN 978-1-74217-884-4 (online).

Welsh, S. (2000) Tasmanian weed mapping guidelines (3rd edn). Tasmanian Weed Mapping Network, Kings Meadow, Tas. ISBN 0 72466 240 5.

Further reading

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Appendix 1 - Decision Making Framework (with scenarios)

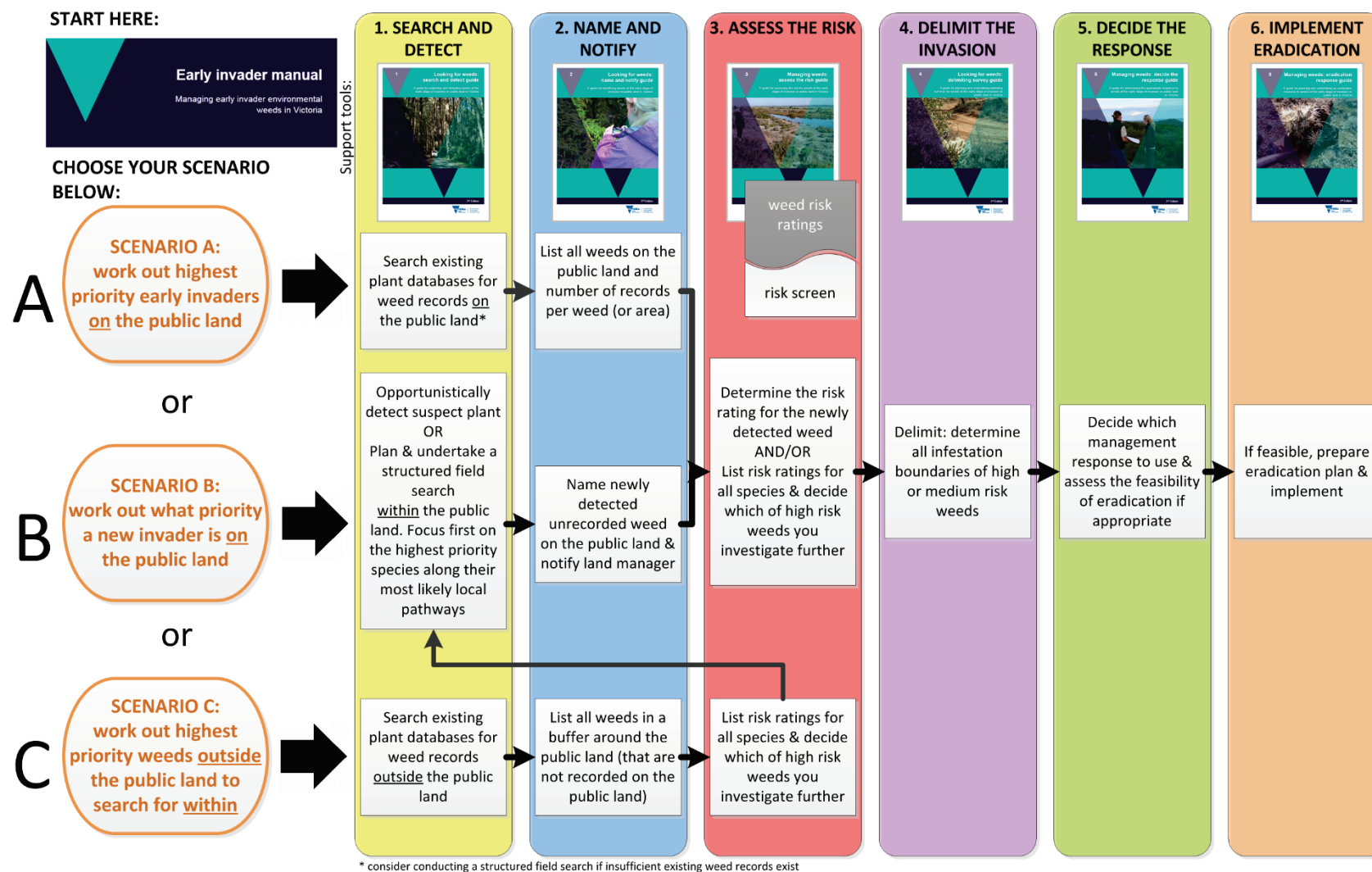


Figure 10 - This is the WESI decision making framework that guides the process for dealing with weeds at the early stage of invasion. This version illustrates three typical scenarios faced by public land managers.

Appendix 2 - Minimum recording requirements for weed infestations

A minimum requirement for recording weed infestations includes:

- name of the recorder;
- start date of recording (indicates when the survey commenced);
- site name;
- location description (provides a detailed description of the location and how to get there);
- species' common and scientific names;
- information on when identification was made for a particular weed infestation and the person who made the identification;
- specimen identification number or tentative identification, to be confirmed later [optional];
- confirmation of whether a GPS was used to collect data;
- type of coordinate system (indicates the type of coordinate system used to derive the data);
- datum (e.g. Geocentric Datum of Australia GDA94 or Map Grid of Australia (MGA));
- MGA zone (e.g. zone 55 or 54);
- geographic coordinates of the location of the plant;
- easting and northing or longitude and latitude;
- positional accuracy (m) (indicates how accurate the site was on the ground);
- survey method (e.g. quadrat);
- survey method detail (length, width, area covered); and
- initial estimate of area of infestation (ha) or number of individuals.

The collected information should be:

- entered directly into the Victorian Biodiversity Atlas (VBA) via the VBAGo app or using the VBA data recording template;
- can be emailed to the WESI project team; and
- passed onto local land managers as appropriate.

If new information is collected about the infestation(s), the updated information should be updated in the VBA and can be passed on to the WESI project team.

Use the field collecting sheet in this guide if a digital field data capture option is not available.

Appendix 3 - Field recording template – multiple records

If you don't have digital field data capture, use this optional sheet for recording multiple species or multiple sites of the same species on public land during structured field searches.

Recorder details		Name: Name of people assisting:					Inspection date:		
Site details (site = the property/parcel boundary within which the weed propagules are located)		Location					GPS accuracy (m):		
		Site address/name:					Datum <input type="checkbox"/> GDA 94 <input type="checkbox"/> WGS84		
		Location description:					MGA Zone <input type="checkbox"/> Zone 54 <input type="checkbox"/> Zone 55		
		Land tenure (e.g. State Forest, National Park):					Survey method: <input type="checkbox"/> Searching <input type="checkbox"/> Delimiting survey <input type="checkbox"/> Ad hoc (opportunistic detection)		
GPS ref #	Species	Pattern of infestation Individual, Scattered, Continuous For point data	Density % cover <1%, 1-5% 6-25%, 26-50% 51-75%, 76-100% For line & polygon data	Area of infestation For point data	Count	Age class (e.g. seedling, juvenile, sapling, mature)	Eastings	Northings	Comments (e.g. roadside, gully)
e.g. 1	<i>Cenchrus ciliaris</i>	<i>Scattered</i>	6-25%	5x5m	20	seedling	548011	6207117	2 m from road edge on north side

Appendix 4 - Photographing and videoing weeds

Being able to photograph or video plants (including weeds) is a useful skill, especially if you can do it well. It allows you to record the plants in the area you manage, can be shared with others to seek help with identification, and can be used to help teach others about your patch.

There are advantages and disadvantages with both still photos (single static images) and video clips (moving images). An advantage of video over still photos is that the plant can be walked around to give a more three-dimensional-like perspective of the plant. Still images can be published in printed material. Both can be used on electronic media, viewed on the internet and be attached to emails. Video clips may take up more storage and require more skill to edit and manipulate.

Images and video clips can be useful in hard copy or electronically for:

- identification purposes;
- accompany specimens to the Herbarium;
- training and presentations;
- awareness raising;
- publications including brochures and information sheets;
- displays and signs;
- social media; and
- video clips on agency internal and external website.

Equipment options

With the recent development in digital technology, digital photography and filming is more accessible than ever. The devices and images referred to here will be assumed to be digital (electronic-based) rather than analogue (film-based).

There are a number of devices that can be used in different ways to capture images of weeds:

- Smart phones – stills and video – are readily accessible and are carried by staff most of the time. Digital image and video quality is improving all the time with phone development. Poor quality images may limit reproduction quality in printed publications or viewing on larger screen resolutions.
- Digital cameras – single lens reflex (SLR) cameras can give higher quality images and can give more flexibility with interchangeable lenses (see notes on lenses below). Smaller digital cameras can be easier and lighter to carry in the field but may not give as good a quality image for publication.
- Digital video cameras – smaller video cameras e.g. Handycam, Camcorders, GoPro make use in the field more feasible and convenient. They can produce higher quality footage for editing for various purposes, including training videos and agency external web site viewing. More skill and software is required to edit raw footage to create quality video clips.
- Digital microscopes – Universal Serial Bus (USB) microscopes plug directly into a computer USB and can be viewed on the computer screen or projected through a data projector or large screen television for an audience. This is useful for plant identification training and taking screen shots.
- Digital document camera attached to a data projector – allows plants to be projected onto a larger screen and looked at by an audience. This is useful for plant identification training.

- Webcam (including cameras in mobile devices) – a plant can be viewed in real-time through a camera attached to an internet feed such as Skype or FaceTime e.g. FaceTime on an iPhone. This allows the plant to be viewed by another person at another location with access to the same software through a live feed. This can be useful when seeking advice from a remote person for identification.
- Digital camera (remote or trail camera) at fixed field points – these could be established in the field to monitor remote location infestations in a similar way to their use for monitoring wildlife and invasive animals. A remote video camera could be turned on at daily or weekly intervals to see if a plant is, for example, flowering, in order to trigger field inspections or to monitor vectors or pollinators. They could also be used as photopoints to monitor change over time with treatment.
- Digital camera attached to unmanned aerial vehicles (UAVs) or drones – aerial videoing, e.g. through the use of remote controlled rotocopters, could assist with scoping where delimiting surveys should be extended to. They could assist with delimiting surveys over water bodies or other areas where access is difficult. Digital camera for this use could include, for example, an adventure camera such as a GoPro. Familiarise yourself with current laws for the use of UAV since they are changing rapidly. DELWP has a network of staff active in the use of this rapidly evolving technology.
- 360° camera with gimbal – easily video a landscape being passed through. Video can then be interrogated in 360 degrees later to assist with surveying or training/education purposes.
- Satellite imagery – can be used for assistance with delimiting infestations. This requires more technical skill.
- Scanner/Photocopier – plant samples and specimens can be placed on a scanner/photocopier bed and be scanned/copied. Scanned digital images can be viewed or sent via email and other electronic media. Photocopied images are printed on paper (hard copy).

There is lots of scope for adaptation and experimental use of digital equipment, gimbals, tripods and vehicles to carry them.



Figure 11 - Good quality images can be very helpful for identification and awareness raising. This *Opuntia monacantha* was photographed with an SLR camera. The flowers, buds and spines can be easily seen. Image by Kate Blood, DELWP.

No matter what your skill level is with a camera, most people can take useful photographs. With the wide use of digital photography, especially with cameras in smart phones, it doesn't matter if you take lots of photos of the same subject – eventually you should get one that works. Keep trying different angles and light conditions until you get a couple you are happy with; delete the rest. You can rely on the automatic settings of the camera to do most of the work for you.

Preparing for the field

Make the most of your field trips by being prepared:

- Think about the purpose of the photographs/videos and where/how they will be used – plan the images/footage you need to take.
- Ensure all equipment is working, batteries (including spares) are charged and you have sufficient storage capacity on your equipment before going out into the field. Do you have a car charger?
- Clean lenses and maintain equipment.
- Make sure you are familiar with the full range of features on your equipment – read the manual or watch video clips on the web and try features you haven't used before.
- If videoing, prepare a story board before going into the field to make most efficient use of videoing time – plan what footage is needed e.g. close-ups of plants and people, and wide shots of landscapes.
- If videoing, prepare a script or dot points before-hand to keep the filmed person on track and avoid long-winded rambling dialogue.
- Research suitable sites and where the weed you want to photograph occurs. Check the weather and possible light conditions you will encounter.
- If you are planning to photograph a particular weed or group of weeds, familiarise yourself with their diagnostic features so you can capture what is needed.
- Always have permission from people being photographed/videoed e.g. ask them at the start of videoing and record them saying “yes”. Check the Department advice on how to record permission and have the forms you need to record written permission with you in your camera bag.
- There is lots of photography and videoing advice on the internet.



Figure 12 - Photographing and videoing weeds is a great way to record them, learn about them and teach others. Image by Kate Blood, DELWP.

Field equipment

In the field several bits of equipment can be useful to have in your kit:

- Camera lens cloth for cleaning smudges and specks off lenses. A small photographer's hand blower can be useful for removing dust.
- Camera bag – try and keep it light and convenient. Avoid putting the bag on the ground as it will collect weed seeds and soil. A comfortable shoulder strap or belt loop will help.
- Tripod or monopod – tripod (three legs) for free-standing mounting of camera/video equipment. A monopod is a single leg used to steady the camera while being held. This is especially useful in low-light or windy conditions, and when interviewing people or panning across landscapes. Investing in a good quality tripod will be worth it in the long run. Small flexible magnetic tripods for mobile devices can also be useful.
- Gimbal – helps to stabilise video equipment when moving through a landscape for filming.
- Reflector for more advanced photography – can be used to reflect sunlight onto weeds in shade for better illumination or can be used to shade weeds in strong sun light. Circular reflectors are available in a variety of sizes and can be folded up into a compact bag. Improvising with foil over a piece of card or an Eski lid can achieve similar results.
- Plastic bag to keep camera equipment dry during rain.

Hygiene of photographic equipment

Camera bags and equipment can become carriers of weed seeds, soil and plant parts. Make sure they are cleaned regularly and remove soil from tripod or monopod legs before moving onto a new site. Do the same with foot wear and clothing.

Geotagging images

Geotagged photographs and video allow images to be associated with a geographical location by geotagging (reference accessed on-line 31/12/2013: http://en.wikipedia.org/wiki/Geocoded_photo). This is especially useful for weeds at the early stage of invasion, where they may be difficult to locate. It is as simple as turning on the GPS feature on your camera equipment, including mobile devices. Spatial data are automatically attached to the image.

Photographing tips for the field

Here are some tips on taking weed photographs:

- If photographing a plant to help with identification, take a range of photos of different aspects of the plant to gather as many of the diagnostic features as possible. Knowing the diagnostic features makes the most efficient use of your time. Once in the field, you can use a mobile device to access diagnostic information on the internet.
- Plant detail images may include flowers, buds, fruit, seed, leaves, how the leaves are attached and arranged on the stem, bark, the plant base, and roots or underground storage organs if the plant is lifted out of the soil.
- Take some shots of the plant in its landscape, as well as close-ups of plant detail.
- Include a ruler or object to indicate size of the plant or plant parts.
- You can experiment with the panorama setting on your camera or smart phone if available. This can help take more expansive landscape views for context.
- Photograph the soil and surrounding ground flora and vegetation, including confusing look-alikes.
- If there is evidence of how a weed has been introduced or carried to the site, photograph this, and possible nearby sources.
- Ensure the detail you are wanting to capture is in focus in the view finder and check images after you have taken them so you can capture them again if they are not in focus or too dark/light.
- When using a smart phone, carefully selecting where to focus can adjust light levels to make a more useful image.
- Composition - Consider what you frame within the photo you are about to take. Move the camera around what you are looking at until you are happy with the framing of the image. It wants to be aesthetically pleasing and achieve the purpose of why you are taking it. Avoid including items that distract from your image.
- Check to make sure your shadow is not in the frame if the sun is behind you and you don't have flaring when the camera is facing the sun.
- Keep good records of when and where photographs were taken and geotag where possible.



Figure 13 - Plastic bags build up static electricity and can attract and hold weed seeds. Camera bags placed on the ground can also pick up and spread weed seeds. Image by Kate Blood, DELWP.

Videoring tips for the field

A bit of preparation before filming can make a big difference to the quality of the video clip produced.

If videoring people, ensure their faces can be seen with sufficient light and if videoring up close, the microphone/camera should be arm's length from the person being interviewed. Ask the interviewee to look at the person holding the camera, not at the camera. Ensure the microphone is turned on and use headphones (if available) when videoring to monitor sound quality.

If recording sound in windy conditions, use the wind setting on the microphone if available, and try to shield the microphone using your body, tree or other structure.

Consider how you frame the image to improve aesthetic considerations.

Keep good records of when and where footage is videoed and geotag where possible.

Video clips that can be viewed on the DELWP external web site should be kept under 3 minutes long (maximum 5 minutes). Seek advice and approvals through your regional communications officer.

More advanced photography tips

If you are a skilled photographer and have a camera with many settings, you can manipulate the camera to make the most of the conditions available, especially by using the manual settings.

Site conditions

- Early morning or late afternoon light often produce better plant images, especially in summer where strong mid-day sun can wash-out images.
- If the sun is low in the sky, and the weed is between the sun and you, good images can be taken using back-light. This illuminates fine features of the weed, such as hairs, spines and awns on grasses - particularly useful for some grasses and spiny cacti. You may need to shade the lens to avoid flaring and avoid looking or pointing the camera directly at the sun.

- Low light, especially under canopy – It can be difficult to have sufficient light to take good photographs of weeds that grow under the canopy of other plants, including trees. Manipulating the camera settings can compensate for low light. You may need to use a tripod/monopod or come back to the site when light conditions or the orientation of the sun has changed.
- In windy conditions it can be difficult to get good images of close-ups of plants. You can hold the weed with one hand and photograph with the other, use your body as a shield, or tie the plant to another object. Being patient can sometimes result in the weed being still during a brief break in the wind. Manipulating the camera settings to take a faster photo will help.

Camera use and attachments

- Depth of field - the camera will focus on a single point and the amount of the image in front and behind that point that is also in focus is the depth of field. For weed images that are being used for identification purposes, it may be important to have a larger depth of field i.e. more of the image in focus. This can be manipulated on an SLR camera by adjusting the settings. The smaller the aperture (i.e. the higher f numbers e.g. f22 and f16), the greater the depth of field will be. See your camera manual for more information.
- Where to focus – focus on the part of the weed that is important for the image you are trying to capture e.g. if you are taking an image of a flower, you would generally focus on the centre of the flower. This may require focussing on the spot, holding that focus and then moving the camera to the side to frame the wider picture as needed.
- Lens hood – When photographing towards the sun, especially when it is low in the sky, flaring can occur in the image. A hood for an SLR camera can be useful if correctly fitted. If using a smart phone camera, use a hand, hat or some other object to achieve the same effect.
- Flash – a flash can be useful in low light conditions for subjects within 5 m of the camera, but often results in a less than adequate image. Skilful manipulation of a flash held to the side or a reflector can improve the image. In windy conditions, it may be necessary to use a flash to capture a moving weed close-up.

SLR camera equipment

- There are advantages of using a single lens reflex (SLR) camera, as it uses an internal mirror so you can see the same image as the camera is taking. Higher quality lenses also mean the image may be of higher quality, which is especially important for publication.
- Lenses – for portraits of weeds, a standard SLR camera with 35 mm lens would be suitable. For close-up images of weed details, a macro lens would be suitable. For more advanced work, a wide angle or telephoto lens is appropriate for landscape and vista shots of weeds. However, a more flexible option could be a zoom lens e.g. 28-80 mm range. Zoom and telephoto lenses can be useful if you are unable to get close to the weed to pick up its detail. Unless you are taking many images of high quality for a particular weed project, investing in multiple expensive lenses that are heavy to carry in the field is not necessary. A macro zoom could be a good alternative to multiple lenses for field work.
- A polarising filter attached to the front of all lenses used on a 35 mm SLR camera can remove unwanted glare and protect the glass of the lens from scratches and smudges. It is easier to replace a filter than have the lens repaired.

Storage of photos and video footage

Be ruthless, culling images that are poor and out of focus to reduce storage requirements and time to view them in the future. It's best to do the culling immediately after taking the images.

Photographs should be clear and of sufficient resolution (e.g. at least 300 dpi) to be viewed on a large computer screen. Check the auto settings on your camera/device for image size.

Image storage typically follows for print publication (high resolution; file format raw, tif or jpeg) and for web and data show publishing (low resolution; file format raw, tif or jpeg). The disadvantage of using jpeg files is that every time you open or resave the image, it reduces in file size and pixels are lost, reducing the image quality.

There is currently no single image and video storage system in DELWP and no file naming conventions. Staff store their images and footage on hard drives, external hard drives, L and other departmental drives. Enterprise Content Management (ECM) does offer a way of saving and storing images. Images can also be saved as attachments to STAR, but note that ECM and STAR have file size restrictions.

DELWP has a corporate image library where images can be stored for the use of other staff. DELWP uses [Instagram](#) and other social media and networking programs to share images. Fireweb keeps an image database of the images it uses.

WESI encourages staff to establish consistent file naming conventions, including an abbreviation of the weed's botanical name and location. Geotag the image so it can be linked electronically with GIS spatial layers and databases.

Download images from your camera and devices regularly and store appropriately into consistently named folders so others can understand when and where they were photographed. Tag images if possible including the name of people in the images.

Back up your image storage regularly, preferably off-site. As cloud storage becomes more widely used consider backing up images remotely.

If leaving your role or the Department, ensure others know where your images are stored and have access to them.

Videoing checklist

Equipment

- ☐ Video camera e.g. Handycam – charged
- ☐ Other digital devices
- ☐ Still camera if needed
- ☐ Charger & spare battery
- ☐ Head phones
- ☐ Microphone (camera mounted)
- ☐ Lapel mic & extender cord
- ☐ Spare AAA batteries
- ☐ Memory disks
- ☐ Tripod
- ☐ Gimbal
- ☐ Spirit level (small)
- ☐ Monopod
- ☐ Laptop & charger
- ☐ Laptop mouse
- ☐ External hard drive
- ☐ Extension cord
- ☐ Power box
- ☐ Leads & cables
- ☐ Reflector
- ☐ Gaffa tape
- ☐ Lens cloth

Personal

- ☐ Hat
- ☐ Sunscreen
- ☐ Coat, umbrella
- ☐ Glasses
- ☐ Notepad & pens
- ☐ Water bottle
- ☐ Food
- ☐ Plastic bags
- ☐ Avoid wearing white or stripes or flappy clothes
- ☐ Mobile phone (on silent)
- ☐ Bum bag

Information

- ☐ Story board planning sheet
- ☐ Script for voice-over
- ☐ Vox pop questions
- ☐ Cheat/fact sheet
- ☐ Filming logging sheet
- ☐ Talent contact details
- ☐ Field guides
- ☐ Set up folders on laptop
- ☐ Ph nos of talent and DELWP help

Appendix 5 - Information sources

There are many tools and resources about weeds. Here is a small selection.

Field guides

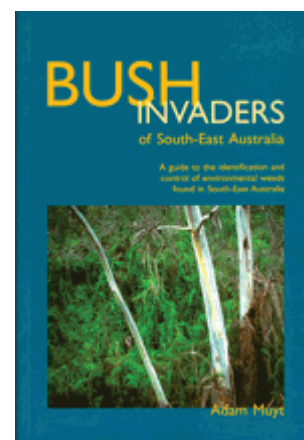
Bush invaders of South-East Australia: a guide to the identification and control of environmental weeds found in South-East Australia.

Author: Adam Muyt

Publisher: R. G. & F. J. Richardson.

Publication date: 2001.

Contains colour photographs, diagnostic features for identification, how they spread, similar looking plants and management information.



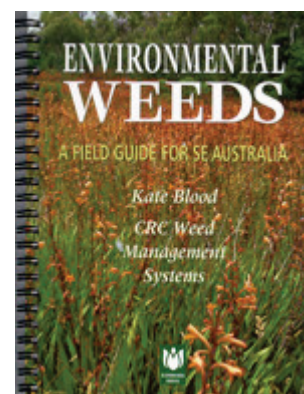
Environmental weeds: a field guide for SE Australia.

Author: Kate Blood

Publisher: Bloomings Books, Melbourne.

Publication date: 2001.

Contains colour photographs, descriptions for identification, look-alikes, how they spread, ecology, reporting sheet to copy and distribution maps.



Weeds of the south-east: an identification guide for Australia (3rd edn).

Authors: F. J. Richardson, R. G. Richardson & R. C. H. Shepherd.

Publisher: R. G. and F. J. Richardson.

Publication date: 2016.

Contains colour photographs and includes brief descriptions and summary distribution information.



Flora of Victoria (Volumes 1-4).

Editors: D. B. Foreman and N. G. Walsh; and N. G. Walsh and T. J. Entwisle.

Publisher: Inkata Press.

Publication dates: Between 1993 and 1999.

Large books with botanical descriptions and keys for indigenous and introduced plants. Some line drawings, distribution maps and glossary of botanical terms. Updated information is now available at VICFLORA: <https://vicflora.rbq.vic.gov.au/>

Other specialist guides

Sainty, G. R. and Jacobs, S. W. L. (2003) *Waterplants in Australia. A field guide* (4th edn). Sainty and Associates, NSW.

Hosking, J., Sainty, G. and Jacobs, S. (2006) *Alps invaders. Weeds of the Australian high country* (2nd edn). Australian Alps Liaison Committee, Canberra.

Matters, J. and Bozon, J. (1995) *Spotting soil salinity: A Victorian field guide to salt indicator plants*. Department of Conservation and Natural Resource, Melbourne.

People, social media and networks including weed ID network

Often the best information is nearby, especially when it comes to when weeds arrived and where they occur. Tap into the knowledge of people by contacting them directly. Ask local DELWP, Agriculture Victoria or Parks Victoria staff for information. Contact your Catchment Management Authority, local governments, consultants and contractors. Tap into local community networks, including field naturalists, friends groups, Landcare groups, conservation groups, Weed Society of Victoria, garden clubs and horticultural groups etc.

Connect with others through social media e.g. Facebook, Twitter, Instagram, and your agency's internal social media e.g. Yammer for DELWP. Try search terms and hashtags such as #invasivespecies #invasiveplants #weeds (but be prepared for drug related material) #weedID #plantID. There are a number of Australian state or regionally-based groups on Facebook including 'The Weed Society of Victoria Inc'. More information on the use of social media for sharing information on invasive species can be found in Blood, 2016.

The WESI team is utilising social media for weed identification (weedID) support using the #weedID search term/hashtag. There are internet-based networks of weed practitioners such as:

Enviroweeds

The ENVIROWEEDS listserver was created by the Cooperative Research Centre for Australian Weed Management (Weeds CRC) to help distribute and discuss information on the management of environmental weeds in natural ecosystems mainly in Australia. The Weeds CRC no longer exists but the listserver is still hosted by the University of New England. Participants can share information, ask questions, participate in discussions and respond to the queries of others.

The audience is those who are managing natural ecosystems, whether on private or public land and water, or those working with environmental weed information. You can subscribe for free at <https://mail.une.edu.au/lists/cgi-bin/listinfo/enviroweeds>

ALIENS-L

ALIENS-L is the mailing list of the Invasive Species Specialist Group (ISSG) (www.issg.org) of the International Union for Conservation of Nature (IUCN) Species Survival Commission. The group aims to "reduce the threats posed by invasive species to natural ecosystems and their native species, through increasing awareness of invasive species and means of controlling or eradicating them". This list is a contribution to that mission. It allows users to freely seek and share information on invasive species and the threats which they pose to the biodiversity of our planet.

The ISSG is a worldwide network of experts on the conservation impacts of invasive species. Membership is by invitation, but it is not necessary to be a full member of the group to contribute to the cause of reducing conservation threats posed by invasive species.

ISSG provides advice on threats from invasive species and control or eradication methods to IUCN members, conservation practitioners, and policy makers. The group concentrates on reducing or preventing the adverse effects of alien invasions on conservation values.

The list homepage: <https://list.auckland.ac.nz/sympa/info/aliens-l>

General information about mailing lists: <https://list.auckland.ac.nz/sympa/help/introduction>

Mobile apps

The development of mobile applications (apps) for mobile phones and tablets is a rapidly growing area. Mobile apps are useful to have in the field where there is internet connectivity. Apps can assist with field data collection, mapping and identification.

On-line information

Agency internal information on weeds, their distribution and management

Spatial, Temporal, Activity Recorder (STAR) (for DELWP and Parks Victoria):

<https://star.biodiversity.vic.gov.au> (performs best in Google Chrome)

Victorian Biodiversity Atlas (VBA): <https://www.environment.vic.gov.au/biodiversity/victorian-biodiversity-atlas> and for log-in: <https://vba.dse.vic.gov.au/vba/#/>

Environmental Information System (EIS) (access through Parks Victoria)

Bioweb, Bioweb2, MAX (access through Agriculture Victoria)

Crown Land Manager (CLM) Pest Infestation Sites (access through DELWP)

Local databases, spread sheets, maps, Geographic Information System (GIS) layers, works plans of weed infestations, note books, filing systems, and registry files

Local reserve, forest, and park etc. management plans that may include weed lists

Plant Identification and information

Weeds in Australia (Federal Government)

<http://www.environment.gov.au/biodiversity/invasive/weeds/>

Weed information notes including environmental weeds - Agriculture Victoria:

<http://agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds/weeds/a-z-of-weeds>

Various keys including weeds at Lucid: <https://keyserver.lucidcentral.org/>

Fact sheets on over 1,000 species: <https://keyserver.lucidcentral.org/weeds/data/>

Lucid key to Environmental Weeds of Australia (originally developed with CRC Weed Management & updated by Qld Herbarium) is online Apps iOS -

<https://itunes.apple.com/au/app/environmental-weeds-australia/id898685476?mt=8> ; Android - <https://play.google.com/store/apps/details?id=org.lucidcentral.mobile.ewa&hl=en>

Weeds of National Significance (WONS): <http://weeds.ala.org.au/WoNS/> and

<http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html>

National Herbarium of Victoria - Identification (some services for fee) and information services. Herbarium specimens and records viewable through AVH & ALA otherwise by appointment with the Herbarium: <https://www.rbq.vic.gov.au/science/herbarium-and-resources/identification-and-information-services>

VICFLORA – Flora of Victoria, comprehensive and current guide to the wild plants of Victoria including weeds. Includes plant profiles, identification tools and illustrations:

<https://vicflora.rbq.vic.gov.au/>

Victorian Noxious weed status - Weeds declared in Victoria under the *Catchment and Land Protection Act 1994* (CaLP Act), are listed at the Agriculture Victoria website:

<http://economicdevelopment.vic.gov.au/>. Information is also available through the Customer Service Centre on 136 186.

Local Government Resources - Use your favourite search engine to search for local government brochures and field guides.

Weed risk and biodiversity modelling

Advisory list of environmental weeds in Victoria - <https://www.environment.vic.gov.au/invasive-plants-and-animals/weed-risk-ratings> or web search for 'early invaders Victoria weed'.

Victorian environmental weed risk database – as above for advisory list.

Weed risk assessments - available on Victorian Resources Online (VRO) (see “Managing weeds: assess the risk guide” for more detail on risk ratings):

http://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/invasive_plants_common_a

Weed Futures - decision-support tool to interrogate profiles for over 500 species within Australia and assess weed threats for regions of interest under current and predicted future climates: <http://weedfutures.net/>

NatureKit - tool to map and report on Victoria's biodiversity values and investment prospects. Includes NaturePrint and Strategic Management Prospects:

<http://maps.biodiversity.vic.gov.au/viewer/?viewer=NatureKit>

Weed lists and distribution

VICFLORA – Flora of Victoria, comprehensive and current guide to the wild plants of Victoria including weeds. Includes plant profiles, identification tools and illustrations:

<https://vicflora.rbq.vic.gov.au/>

NatureKit - tool to map and report on Victoria's biodiversity values and investment prospects:

<http://maps.biodiversity.vic.gov.au/viewer/?viewer=NatureKit>

Victorian Biodiversity Atlas (VBA): <https://www.environment.vic.gov.au/biodiversity/victorian-biodiversity-atlas> and for log-in: <https://vba.dse.vic.gov.au/vba/#/>

Australia's Virtual Herbarium (AVH): <http://avh.chah.org.au/>

Atlas of Living Australia (ALA): <http://www.ala.org.au/>

Flora Information System (FIS) - available from Viridans Pty Ltd.

Global Biodiversity Information Facility (GBIF): <http://www.gbif.org/>

Names and nomenclature

VICFLORA – Flora of Victoria, comprehensive and current guide to the wild plants of Victoria including weeds.

Includes plant profiles, identification tools and illustrations:

<https://vicflora.rbq.vic.gov.au/>

Australian Plant Name Index (APNI):

<http://www.anbg.gov.au/apni/>

Australian Plant Census (APC):

<http://www.anbg.gov.au/chah/apc/>

International Plant Names Index (IPNI):

<http://www.ipni.org/ipni/plantnamesearchpage.do>

More useful plant name links here: <https://www.anbg.gov.au/cpbr/databases/names.html>



Grass information

Grassbase the Online World Grass Flora: <https://www.kew.org/data/grasses-db.html>

AusGrass2: <http://ausgrass2.myspecies.info/>

Opuntoid Cacti information

Managing Opuntoid Cacti in Australia manual and field identification guide:

<https://www.agric.wa.gov.au/invasive-species/opuntoid-cacti-best-practice-control-manual>

Opuntoid Cacti resources: <http://weeds.ala.org.au/WoNS/opuntoidcacti/>

Australian Invasive Cacti Network: <http://www.aicn.org.au/>

Global working group on the management of cactus species:

<http://academic.sun.ac.za/cib/projects/cactuswg/invasivecactus.asp>

Other resources

Global compendium of weeds (3rd edition) has over 3,000 pages and there are several sources of this document:

<https://www.cabi.org/isc/FullTextPDF/2017/20173071957.pdf> or

https://www.dpaw.wa.gov.au/images/documents/plants-animals/plants/weeds/Compendium_3rd_Edition_2017.pdf or

<https://nla.gov.au/nla.obj-512788350/view>

VicVeg online: <http://www.vicveg.net.au/vvInfo.aspx>

BioControl Hub: <https://biocollect.ala.org.au/biocontrolhub>

Appendix 6 - Field recording template - single

Record opportunistic sightings in the Victorian Biodiversity Atlas (VBA). Use the VBAGo app in the field. Use this sheet (one site or weed per sheet) to accompany specimens to the National Herbarium of Victoria. Attach the sheet to the appropriate project in Spatial, Temporal, Activity Recorder (STAR).

*Required fields

OBSERVER DETAILS

*Person recording: _____

*Phone number: _____

Email: _____

*Date sighted/collected: ____/____/20____

WEED LOCATION

*Describe where it is (Address; or distance & direction from place; or attach mud map).			
*GPS reading *Datum used with GPS	Grid Ref: E _____ N _____ Lat. ____°____', ____ S _____ _____ E _____	Long. _____°____', _____	<input type="checkbox"/> WGS84 <input type="checkbox"/> GDA94 <input type="checkbox"/> Other
*Patch type (check)	<input type="checkbox"/> Point (one or few plants) <input type="checkbox"/> Linear (e.g. roadside) <input type="checkbox"/> Polygon (non-linear shape)		
Land tenure (check)	<input type="checkbox"/> Private <input type="checkbox"/> Public / govt. <input type="checkbox"/> Roadside <input type="checkbox"/> Unsure		
*Land use (check)	<input type="checkbox"/> Agriculture <input type="checkbox"/> Horticulture <input type="checkbox"/> Forestry <input type="checkbox"/> Garden <input type="checkbox"/> Conservation <input type="checkbox"/> Roadside <input type="checkbox"/> Urban <input type="checkbox"/> Aquatic <input type="checkbox"/> OTHER _____		
Land owner (if known)			

WEED CHARACTERISTICS

Plant name (if known)	<i>Scientific preferable</i>		
*Number of plants (check)	<input type="checkbox"/> 1-10 <input type="checkbox"/> 10 – 50 <input type="checkbox"/> 50 + OTHER: _____		
*Area of infestation (check)	<input type="checkbox"/> under 1m ² <input type="checkbox"/> 1-10m ² <input type="checkbox"/> 10-100m ² <input type="checkbox"/> over 100m ² OTHER: _____		
*Plant form (check)	<input type="checkbox"/> Tree <input type="checkbox"/> Shrub <input type="checkbox"/> Herb <input type="checkbox"/> Vine <input type="checkbox"/> Grass <input type="checkbox"/> Aquatic <input type="checkbox"/> Seedling		
Reproductive state (check)	<input type="checkbox"/> No flowers <input type="checkbox"/> Flower or bud <input type="checkbox"/> Fruiting <input type="checkbox"/> Seeding		
Comments			
Photos	Close-up (file names):	Habitat (file names):	
Plant specimen details (if applicable)			

Post or deliver specimens and information to: Identifications and Information Service, Royal Botanic Gardens Victoria, Private Bag 2000, South Yarra, Victoria 3141. Fees may apply. More information at <https://www.rbv.vic.gov.au/science/herbarium-and-resources/identification-and-information-services>

Appendix 7 - Wellbeing, safety and hygiene for field work

Wellbeing and safety

Refer to your agency's Occupational Health and Safety (OH&S) requirements for personal protective equipment and safety requirements. Items that should be considered include:

- first-aid kit and snake bite kit;
- personal protective equipment; and
- satellite phone and emergency position-indicating radio beacon (EPIRB) if in remote locations.

Consider these points when you are planning and conducting field work:

- Avoid sun damage to skin – wear appropriate clothing, broad-brimmed hat, gloves, sunscreen, and sunglasses.
- Avoid field work on days of extreme fire danger.
- Be aware of flood and other emergency and weather warnings for the area and take appropriate precautions.
- Have a safety plan and reporting procedure in place for working remotely (refer to your agency's OH&S guidelines).
- When working near roadsides, park safely and wear high visibility clothing such as a reflective vest.
- Wear gaiters and carry a snake bite kit and know how to use it.
- Wear appropriate protective clothing when handling weeds. Be aware of plants which have:
 - spines or barbs that may have sheaths, toxins or irritants. Avoid stick injuries and treat punctures immediately.
 - sap that can cause skin irritation immediately or after exposure to sunlight.
 - fine hairs that can cause skin irritation and become lodged in clothing.
 - pollen and perfumes that can cause allergic reactions including respiratory irritation and hayfever.
- If working with cacti, carry pliers to remove cacti spines from footwear. Always check the back of boots before crouching down. Some cacti have spines with sheaths that remain in the body when the spine is removed. The "Managing Opuntoid cacti in Australia" manual has a chapter on safety and welfare (Sheehan and Potter 2017).
- Seek prompt medical advice if reactions, injuries or infections occur.

Hygiene

It is very important not to spread weeds, pests, wildlife diseases, soil-borne and plant-borne diseases within and between sites. Examples of things that may spread other than weeds include soil and plant-borne pathogens such as Phytophthora, Myrtle Rust, Chytrid fungus of frogs, and crazy ants. Consider these hygiene points when you are planning and conducting field work and check your agency's hygiene protocols:

- Carry a hygiene cleaning kit with instructions in vehicles, and a sealable container (e.g. plastic bottle with screw-top lid) in which to place loose seeds removed from clothing for later safe disposal.
- Wear cotton clothing that seeds do not readily adhere to and avoid cuffs on trousers and shorts.

- Wear gaiters over socks and boots.
- Clean footwear and clothing including seeds in laces and socks, and soil on soles before and immediately after a site visit.
- Avoid placing carry bags and packs on weeds that are in seed.
- Regularly check camera bags and clothing pockets for seeds.
- Plastic sample bags can build up static electricity to which weed seeds can readily adhere.
- Avoid driving vehicles into weed infestations and check and clean the vehicle regularly including within the cabin and boot or tray.
- Consider undertaking WeedStop training to maintain suitable vehicle hygiene standards.
- Ensure other staff and contractors conducting field work are following appropriate hygiene standards.
- Be aware that the transportation of plant propagules of declared noxious weeds without a permit is prohibited. If collection of a sample or herbarium specimen is required for identification purposes, contact 136 186 for further advice.
- Companion and conservation working dogs readily pick up and spread weed seeds on their coat and between their toes.
- Consider using a footbath before entering and leaving wetland areas to reduce the risk of spreading Root Rot (*Phytophthora cinnamomi*) or frog disease, Chytrid fungus (*Batrachochytrium dendrobatidis*).

Support

Working with invasive species can be overwhelming at times. Seek help if you are feeling down or overwhelmed. Check in with your local workplace peer support person, OH&S person or contact:

Beyond Blue: www.beyondblue.org.au 1300 224 636

Lifeline Australia: www.lifeline.org.au 13 11 14



Figure 14 - Keeping boots, clothing and equipment clean is a good way to avoid spreading weeds and other organisms in the field. Check footwear before arriving at and leaving a site and remove soil and seeds. Image by Kate Blood, DELWP.

Appendix 8 - Weed samples and specimens

Weed samples

Samples of live plant material are often collected when plants are found in the field. They can be taken back to the office for closer inspection and to assist with identification. Often, they are left on the seat or dashboard of the vehicle or on a desk to shrivel and dry and eventually be binned. If samples are collected, they should be put straight into a sealable plastic bag and kept in the cool shade until they can be looked at again. An Eski is a useful tool to have in the vehicle for this purpose.

Once you have finished with a sample, it should be carefully disposed of (see below) to ensure that weed seeds and plant parts cannot escape and spread.

Weed specimens

Weed specimens are carefully collected plant material with the purpose of making a pressed and dried sample submitted to the [National Herbarium of Victoria](#) (Herbarium).

Herbarium specimens provide a permanent record validating the occurrence of a species at a particular locality and time. Specimens and the associated label data also provide a verifiable and invaluable source of information such as distribution, ecological preferences and associated species (Reference viewed on-line 5/2/2016: <http://www.rbq.vic.gov.au/science/herbarium-and-resources/national-herbarium-of-victoria/preparing-herbarium-specimens>). See the recording template in Appendix 6.

Due to the risk of seeds and plant parts escaping from specimens, only trained and experienced people should collect them. It is very time consuming to collect quality specimens and accompanying information.

Rare and threatened plants have been collected mistakenly as weeds, putting at risk valuable plant populations in the wild.

Seek advice from the WESI team if you think a specimen should be collected for the Herbarium.

Once a specimen has been submitted to the Herbarium, it will be pressed and dried, and stored until it can be identified and lodged by a botanist. The specimen will be mounted on a special large archival card, photographed and the written information accompanying it entered into the Herbarium database. The specimen will be stored in special cupboards and preserved. The image and information will then be shared with Australia's Virtual Herbarium, where it can be seen by others.

Specimens can also be preserved in other ways, such as in fluid in containers, if they cannot be pressed and dried.

The Herbarium has an extensive online [guide to the collection and preparing of herbarium specimens](#) and "Collecting and preserving herbarium specimens" (Albrecht 1993) in printed form.

Permits to collect samples or specimens

To collect and transport weeds that are declared in Victoria, you need a permit under the *Catchment and Land Protection Act 1994*. Contact the Customer Service Centre on 136 186 for further advice. Permission is required to collect in National Parks. Contact [Parks Victoria](#) on 13 1963.

Disposal of samples or specimens

Ensure samples and specimens are disposed of appropriately to avoid weed spread e.g. in a sealed plastic bag inside another sealed plastic bag (i.e. double bagged) for deep burial at a tip site or autoclaving.

Appendix 9 - Writing weed names

Here are some basic tips on writing weed and plant names. WESI follows the standards of the [National Herbarium of Victoria](#) and “Plant names. A guide to botanical nomenclature” (Spencer *et al.* 2007) provides lots of further detail on understanding plant names.

Common names

Many weeds have multiple common names. It is recommended that common names are spelt with capital letters to help differentiate them from the surrounding text and avoid ambiguity, but there is no convention about which is correct. If the common name contains more than one word, each component word should start with a capital unless it includes hyphenated words, in which case the hyphenated word is lower case, for example:

White Spanish Broom

Berry-flower Heath

Many weeds have more than one common name. This can be very confusing when searching for information in books or on the internet. The same common name can be used for different weeds.

Botanic names

The two words that make up the species name (genus and specific epithet) are written in italics. The first word (genus) is written starting with a capital, and the second word (specific epithet) is written in lower case, for example:

Ferraria crispa

A species can sometimes be broken into smaller categories: subspecies, variety or form. Some weeds that have escaped from cultivation e.g. escaped garden plants, may be cultivated varieties which are called cultivars. These are written as examples shown here:

subspecies (shortened to subsp. or ssp.)

Erica discolor subsp. *andreseanthus*; or

Erica discolor ssp. *andreseanthus*

variety (shortened to var.)

Fallopia japonica var. *compacta*

cultivated variety (cultivar) is written starting with capitals and is enclosed by single quotation marks

Zantedeschia aethiopica ‘Green Goddess’

form (shortened to f.)

Synonyms

Synonyms (shortened to syn.) are outdated or formerly-used botanical names and are often included after the current name within brackets, for example:

Alstroemeria aurea (syn. *Alstroemeria aurantiaca*) - i.e. *Alstroemeria aurantiaca* is the old name.

It is common for weeds to have many synonyms, which can be very confusing.

Uncertain names

If unsure of the correct botanic name, this can be indicated by using a question mark in front of the component of the relevant part. If unsure of the correct identification, place a question mark in front of the whole name, for example:

?Cylindropuntia pallida

If you know the genus, but are unsure about the specific epithet, follow this example:

Cotoneaster ?corniculatus

If you know the genus, but not the specific epithet (use species shortened to sp.), follow this example:

Cotoneaster sp.

Appendix 10 - Further contacts

Contact the WESI project team

When an initial detection of a suspect plant(s) has been made, let the WESI project team know. They can assist with its identification and verification. WESI can then help with recording the plant and working out what to do next.

Having some information ready when making contact will make it easier for the WESI project team to help you:

- Your name and contact details (email, mobile phone etc.)
- What you think the detected weed is including botanical name
- Where and when the weed was detected (location name, land tenure, directions, and GPS reading)
- Any notes on what it looks like and the situation it is growing in e.g. growing in sand or clay or in a water body
- Observations about how the weed may have got there, what is spreading it and how far it has spread. An estimate of how many plants there are and the area covered
- What are its impacts and what are the biodiversity values under threat?

Have you taken photographs of plant features and landscape that can be emailed? Electronic images can be emailed to the WESI project team to assist with identification (if images are large, only one image should be attached to each email). Alternatively, let WESI know that you have placed images in the WESI folder on the DELWP corporate drive statewide: L:\Department Business Share\WESI early invaders

For assistance with a possible weed at the early stage of invasion contact the WESI project team.

Bianca Gold

bianca.gold@delwp.vic.gov.au

Kate Blood

kate.blood@delwp.vic.gov.au

Phone via the Customer Service Centre 136 186.

The WESI project has a seasonal newsletter “Early invader update” that you can receive for free. Contact us to subscribe.

The project team is active on social media. Search for handle @weedyk8 and hashtags #WESIProj #weedID #invasivespecies

Agency contacts

Victorian Government Customer Service Centre: 136 186 (for DELWP and DEDJTR/DJPR Agriculture Victoria)

<https://www.environment.vic.gov.au/>

<https://economicdevelopment.vic.gov.au/>

Parks Victoria: 13 1963

<http://parkweb.vic.gov.au/>

Glossary and abbreviations

Glossary

Asset-based approach - Involves prioritising control actions for a number of threats, based on the relative value of identified assets that will be protected by the actions. The aim of prioritisation is to maintain the viability of important environmental assets and optimise outcomes for asset protection and management (Victorian Government 2010).

Biodiversity - The variety of life forms: the different plants, animals and microorganisms, the genes they contain and the ecosystems they form (Victorian Government 2010).

Bioregion - Broad scale mapping unit that captures the patterns and ecological characteristics in the landscape. These units classify the environment using a range of attributes such as climate, geomorphology, geology, soils and vegetation. There are 28 bioregions identified within Victoria.

Case - In this instance, a particular site or species related circumstance.

Containment - The aim of preventing or reducing the spread of invasive species, e.g. by preventing invasions into new areas and eradicating any species that are found outside a defined area or beyond a defined line (Panetta 2016).

Cultivar - Cultivated variety, a variety developed in cultivation. An assemblage of cultivated individuals distinguished by any characters significant for the purposes of agriculture, forestry or horticulture, and which, when reproduced such a variety retains its distinguishing features (FloraOnline 2010).

Decision making framework - Information organised in such a way to lead the user through a logical step-by-step process to make decisions.

Delimit, delimiting survey, delimitation - The process of determining the full extent of an invasion. This usually involves intensive surveys of areas in which the species is considered likely to be present (Panetta 2016).

Determination - Giving the correct name to a specimen: identification (Albrecht 1993).

Drone - See 'unmanned aerial aircraft'.

Early intervention - The timely action to prevent a small problem becoming a large one.

Early invaders, early weed invaders - These are plants that have naturalised and that have started to spread. Since spread has just begun, such plants are not at all widespread and are generally encountered only by chance, unless specifically targeted by search efforts. Co-ordinated management intervention, i.e. eradication or containment, is at its most feasible for plants at this stage of invasion, owing to their highly restricted distributions (Panetta 2016).

Early stage of invasion - See 'early invader'.

Environmental weed - Exotic or Australian native plant growing beyond its natural range that has, or has the potential to cause, a detrimental effect on natural values (DSE 2009).

Epithet - Used for the words in a combination other than the generic name and any rank-denoting term (International Code of Nomenclature 2013).

Eradication - The elimination of every single individual (including propagules) of a species from a defined area in which recolonisation is unlikely to occur (Panetta 2016).

Extirpation - Denotes local, as opposed to global, elimination of a species (Panetta 2007). For this guide series 'park-scale eradication' is used instead.

General impression of size and texture (GIST) - A picture formed in our heads as we become more familiar with, in this case, a weed. It makes it easier to instantly recognise the plant when observed in the field.

Genus - Consists of one or more kinds of plants that share a distinctive set of characters (i.e. closely related species). Its name is a singular noun in Latin form, such as *Rhododendron* (Spencer *et al.* 2007). Plural is 'genera'.

Geotagging - The process of adding geographical identification metadata to various media such as a geotagged photograph or video, constituting a form of geospatial metadata. These data usually consist of latitude and longitude coordinates, though they can also include altitude, bearing, distance, accuracy data, and place names (Reference viewed online 1/9/2015: <https://en.wikipedia.org/wiki/Geotagging>).

Hygiene - For weed practitioners, hygiene relates to the cleaning of equipment, machinery, vehicles, personal clothing and footwear etc. to avoid spreading weed propagules, pests, wildlife diseases, soil-borne and plant-borne diseases within and between sites.

Identification - The process of naming a plant, if not instantly from your knowledge, then through a more structured process, either by using a botanical key or other reference. Until a plant identification has been verified through the collection and submission of a specimen to the National Herbarium of Victoria (Herbarium), a proposed or preliminary name can be called a 'provisional' identification.

Indigenous - Native to the area; not introduced (FloraOnline 2010).

Introduced (exotic) - Not native to the area; not indigenous (FloraOnline 2010).

Invasion - The process of spread (see 'invasive plants'). The propensity to spread (invasiveness) is one of the two components of weed risk assessment, the other being impact. It is important not to confuse these two components (Panetta 2016).

Invasive plants - Naturalised plants that produce reproductive offspring, often in very large numbers, at considerable distances from parent plants (approximate scales: greater than 100 m; under 50 years for plants spreading by seeds and other propagules; greater than 6 m in 3 years for plants spreading by roots, rhizomes, stolons, or creeping stems), and thus have the potential to spread over a considerable area (Richardson *et al.* 2000).

Invasive species - A species occurring, as a result of human activities, beyond its accepted normal distribution and which threatens valued environmental, agricultural or other social resources by the damage it causes (Victorian Government 2010).

Look-alikes - Plants that look similar and can be confused with another species of plant.

Monitor - To observe and check the local performance of a plant species over a period of time, in order to detect increases in invasiveness and impact should these occur. If practicable, monitoring at yearly intervals is recommended (Panetta 2016).

Naturalised plants - Non-indigenous species that sustain self-replacing populations for several life cycles without direct intervention by people, or despite human intervention. Naturalised species are not necessarily invasive, that is they have not (yet) spread any significant distance (Panetta 2016).

Noxious weed - In Victoria, a weed declared under the *Catchment and Land Protection Act 1994*, and there are four categories of noxious weed.

Pathogen - An infectious agent such as a virus, bacterium, prion, fungus, viroid, or parasite that causes disease in its host (Reference viewed online 3/9/2015: <https://en.wikipedia.org/wiki/Pathogen>).

Polygon - A number of joined spatial points representing an area when the first point is joined to the last (Sheehan *et al.* 2016).

Prevention - Is the act of preventing, to keep from occurring (Delbridge *et al.* 1998).

Propagule - An independent part of a plant (i.e. a seed or other vegetative structure) that is capable of being dispersed and growing into a new plant (Panetta 2016).

Provisional name - A proposed name for a plant until it is verified at an Herbarium.

Public land - Land set aside for the use and benefit of the community/public e.g. State forest, national park, public park.

Quadrat - A relatively small area e.g. 1 x 1 m, in which surveying of vegetation occurs.

Recognition - The ability to be able to instantly recognise a plant, if it is a weed or indigenous, possibly even be able to name it. It is the ability to know that a plant fits within the context that you are viewing it. You may not be able to recall its full botanic name, even its common name, but you know that you have seen it before.

Risk - The chance of something happening that will have an impact on objectives. NOTE: The level of risk (e.g. high, medium or low) is defined by the particular method being used. Estimating the level of risk requires an objective, evidence-based consideration of the likelihood and consequences of a particular set of circumstances (Victorian Government 2010).

Search, searching - The act of looking for something.

Site - The boundary of the area of interest for the search, survey or treatment within the broader reserve, State forest, or national park etc. It may be defined by vegetation communities, land type most susceptible to invasion, roads or river boundaries that divide the land parcel into more manageable areas (Sheehan *et al.* 2016).

Synonym - One of two or more names that apply to the same, in this case, plant.

Treatment - Is a technique applied to a weed to kill or reduce the vigour of the weed and/or its propagules.

Unmanned aerial vehicle - An aircraft without a human pilot onboard. Its flight is controlled remotely by a person or autonomously by onboard computers. Also known as drones or remotely piloted aircraft (Reference viewed online 3/9/2015: https://en.wikipedia.org/wiki/Unmanned_aerial_vehicle).

Verify, verified, verification - Confirming the correct identification and name for a plant through the collection of a specimen, and submission to a herbarium.

Victorian environmental weed risk database - The Victorian environmental weed risk database is an *Excel* spreadsheet that contains a summary of the scores from the Victorian Weed Risk Assessments.

Weed - Plants (not necessarily alien) that grow in sites where they are not wanted and which usually have detectable economic or environmental effects (synonyms: plant pests, harmful species, problem plants) (Richardson *et al.* 2000).

Weeds at the early stage of invasion - See 'early invaders'.

Abbreviations

ALA	Atlas of Living Australia
APC	Australian Plant Census
APNI	Australian Plant Names Index
app	application
ASAP	as soon as possible
AVH	Australia's Virtual Herbarium
CaLP	Catchment and Land Protection
CLM	Crown Land Manager
CSC	Customer Service Centre
DEDJTR	Department of Economic Development, Jobs, Transport and Resources (to be replaced by DJPR on 1 January 2019)
DELWP	Department of Environment, Land, Water and Planning
DJPR	Department of Jobs, Precincts and Regions (to replace DEDJTR 1 January 2019)
DMF	decision making framework
ECM	Enterprise Content Management
Ecodev	URL abbreviation for DEDJTR
EIS	Environmental Information System
EPIRB	Emergency Position Indicating Radio Beacon
<i>et al.</i>	<i>et alia</i>
f.	form (forma, Latin)
FIS	Flora Information System
GBIF	Global Biodiversity Information Facility
GDA	Geocentric Datum of Australia
GIS	Geographic Information System
GIST	general impression of size and texture
GPS	Global Positioning System
ha	hectare
id, ID	identification
IPNI	International Plant Names Index
I-SPEI	Invasive Species Prevention and Early Intervention
ISSG	Invasive Species Specialist Group
IUCN	International Union for Conservation of Nature
jpeg	jpeg
m	metre
MGA	Map Grid of Australia
mm	millimetre
NHV, MEL	National Herbarium of Victoria, Melbourne
OH&S, OHS	Occupational Health and Safety
SLR	single lens reflex
sp. (singular)	species
spp. (plural)	species
ssp., subsp.	subspecies
STAR	Spatial, Temporal, Activity Recorder
syn.	synonym

UAV	unmanned aerial vehicle
URL	Uniform Resource Locator
USB	Universal Serial Bus
var.	variety
VBA	Victorian Biodiversity Atlas
VRO	Victorian Resources Online
Weeds CRC	Cooperative Research Centre for Australian Weed Management
WESI Project	Weeds at the Early Stage of Invasion Project
WONS	Weed of National Significance

List of Figures and Tables

Figure 1 - This is the WESI decision making framework that guides the process for dealing with weeds at the early stage of invasion. There is an enlargement of the framework with scenarios in Appendix 1.

Figure 2 - Stopping to look at a plant that is not familiar to you may turn out to be a weed at the early stage of invasion in your area. This is a *Sparaxis* species, a member of the Iris family Iridaceae, that is becoming invasive in some parts of Victoria. Image by Kate Blood, DELWP.

Figure 3 - How to use this guide.

Figure 4 - Where to record data.

Figure 5 - Victorian Biodiversity Atlas.

Figure 6 - Record geographic information with a GPS or other device in the field. Image by Kate Blood, DELWP.

Figure 7 - Blue Periwinkle (*Vinca major*) is relatively easy to identify when it is flowering as there are not many confusing look-alikes. Although widespread in the State, it is still moving into new areas. Image by Kate Blood, DELWP.

Figure 8 - Who to notify about early invaders.

Figure 9 - Planning what to do next.

Figure 10 - This is the WESI decision making framework that guides the process for dealing with weeds at the early stage of invasion. This version illustrates three typical scenarios faced by public land managers.

Figure 11 - Good quality images can be very helpful for identification and awareness raising. This *Opuntia monacantha* was photographed with an SLR camera. The flowers, buds and spines can be easily seen. Image by Kate Blood, DELWP.

Figure 12 - Photographing and videoing weeds is a great way to record them, learn about them and teach others. Image by Kate Blood, DELWP.

Figure 13 - Plastic bags build up static electricity and can attract and hold weed seeds. Camera bags placed on the ground can also pick up and spread weeds seeds. Image by Kate Blood, DELWP.

Figure 14 - Keeping boots, clothing and equipment clean is a good way to avoid spreading weeds and other organisms in the field. Check footwear before arriving at and leaving a site and remove soil and seeds. Image by Kate Blood, DELWP.

Notes:

[illegible]

