

Section Four

Follow-up control, revegetation and monitoring



Follow-up control	44
Other weeds invading after boneseed control	45
Restoring native vegetation	45
Natural regeneration	45
Revegetation	46
Monitoring your progress	46
Photopoints	46
Measuring density	47
Measuring cover	49
Surveying and recording boneseed distribution	49

Follow-up control

There are three stages to achieving successful weed control:

- **primary treatment** – removal of mature boneseed plants and existing seedlings
- **secondary treatment** – intensive control of the seedlings that emerge after removal of mature boneseed plants, and control of resprouting mature plants
- **maintenance weeding** – ongoing removal of boneseed seedlings that establish from the seedbank or from seeds imported to the area by birds or other sources.

Follow-up control (i.e. secondary treatment and maintenance weeding) is crucial because boneseed seedlings can continue to germinate from the long-lived seedbank, possibly for up to 10 years.

For effective follow-up control you should:

- Inspect treated areas within 6 to 12 months of primary control, and remove boneseed seedlings by hand pulling or foliar spraying before they flower and set seed.
- Inspect treated areas where boneseed roots have been left in the ground (i.e. after foliar spraying, cutting-and-swabbing, or cutting without herbicide treatment) for regrowth and control if necessary.
- Conduct maintenance inspections at least every 12 months and remove any new boneseed seedlings by hand. The extent of follow-up control required will decrease each year and inspections can be as simple as an annual walk and hand pulling day.
- Survey regularly for new infestations, especially if there are other infestations of boneseed nearby.



Nicole Zeoli

Removing boneseed in the Murray Mallee region, SA.

- Pay close attention to areas where seeds might be dispersed, such as under trees and along fence lines where birds perch.
- Combine yearly progress monitoring with follow-up control, and record weeds as you remove them.

The extent of follow-up control required will depend on the density of the infestation and how long it had been established. The larger the boneseed seedbank, the more resources that will be required for follow-up work.

Numerous boneseed seedlings will germinate after mature plants are removed. However, many will die during summer. As boneseed rarely flowers in the first year, this first flush of seedlings can be left to thin out naturally, and the remaining young plants pulled up or cut-and-swabbed in autumn. The juvenile plants will also be easier to spot than the small seedlings, making control more efficient.



Peter Tucker

Native acacia seedling growing amongst boneseed seeds.

Follow-up after a fire

After a fire, a protective crust is formed on the soil surface. This crust reduces erosion and retains soil moisture. Working in a newly burnt area can disturb the protective crust and cause soil compaction. In the initial stages after a burn a cover of weed seedlings may help to conserve moisture and protect native seedlings. It can be beneficial to allow the site at least six months to regenerate naturally before carrying out follow-up weed removal. Of course, boneseed seedlings do need to be controlled before they set seed.

Other weeds invading after boneseed control

The control of boneseed often leads to invasion by other weed species, which may have been present in only small numbers before boneseed was treated. Your management plan must address this issue, as your efforts in controlling boneseed will be negated if another weed spreads and requires intensive control. For example, weeds such as bridal creeper, montpellier broom, gorse and non-native grasses have been reported to invade after boneseed is removed, and can often be harder to control than boneseed.

Ensure that your weed management plan addresses all weeds present at your site. Multiple weeds may need to be removed from a particular area at the same time.

Restoring native vegetation

Natural regeneration

The aim of bush regeneration is to encourage native plants to regenerate from the existing seedbank. Allowing native bush to re-establish through natural regeneration is preferable to revegetation for three reasons:

- native plants establish that are adapted specifically to the site (these are known as 'local provenance' species)
- local biodiversity is conserved
- natural regeneration is far more cost-effective than revegetation.

Removing mature boneseed plants can promote substantial regeneration of native seedlings, provided a native seedbank still exists. Natural regeneration will be more successful where native vegetation is intact and the boneseed infestation is recent. Where dense patches of boneseed border native bush, work from the edges of the boneseed infestation towards the middle of the infestation. This allows natives to regenerate from propagules dispersed from the adjacent bush.

Revegetation

Revegetation by planting tube-stock or direct seeding is useful when:

- a site has limited or no potential for natural regeneration (e.g. if the boneseed infestation was long established and a native seedbank is no longer present)
- key species are missing and cannot be naturally recruited to an area.

Use only locally indigenous species in your revegetation project, preferably propagated using material sourced from the bushland area to be planted (local provenance species). This ensures that the plant community you are attempting to establish is appropriate for the habitat you are working in. For example, you want to ensure that a natural grassland community is not replanted with trees and shrubs.

Timing is important when establishing native vegetation from direct seeding or tube-stock. Include revegetation in your boneseed management plan, and try to schedule your weed-control activities to coincide with the best time to revegetate.

For detailed information on revegetation see *Bush Regeneration: Recovering Australian Landscapes* by Robin Buchanan (1989).

Whether through natural regeneration or revegetation, rehabilitation of bushland is a long-term process that requires a commitment to extended monitoring and follow-up.

Monitoring your progress

You can monitor your progress using many different methods, including site maps, photopoints, or quantitative measures such as density or cover. The most suitable method depends on the resources available, the expertise of the people carrying out the monitoring, the questions you want to answer, and the intended audience. For example, if you wish to demonstrate the native regeneration following boneseed control at your site to the wider community, photopoints are ideal. Or, if you need to present quantitative data on the results of your control activities to your funding body, you could monitor the numbers of boneseed plants and native species using plot transects.

To make valid comparisons, monitoring needs to be done at a similar time of year, at least once each year, and in a consistent manner. Incorporate monitoring into your yearly activity timetable. Monitoring can be combined with follow-up control – pull up any seedlings as you survey the area.

A site diary is useful for documenting activities undertaken, as well as observations about seasonal conditions or other factors that may influence the results of your control program. Recording the cost of control (both in labour and dollars) is important for evaluating the cost-effectiveness of different methods and helps you stay within budget.

Photopoints

Photopoints are a photographic record of changes occurring over time at your site, taken from the same point each time. They are an excellent tool for demonstrating progress to members of community groups, the public, and funding bodies.



Kym Smith

Dense boneseed infestation before control.

Setting up a photopoint

- Choose sites that will best represent the work undertaken at your site, such as an area with significant ecological values, or a heavily infested area.
- Place a permanent marker such as a stake at the point from where you will take the photo each time.
- Label an A4 card with the date and photopoint location, and attach to another stake approximately 10 metres from the camera position.
- Stand at the marker, face the labelling card, and take your photo.

Tips

- Align markers north to south to avoid excessive sun or shadow, and to make it easy to remember which direction to take the photo if the markers are removed.
- Try to include a distinctive object in each photo, such as a tree or fence post, that will be there each time.
- Use the same camera and film type (or the same settings on a digital camera), and take the photos from the same height (rest the camera on the stake), with the same zoom settings.
- Take photos as frequently as required to reflect changes at the site, but ensure you have photos taken at the same time each year to make valid comparisons.
- Label each photo with the date, location, and the reason for taking the photo (e.g. annual monitoring, before and after weed removal).



Kym Smith

Native regeneration after partial and gradual boneseed removal.

Measuring density

Density is defined as the number of individual plants per unit area – for example 100 boneseed plants per hectare. Density is a good measure of boneseed population size, as boneseed populations will respond to most control treatments by a change in the number of individuals (of various age classes), rather than a change in vigour or plant size.

Density is the most appropriate population measure for scattered boneseed infestations. Measuring the density of thick boneseed infestations is difficult, as it can be time-consuming to determine how many individual plants are present in a clump. For dense thickets it is more appropriate to measure cover (see page 49).

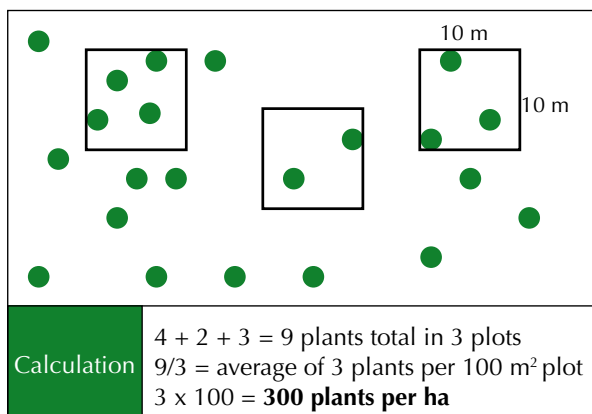
Measuring density in age classes will more accurately reflect the changes caused by the control treatments. It is a good idea to determine the density of juvenile and mature plants separately, as the removal of mature boneseed plants is generally followed by the germination of many boneseed seedlings. Juvenile plants could be defined as those under 50 cm tall, or, if measured when the population is in flower, juvenile plants could be those that are not flowering.

For example, before treatment, the density may be 500 mature plants and 100 juveniles (total 600 plants) per hectare. Six months after the initial treatment, the density may be 50 mature plants and 650 juveniles (total 700 plants)

per hectare. Follow-up control is carried out 12 months after the initial control. After 18 months, the density may have dropped to 0 mature plants and 300 juveniles (total 300 plants) per hectare. If only total numbers of boneseed plants were counted, the dramatic effect of the initial treatment on the boneseed population would not have been captured.

Plot counts

Boneseed density can be measured simply, by marking out three or more plots ('quadrats') of 10 m x 10 m (100 square metres). The plots should be randomly located over the site, and the more plots you have, the more precise the results will be. Count the number of boneseed plants (in each age class) in each plot, and determine the average. Multiply the average number of plants per 10 m x 10 m plot by 100 to get the number per hectare (one hectare is 10,000 square metres). For plants straddling the boundaries of the plot, count all individuals along two contiguous sides, and do not count the individuals that straddle the other two sides.

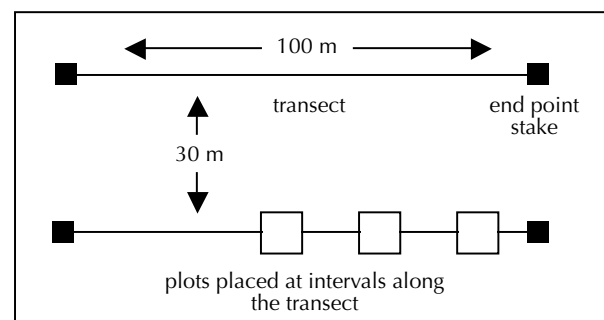


Calculating density using plot counts.

Plot transects

Plots are often placed along sample lines called transects. Transects are commonly 100 m long, and are placed 10–50 m apart, parallel to each other. Using multiple transects will give you results that are more representative of your entire site. Plot size will depend on the species being measured. For shrubs such as boneseed, 2 m x 2 m plots may be appropriate. Smaller plots (50 cm x 50 cm) would be needed if you were measuring native seedling regeneration. Keep the plots the same size on each subsequent monitoring occasion, so that results are comparable.

If you wish to monitor native regeneration, you can count all species in each plot. Or, you may choose one or two key native species as the target species to be monitored. Record the number of individuals of the target species within each plot. Average the number of individuals of each species in each plot (over all transects), and convert to a density measure (i.e. individuals per square metre or individuals per hectare).



Calculating density using plot transects.



Rachel Melland

Post control monitoring using a 2 m x 2 m plot frame.

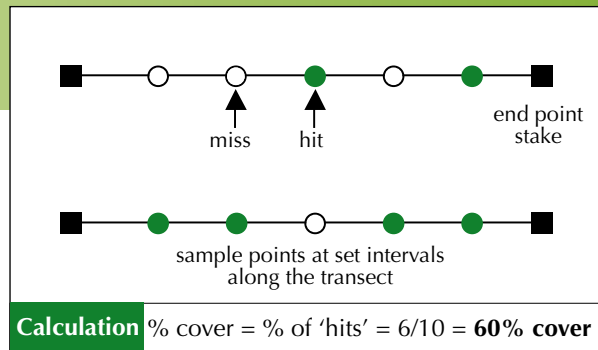
Measuring cover

Sample point method

Counting individual boneseed plants is only possible for scattered or light infestations, as separating individual plants is very difficult in dense infestations. An easier method for measuring dense boneseed populations is to determine percentage cover using the sample point method.

Use a tape-measure and a narrow pole to measure sample points along a transect. Place the pole next to the tape at set distances along each transect, and record a 'hit' if the pole touches a boneseed plant, or a 'miss' if the pole does not touch a boneseed plant. The proportion of sample points with a 'hit' is an estimate of the cover. Using more sampling points gives you more precise results.

Alternatively, walk between two points (e.g. two stakes or other permanent features) and record a 'hit' if a boneseed plant is present within a metre of you at a given step interval. For example, you start at the gate and walk towards the large gum tree for a total of 400 steps, recording 'hit' or 'miss' every 10 steps. You can vary distances and intervals to suit your site.



Calculating percentage cover using the sample point method.

Surveying and recording boneseed distribution

The information you record on the distribution of boneseed at your site may not have been recorded before. If you think you have identified a new or previously unknown boneseed infestation, report it to your local weeds officer (contactable through your local council or shire). The information can then be passed on to state agencies, and be added to maps at state and national levels.

Consider surveying for boneseed beyond the boundaries of your site. This will help you to identify possible threats to your control efforts such as a large boneseed infestation nearby, and will improve knowledge of the distribution of boneseed in the region. Recording the absence of boneseed in an area is also important, so the area is known to be surveyed and free of boneseed. Be sure to pass the results of your survey on to the relevant weed contacts.

A field manual has been developed by the Bureau of Rural Sciences to standardise the mapping of Weeds of National Significance. *A field manual for surveying and mapping nationally significant weeds* (McNaught *et al.* 2006) lists the attributes that should be recorded when surveying for weeds, and describes various methods of determining weed density. Copies of the manual are available from the Weeds Australia website <www.weeds.org.au>.

