Local Land Services

# Bush regeneration in progress

## An ongoing management guide for landholders in the North Coast

NSW GOVERNMENT

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**Acknowledgement of Country**

The Department of Primary Industries and Regional Development acknowledges that it stands on Country which always was and always will be Aboriginal land. We acknowledge the Traditional Custodians of the land and waters, and we show our respect for Elders past, present and emerging. We are committed to providing places in which Aboriginal people are included socially, culturally, and economically through thoughtful and collaborative approaches to our work.

This resource may contain images or names of deceased persons in photographs or historical content.

# About this booklet

North Coast Local Land Services is pleased to present *Bush regeneration in progress: an ongoing management guide for landholders in the North Coast*.

This booklet has been developed to protect and enhance the investment of natural resources on private properties, by providing practical guidelines for managing ecological restoration projects on an ongoing basis.

It is intended for use by landholders who have been part of a Local Land Services restoration project and who already have a management plan in place.

Disclaimer: This booklet is not a comprehensive guide to maintaining your land. It is intended to offer general advice. No legal liability is accepted for the information presented in this handbook. The information contained in this publication is based on knowledge and understanding at the time of writing. Because of advances in knowledge, you need to ensure that information is up to date by checking with Local Land Services or your independent adviser.

Presented by Local Land Services with assistance from Richmond Landcare Inc.

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Richmond Landcare Inc.

Australian Government

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# Contents

# 1. Introduction to bush regeneration

## Key terms

This booklet uses 2 key terms throughout:

- **Ecological restoration** refers to the process of helping the recovery of an ecosystem that has been degraded, damaged or destroyed.
- **Bush regeneration** is a specific form of ecological restoration that focuses on renewing and restoring degraded, damaged or destroyed vegetation areas, particularly in natural environments.

## Your site management plan

This booklet refers to the site management plan created when you started the bush regeneration project on your land. The guidance provided aims to help you in planning, undertaking and managing the ongoing maintenance of your regeneration project.

If you are unsure whether there is a management plan for your site, or you do not yet have a plan, contact your project officer.

## Aims of restoration work

The main aim of restoration work is to help bring back or establish natural processes and vegetation on a site, so that the ecosystem can sustain itself without human intervention.

The role of humans in bush regeneration is to be a starter button for natural activity to kick in later on.

That means your involvement in restoration of your site is meant to decrease over time, until the ecosystem no longer needs your help to sustain itself.

# Principles of ecological restoration practice

The *National standards for the practice of ecological restoration* in Australia set out 6 key principles that underpin a successful ecological restoration project.

The principles are summarised below, but you can find more details on the Society for Ecological Restoration Australasia website at seraustralasia.org

## Principle 1: An appropriate local native reference ecosystem

A key part of ecological restoration is choosing the right **reference ecosystem** – that is, a model you use to identify the particular ecosystem that is the target of your restoration project. This helps set goals for your project and provides a way to measure progress.

Your reference ecosystem describes the native species and biota – including plants, animals, insects, microorganisms and soils – that were part of the environment before it was degraded. It can either be an actual site, like an intact remnant (a reference site), or a model built from several sites, field indicators, and historical or predictive data.

The good news is that this is not something you need to do yourself as part of ongoing maintenance. The management plan for your project should have the reference ecosystem information in the site description.

To find out more about reference communities, speak to a local adviser or see Trees Near Me (listed in Section 6. Further resources).

## Principle 2: Restoration inputs and resilience

The amount of work needed for your bush regeneration project depends on how healthy or degraded the site is. Sites in good condition need less effort. Sites that are more degraded need more resources and actions, like planting and weed control.

The other factor is resilience – a capacity to recover naturally from external stresses or shocks. Understanding your site's resilience helps you decide how much work to put in, ensuring your efforts are effective and appropriate for the site's condition.

## Principle 3: Clear targets, goals and objectives

Clear targets, goals and objectives provide a roadmap for your bush regeneration project, helping you focus your efforts and track progress.

The terms targets, goals and objectives provide a planning hierarchy.

**Targets** are set in relation to the reference ecosystem – the ultimate result of the project, such as full recovery of the site. Your site management plan should already identify your targets.

**Goals** describe a high-level outcome that will help you reach your target ecosystem. They are set in terms of a measurable status within a defined area and time. For example, you might want to improve soil health, increase native plant cover or boost wildlife numbers within 20 hectares (ha) within 5 years.

**Objectives** are the specific outcomes you need to take to reach each goal.

By identifying what you want to achieve at each level of planning, you'll have a clear direction for your work. Setting goals and objectives will help you stay on track, measure success and adapt your approach as needed to reach your restoration target.

## Principle 4: Full recovery, even if it takes time and effort

The ultimate aim of ecological restoration is for full recovery of the site, or as close to full recovery as possible, as defined by the reference ecosystem – even if it takes a long time or requires a lot of effort.

Restoration is not a quick fix – it usually takes years and sometimes decades for ecosystems to fully bounce back. Sometimes, this means putting in significant work, like undertaking intensive weed control, planting native species or repairing waterways. But with patience and consistent effort, you can achieve a healthy, functioning ecosystem that benefits both the environment and your property in the long run.

### Principle 5: Restoration science and practice work together

Restoration science and practice go hand in hand. Restoration science provides the knowledge and research needed to understand ecosystems and guide restoration efforts. Restoration practice applies that knowledge to real-world situations. It also draws on knowledge and experience gained on the ground, particularly from local sources.

By combining the two, you can make informed decisions and adapt techniques as needed. The more you learn from both science and practical experience, the better the results of your bush regeneration project.

### Principle 6: Social and cultural aspects are key

The social and cultural aspects of ecological restoration are just as important as the environmental work. Engaging with the community, local stakeholders, and people with cultural knowledge of the land can make a big difference in the success of your project. This includes involving neighbours, local groups, and especially Aboriginal traditional custodians or other cultural custodians who have a deep understanding of the landscape. Their knowledge can provide valuable insights into the land's history, the plants and animals that once thrived, and sustainable management practices.

## Stages of ecological restoration

While the aim is to help establish a mature, fully operational ecological community on your site, the vegetation will go through various stages, over many years, before reaching that point.

The stage your project is in will depend on the specific project or grant you're involved with. Whatever your starting stage, you need to allocate enough resources to ensure that your project progresses effectively.

Most projects begin with controlling the threats – such as excluding stock by fencing, and weed control – because it is important in allowing native plants to grow. Planting of native plants is another task that might be done in the first stages of the project.

After the primary work comes the follow-up work: regular, timely maintenance. For example, treating weeds at their emergent phase reduces the time, effort and resources needed to prevent them from re-establishing.

The final stage is ongoing maintenance until the site is fully recovered.

At all stages, achieving positive outcomes requires consistent follow-up and maintenance, rather than occasional efforts. The encouraging aspect is that as weed loads decrease over the years through active management, the workload diminishes, and the ecosystem becomes more resilient and self-sustaining.

## Primary work – year 1

Primary work often includes a series of tasks such as:

- controlling groundcover weeds, understorey woody weeds and exotic vines
- tackling weed trees (canopy)
- planting local native species.

This primary work disturbs the area, which prompts the growth of both native and exotic species (Figure 1). Newly germinating weeds need to be treated so they don't outcompete natives, so you need to do follow-up weed control soon after the first visit.

## Follow-up work – years 1 to 3

Follow-up work is ongoing in the first few years. It usually includes further weed control, such as:

- spot-spraying newly germinating weeds
- treating resprouting sections of woody weeds and vines.

It is crucial to visit the site several times during this stage to evaluate progress and decide on additional follow-up actions.

Inadequate timing, frequency or extent of follow-up can cause setbacks like:

- weed seeds readily establishing in recently disturbed areas
- native seedlings being overpowered by weeds (Figure 2).

## Maintenance work – year 4 onwards

Maintenance work begins once the vegetation community reaches a point where:

- native plant species are germinating and establishing
- canopy formation is underway (Figure 3)
- weed density begins to decline as the native plants start to outcompete them.

**Figure 1. Primary stage: after weed control and planting**

**Figure 2. Follow-up stage: mostly controlling weeds among the plantings**

**Figure 3. Maintenance stage: plantings shade out most of the site and weed load is greatly reduced**

# Restoration strategies

## Not all restoration work takes the same approach. Different strategies are used to achieve different outcomes.

The choice of restoration strategy depends on factors such as:

- the level of habitat disturbance and degradation
- the potential for habitats to recover
- successional changes – that is, the changes in vegetation that occur over time
- the goals of the restoration project.

In some cases, a combination of strategies is necessary.

Table 1 sets out the different restoration strategies, including the criteria for determining when to use the strategy.

**Table 1. Restoration strategies**

| Strategy | Description | Criteria |
|---|---|---|
| Natural regeneration | Pre-existing plants and animals recover naturally on their own | • Predation or competition from invasive species has decreased<br>• Harmful practices like clearing native vegetation, overgrazing, overharvesting, overfishing, blocking water flows, or disrupting fire patterns have stopped<br>• Remnant habitat is present |
| Assisted regeneration | Limited human intervention to encourage natural regeneration | • Measures such as weed control, fencing and stopping of harmful practices will be enough to trigger natural recovery processes |
| Reconstruction | Human intervention in recovery processes | • Little to no native species are present on a site (e.g. because of previous clearing activities)<br>• Disturbance has reached the point where the original native plant community cannot naturally recover |
| Combined approach | Assisted regeneration alongside reconstruction | • Patches of remnant habitat are surrounded by areas with no native vegetation |
| Rehabilitation | Reinstating degrees of ecosystem functionality on degraded sites where restoration is not the target | • Conditions are permanently changed<br>• Rehabilitation is the highest and best outcome possible at a site and represents an improvement in condition to its prior state |

# Monitoring, evaluation and adaptive management

## Monitoring

Monitoring is crucial for making sure your restoration project stays on track. Keeping an eye on things regularly will help you:

- see how your efforts are paying off, including whether you're hitting your goals
- catch and fix problems early
- gather solid evidence of progress, which can be beneficial when seeking further funding through grants.

Taking photographs is an important part of monitoring, because it gives you a visual record of the changes taking place on the site.

A time series of photographs, from a degraded state before restoration work started, through the transition stages, to the minimum maintenance stage, can be a powerful reminder of how much the restoration project has achieved.

To be effective for monitoring purposes, photographs must be:

- taken at the same places on the site – designated, permanent photo points
- taken at regular intervals during the project
- accompanied by notes for each photo, to explain the content and context of the image later.

Since you've been involved in a project before, you probably already have photo points set up. If not, use a star picket marked with a fluorescent yellow safety cap as a permanent marker of each photo point (Figure 4).

**Figure 4. Taking photographs at permanent photo points**

## Evaluation

Evaluation is the process of analysing your project to assess its progress and effectiveness – identifying:

- what has worked or is working
- what has not worked or is not working
- what areas need improvement.

Each time you undertake monitoring, use the information gathered to check progress against:

- the site's initial, degenerated state
- its state the last time you monitored it
- any specific objectives and goals for the site
- the overall target for the site.

## Photography tips

- Use a smartphone to capture a GPS point of each photo point, so you can accurately retrace its location next time.
- Take several photos and select the best or clearest shot later.
- Include a fixed object, such as a distinctive tree or fence post, in your photo to provide a point of reference.
- Choose good light for taking the photos. Light, cloudy days are ideal for photography as the weaker sunlight reduces shadows from vegetation, providing a more even and consistent image. Avoid extreme lighting, such as dawn, midday and dusk. Do not use a flash.
- Try to take the photos at the same time of day each time.

Table 2 sets out the specific markers of ecological health, and the aspects you need to consider when evaluating the progress of your site.

**Table 2. Ecological markers for evaluating progress on restoration sites**

| Marker | Considerations |
|---|---|
| Weeds | • Are problem weeds decreasing or increasing?<br>• If weed populations are not being reduced as intended, do you need to reassess your control measures? |
| Plantings | • Are your planted trees surviving in the conditions provided?<br>• Are native seedlings emerging and growing as expected? |
| Wildlife | • Is native wildlife returning?<br>• Are introduced species harmful to native wildlife reducing or being controlled effectively? |
| Soil | • Are soil conditions improving?<br>• Are there signs of improved soil health, such as increased leaf litter or reduced erosion? |
| Biodiversity | • Are there signs of improved biodiversity – that is, an increase in the variety of plant and animal species? |

## Adaptive management

Adaptive management is a practical and effective approach to enhance project outcomes. It means taking a flexible approach to management strategies, so that you can adapt to changing circumstances.

Here's how you can apply adaptive management principles in a bush regeneration context:

1. **Assess progress:** Do regular monitoring and evaluation of your restoration efforts.
2. **Identify problems:** Look for any issues or unexpected results, such as poor plant survival or persistent weed problems. Note any patterns or recurring challenges.
3. **Adjust strategies:** Based on your observations, consider modifying any strategies that aren't working. For instance, if a particular plant species consistently struggles or dies on your site, consider replacing it with a species that is thriving and performing well under the same conditions.
4. **Implement small changes:** Apply the revised strategies in small, incremental adjustments rather than large, sweeping changes, so you can monitor their effectiveness and understand what works.
5. **Seek advice:** If you're unsure about certain aspects, consult with local experts or organisations specialising in ecological restoration. Their advice can provide valuable guidance and help refine your approach.
6. **Review and plan ahead:** Regularly review your project's progress and plan for future needs. Consider what additional actions might be necessary to achieve your restoration goals and ensure long-term success.

# 2. Planning the work

## How to use your site management plan

### The reference ecosystem identified in your site management plan guides your project targets and provides a basis for monitoring and assessing outcomes.

Your plan should describe the reference ecosystem that you aim to restore the site to in terms of:

- historical composition – the species that used to be on the site
- structure – the ecosystem's complexity and configuration
- function – the processes and dynamics of what happens in the ecosystem.

The plan will include:

- the baseline condition of the site
- the target condition of the site
- a map of the site
- a table setting out the priority work that needs to be done
- the ongoing maintenance requirements for your site.

The baseline condition of the site will include notes on things like:

- site constraints
- listed weeds
- native plants – species and number
- native animals – species and number
- soil conditions.

Often you will see on both the map and the works table that your project site has been split into subsites or zones, depending on what restoration strategy is appropriate and the works that needs to take place. Figure 5 shows an example.

Some management plans will outline the baseline condition and works required in each subsite or zone. The zones or subsites may even have their own set of objectives and different restoration strategies.

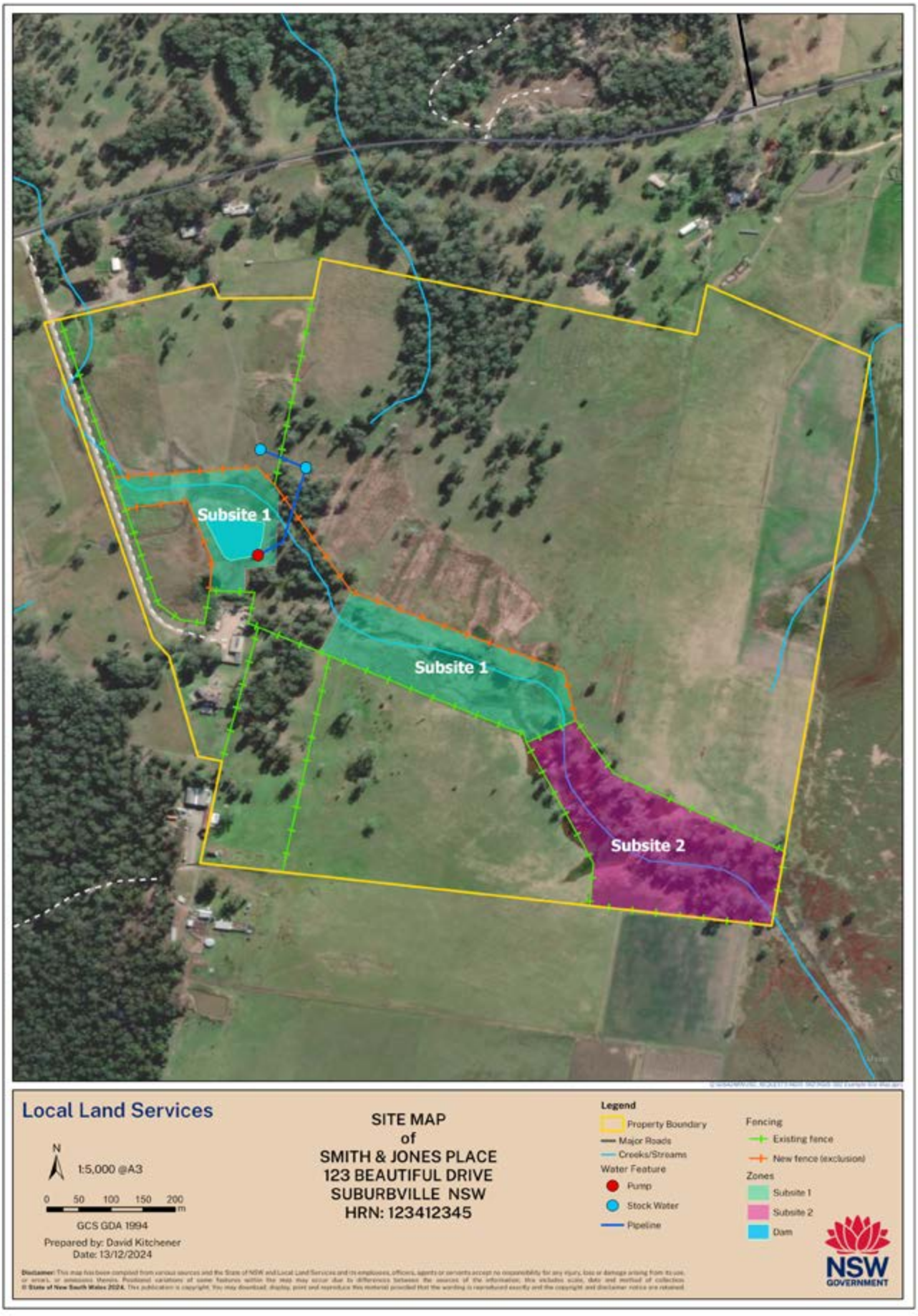



**Figure 5. Example of a site map showing subsites**
*Source:* DCS Spatial Services

Although the tasks and methods in each subsite or workzone might be different, you are still aiming for a structurally diverse, self-sustaining and healthy ecosystem. An example of a site management plan that has 2 subsites, each with a different restoration strategy, target condition and objectives, is shown in Table 3 and Table 4.

**Table 3. Subsite 1 – restoration strategy is reconstruction**

| Objectives | Year 1 target condition criteria | Year 3 target condition criteria | Year 5 target condition criteria |
|---|---|---|---|
| **1. Controlling threats**<br>Reduction in the abundance and impact of targeted threats through active management interventions such as erosion control, and pollution mitigation | Riparian buffer width is a minimum of 10 m and has been planted with local native species | Riparian buffer width is a minimum of 10 m and planting density is at target condition | Riparian buffer width is a minimum of 10 m and planting density is at target condition |
| **2. Species composition and community structure**<br>Diverse assemblage of native plant species established, including canopy trees, understorey shrubs and ground covers reflective of subtropical rainforest, through active management interventions such as weed control and revegetation | • > 90% survival rate of planted stock<br>• Mid-storey weeds 100% controlled<br>• Ground-layer weed dominance 100% controlled | • Growth of > 2 m for rainforest plantings<br>• Mid-storey weeds > 1 m absent or < 5% cover<br>• Ground-layer exotics reduced to < 10% cover and represented by only benign species | • Growth of > 4 m for rainforest plantings<br>• Mid-storey weeds > 1 m absent or < 5% cover<br>• Ground-layer exotics reduced to < 10% cover and represented by only benign species |

**Table 4. Subsite 2 – restoration strategy is assisted regeneration**

| Objective | Year 1 target condition criteria | Year 3 target condition criteria | Year 5 target condition criteria |
|---|---|---|---|
| **Species composition and community structure**<br>Diverse assemblage of native plant species established, including canopy trees, understorey shrubs and ground covers reflective of subtropical rainforest, through active management interventions such as weed control and revegetation | • Treatment of vine weed canopy 100% complete, with no untreated vines present in the canopy | • Vine weeds reduced to < 10% cover, with no reinfestation in the canopy<br>• Presence of regenerating native flora | • Vine weeds reduced to < 10% cover, with no reinfestation in the canopy<br>• > 70% canopy cover of native trees<br>• Presence of regenerating native flora |

The maintenance requirements section in your management plan outlines the specific works needed in your site (and each subsite or zone), and how often you should do the work, and when, each year. The time of year will depend on what weeds you have on your property and when their active growing season is.

Table 5 shows an example of a maintenance schedule similar to what you might see in your own plan. This project site requires follow-up weed control works 6 times a year for the first few years. This could look like 2 spray runs over the spring season, or a combination of hand weeding around the plantings to prepare for a spray run.

**Table 5. Example of maintenance requirements in a site management plan**

| Year | Work activity | Subsite | Detail | Frequency of maintenance |
|---|---|---|---|---|
| 2–3 | Follow-up | 1 | • Maintain plantings by removing competing weeds.<br>• Undertake additional planting if required.<br>• Spot-spray identifiable weeds. | • 2 visits in spring<br>• 2 visits in summer<br>• 1 visit in autumn<br>• 1 visit in winter |
| 2–3 | Follow-up | 2 | • Treat re-emerging vine and woody weeds before they reach knee height.<br>• Spot-spray identifiable weeds. | • 1 visit in spring<br>• 2 visits in summer<br>• 1 visit in autumn<br>• 1 visit in winter |
| 4–5 | Maintenance | 1, 2 | • Spot-spray identifiable weeds.<br>• (Optional) – successional planting to increase species composition. | • 1 visit in spring<br>• 1 visit in summer<br>• 1 visit in autumn<br>• 1 visit in winter |

Maintenance runs should be staggered towards the growing seasons for your area. Table 6 outlines the basic seasonal maintenance demands in the North Coast.

**Table 6. Seasonal maintenance requirements for the North Coast**

| Season | Maintenance tasks |
|---|---|
| Spring (September, October and November) | Target early emergent weeds and address any tasks missed in autumn. |
| Summer (December, January and February) | Prioritise this run to prevent weeds from taking advantage. Previous early runs make this one a manageable task. |
| Autumn (March, April and May) | Expect an extensive run, addressing issues during the wet season. As you prepare your site for winter, take a break to consider woody weed control and expanding your efforts if your maintenance routine is effective and well-managed. |
| Winter (June, July and August) | Maintenance requirements typically decrease during this period, making it an opportune time to focus on woody weed control. |

# Management strategies

## There is no one way to manage your restoration project.

Tailor your management decisions according to:

- each site's unique characteristics and constraints
- your available time
- your available resources.

## Understanding the plant species on your site

Your management plan is a good place to start. It might include a species list of plants, including both native and invasive species, on your site. You will need to be able to identify specific plants, especially problem weeds so that you can treat them.

Section 4. Plant identification provides guidance on plant identification and Section 3. Weed control details weed control methods for different types of weeds.

- If your management plan doesn't include a species list, ask the contractor who worked on your property if they have the species list for your sites. This can help you narrow down the identification of the plants that have been established at your property.
- If you know what the problem weeds are on your property, research when their active growing season is to help you plan how to rotate through your subsites effectively.

## Zone coverage

Maintenance work in each zone or subsite needs to be both **systematic** and **comprehensive**. That means covering every square metre of the work area, as far as conditions allow (Figure 6).

Overlooking an area:

- results in missed weeds
- wastes valuable time and resources when you have to revisit the area
- may lead to continued flowering and fruiting of weeds
- impedes overall site progress.

When faced with limited time to cover an entire zone, a good strategy is to use marker points such as stumps, fence posts, trees, and other prominent features (Figure 7). By setting up distinct work zones using these markers, you establish clear boundaries and reference points that not only guide your progress but also help prevent the inadvertent omission of areas during spot-spraying or maintenance activities.

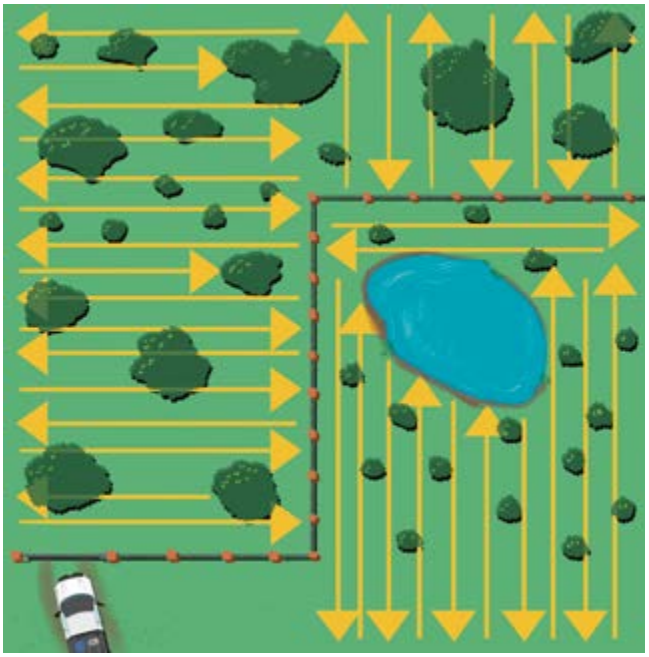


**Figure 6. Example map showing direction of works covering each subsite**

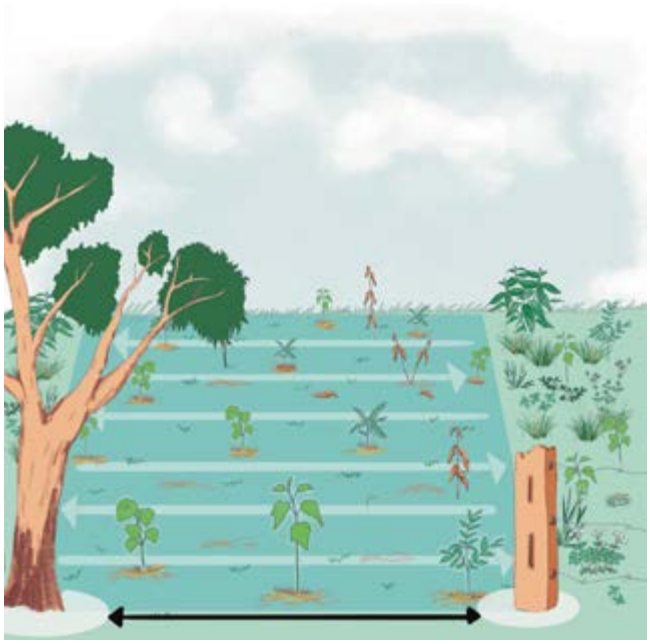


**Figure 7. Using marker points to establish a work zone**

## Working in a team – line method

If you are working in a pair, or have a few helpers undertaking the work in a zone or subsite, use the line method to cover the area systematically and comprehensively.

Follow the steps below, using the diagram in Figure 8 as a guide.

1. The first team member initiates work using an edge as a reference point, progressing from one end of the work site or zone to the other (shown in yellow in the figure). The width of the worked area is adapted based on the density of vegetation and the type of weeds encountered. Each individual's worked area will vary accordingly.
2. The second team member is positioned slightly behind and to the side of the first team member, maintaining a distance of approximately 1–3 metres from the edge of the line (shown in red in the figure). This positioning allows the second member to see the area already worked and synchronise their weed control efforts to seamlessly connect with the first member's work. The width of the second member's worked area also adjusts based on vegetation density. To uphold team cohesion, the second member needs to ensure they do not fall more than 5–10 metres behind the first member.
3. Any additional team members adopt a similar arrangement (shown in blue in the figure), ensuring that the line remains staggered. All team members must maintain verbal communication with each other throughout the task.

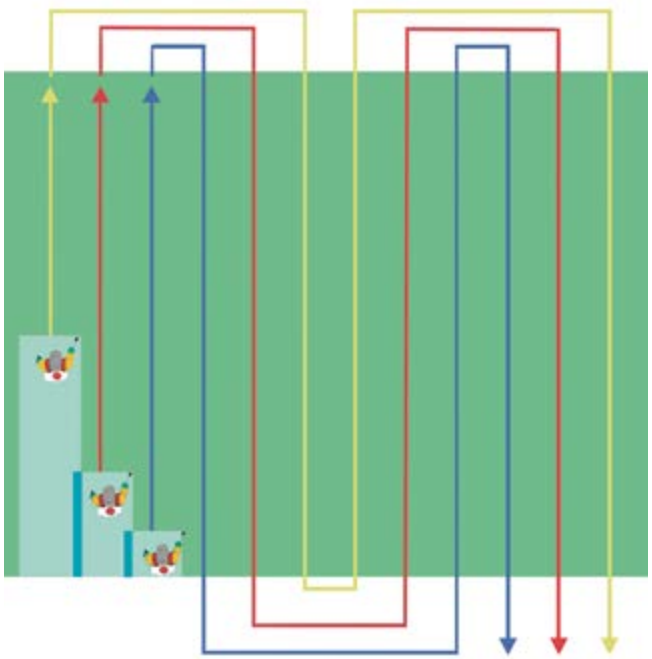


**Figure 8. Diagram showing the line method for working in a team**

## Tips for planning your work

- Scheduling your maintenance work by subsite or zone is a good way to manage your time, so it doesn't seem overwhelming.
- Looking at the priority works section of your plan can give you an idea of what has been done in each area. Some subsites might require more work than others, so be mindful that those subsites will generally need more maintenance.
- Stage treatments at different subsites to spread the workload out over the year.
- Be careful to not let any subsite go without maintenance for too long or the weed load will increase, and it will take you longer to get it to the target condition.
- Treating weeds early on in their growth cycle, while they are below knee height, will prevent them from seeding and mean less work and fewer resources needed later on.

# Planting management

While you will need to do ongoing maintenance for several years after planting, consistent and thorough care during the initial 1 to 2 years can significantly reduce the amount of maintenance needed later on.

## Supplementary planting

Supplementary planting usually happens for 2 reasons: plant loss and for planned vegetation succession.

**Plant loss** happens in most revegetation projects. Factors such as weather conditions, animals, insects and weeds can cause sufficient stress or damage to a plant so that it does not survive.

When plant losses accumulate, you may need to undertake additional planting to maintain project progress. This could involve replacing plants that haven't survived, to meet survival rate goals or to fill in gaps.

**Planned vegetation succession** is when a new species can be planted once a site reaches a state that will allow the species to survive. For example, in a rainforest restoration, your site needs an established canopy of pioneer species before you can plant mature-phase species that are sensitive to frost, sun or wind.

## Species selection

Choosing the correct species for your revegetation project is vital for its overall success. Start by seeing if your management plan has a species list, or plant community listed. If not, you can look this information up (see Section 6. Further resources) or look at what has previously thrived on your site and use those species as a guide.

Note that some species might take priority over others, because they grow faster or provide other benefits. These are your **pioneer species** – the resilient species that will establish best in degraded land. For large gaps, begin with pioneer species that are fast-growing and hardy, as they help establish a canopy and structure for the community.

An early canopy has several flow-on benefits, such as:

- filling in any gaps in your planting faster
- keeping your maintenance to a minimum
- attracting birds and animals into the site, which further encourages natural regeneration.

See the resource list in Section 6. Further resources for where to find information on species selection.

## Site preparation and timing

Your planted seedlings will get the best chance of survival if:

- they have less competition for space, nutrients and moisture
- weather conditions are suitable for germination and growth.

Choose a time when you can be confident that rain will likely fall in the first few weeks following planting. On the North Coast, this is typically from late summer to autumn. In frost-prone areas, planting early in this period allows plants to become well-established before the first frost. If there is adequate soil moisture, early spring can also be a good time to plant – just before summer's extreme heat sets in. Late autumn and winter are usually drier periods, making them less ideal for planting, as the cold months don't provide young plants with the early growth opportunities that warmer months do.

If rain doesn't happen as expected, you will need to water the plants regularly.

Before planting, you will need to take 2 essentials steps to prepare the site:

1. Remove all invasive woody weeds and vine weeds within the site using methods appropriate to the area.
2. Clear each planting spot in the shape of a circle 1 metre across (the seedling will go in the centre). You can clear the spot either by brushcutting to the ground or by using a herbicide.

If you decide to use any herbicides, make sure:

- the site is suitable – for example, not next to a waterway where chemical runoff could harm aquatic life
- you apply the herbicides 2–3 weeks before planting
- you follow all instructions and best practice for safe use.

See Section 3. Weed control for detailed information on weed control methods, including the use of herbicides.

## Planting method

When your planting site is ready, plant only one seedling in each circular spot you have prepared. For best results:

- Plant in soil, not mulch.
- In the centre of the spot, dig a hole deep enough for the plant's roots – at least the depth of the container the plant comes in.
- For clay soils, ensure the edge of the hole isn't smooth or glazed, as this can prevent roots from spreading into the surrounding soil.
- Water the plant before planting, and also water the hole to moisten the soil. Let it drain before placing the plant in. Water again after planting.
- Gently tap or knock the plant out of the container, either from the top or bottom, and squeeze the sides to loosen the root ball. Avoid pulling the plant out by the stem.
- If the roots are densely matted, gently tease them out before planting to encourage outward growth.
- Place the plant in the hole and firmly pack soil around it, ensuring the roots make good contact with the soil while still allowing air and water to penetrate.
- If necessary, place a tree guard around the plant to protect it. Take care when maintaining the plant while in its tree guard (see below).
- For some species, adding native plant fertiliser or slow-release tablets are recommended. Seek advice from your plant supplier.

## Maintenance

You will need to undertake maintenance tasks for several years after planting, until your efforts are no longer needed for the site to sustain itself.

Key maintenance tasks include:

- controlling weeds (see Section 3. Weed control)
- adding mulch as needed to maintain coverage and suppress weeds
- ensuring that fencing remains intact to protect plants from pests and animals
- replanting any species that have not survived or introducing new species instead
- fixing any damage to tree guards to protect your plants and removing them when not needed.

## Tree guards

Ensure weeds do not grow inside the tree guard, because they will outcompete the seedling (Figure 9). But do not use herbicide for weed control inside the tree guard, or you risk killing the seedling too.

**Figure 9. Weeds growing inside a tree guard**

Instead, lift the tree guard up and hand weed around the plant (Figure 10). Be careful not to pull the plant out with the weeds.

**Figure 10. Raised tree guard for hand weeding**

Place the tree guard back down around the plant (Figure 11).

**Figure 11. Tree guard in place around the plant**

Remove the tree guard when the plant has grown enough to start being restricted by it (Figure 12).

**Figure 12. Plant restricted by its tree guard**

Take care when removing a tree guard where the plant has started growing through it. It is best to use a box cutter to free the limbs before removing the guard (Figure 13).

**Figure 13. Using a box cutter to remove a tree guard**

Tall trees left too long may not be able to support themselves when guards are removed. If your plant needs extra support, leave the stakes in place and carefully attach them to the plant using a tree tie (Figure 14).

**Figure 14. Plant supported by stakes**

# Decisions in the field

## Sometimes controlling weed infestations can seem daunting and it can be hard to know where to start, especially if maintenance lapses and the weeds have had a chance to take hold.

Remember, the decisions you make in the field will depend on the characteristics of your site, as well as the time and resources available to you.

> **As a general guideline, the priority of work depends on how fast a site can change – that is, the density and vigour of weed growth – whether you do any treatment or not. If you expect to see little change from leaving the site untreated or treating it later, the work is lower priority.**

This section presents common scenarios in bush regeneration projects and how to approach the work needed – the goal you need to keep in mind **(think)**, what you need to **assess**, what you need to **consider** and any **actions** you can take.

## Working out priorities

**Think**

Your goal is to optimise your maintenance efforts so that all areas are treated and weed loads reduce over time.

**Assess**

If you only have a few hours on each maintenance run, divide the work into zones so it is manageable, and you are still achieving your goals. Then assess the work required in each zone.

For example, one area – Zone A – has groundcover weeds popping up throughout that are at ankle height (Figure 15). Another area – Zone B – has groundcover weeds at knee height and vine weeds spreading up the canopy and across the ground (Figure 16).

**Figure 15. Emerging weeds below knee height (Zone A)**

**Figure 16. Emerging weeds above knee height and growing into canopy (Zone B)**

You might decide to treat:

- Zone A first, because it will be quicker to complete, or
- Zone B first, because it contains vines in the canopy or problem weeds that are about to seed.

Addressing Zone A first allows you to take advantage of the reduced time required for treatment, creating a window of opportunity to manage Zone B without the added challenge of actively growing weeds from Zone A.

Addressing Zone B first allows you to prevent the weeds in the canopy and those about to seed from becoming larger infestations that are harder to treat – but by the time you finish, the weeds in Zone A might get to seeding stage.

Assess which strategic approach will optimise your maintenance efforts across both zones and ultimately reduce the overall time needed to achieve effective weed control.

**Consider**

When you plan to do your next maintenance run – the next day, the next week or at least another fortnight?

How fast is each zone likely to change without treatment?

Plan out time to look after your site, making it easier to know where to dedicate your efforts.

## Ground-storey weeds are in the planting zone

### Think

Your goal is to prevent ground-storey weeds from outcompeting your plantings for sunlight, water and nutrients.

### Assess

What is the best approach to achieving your goal?

When it comes to managing ground-storey weeds, the idea of 'kill all weeds' can be tempting but is not always the best approach.

Where mass planting has occurred in pasture, strategic, targeted treatment is more effective and sustainable, particularly when considering the ecological balance of the area and the long-term health of your native plantings.

In many restoration or planting projects, groundcover – whether native plants or non-invasive weeds – plays an important role in protecting the soil and supporting the surrounding environment.

A bare soil area, after weed removal, may not be ideal, especially in areas prone to erosion or near waterways (riparian areas).

To assess the situation and develop a targeted weed management strategy, ask yourself:

1. Will untreated weeds significantly impact native plant establishment?
2. Are the weeds seeding or likely to spread quickly?
3. Can the weeds be managed without chemical treatment?
4. What type of weeds are present? Is a selective herbicide the better option?
5. Does the whole area need treating, or just a 1-metre buffer around the plantings?
6. Can all the weeds be identified?

Remember if you don't know what the plant is, don't treat it! Take a photo and identify it, or wait for it to grow a bit and reveal some more features.

### Consider

If plantings are spaced far enough apart to mow, remember to keep on top of the mowing. Don't let the grass tower over your plantings.

If the weather is not compatible with spraying, can you brushcut the weeds to give you extra time before they seed?

Flagging plantings with pink tape or placing a bamboo stake next to them can help you avoid damaging them accidentally.

### Actions

**If weeds are under knee height**, and you can easily see your plantings:

- You can carefully spray the weeds.
- For a chemical-free method, hand weed around the plantings.
- If confident you can brushcut the weeds between plants, be very careful not to damage desirable plants.

## Actions

**If weeds tower above knee height** and tree locations are obscured or entangled within them:

- Refrain from spraying the area.
- Take the time to do the spray prep. Spray drift can kill your plantings and set the project back.

When hand weeding around planted trees, tagging natives with fluorescent tape can be helpful to know which plants to protect.

Flatten larger weeds by stomping or laying them over so they are lower to the ground, to prepare for herbicide application.

Carry out careful foliar herbicide spray.

If you do get off-target damage, *within 30–60 seconds* pour water on the plant to wash off the herbicide. It can be useful to carry a spray bottle of water for this purpose.

## Groundcover weeds are outcompeting desired plants but woody weeds are taking hold

**Think**

Your goal is to prevent weeds from seeding and from outcompeting desired plants for sunlight, water and nutrients.

**Assess**

How can you prioritise works to best meet these weed control objectives?

If your plantings are still small and being outcompeted by groundcover weeds, and you have woody weeds popping up sporadically throughout the project site, you might want to focus on the groundcover first.

**Consider**

While the goal is to comprehensively and systematically control all weeds to reduce the risk of weed recolonisation, in some circumstances prioritising targeted weed control may be necessary. That is, sometimes you need to concentrate on one weed species, such as:

- weeds that are highly invasive, dominating or difficult to control
- weeds with seasonal susceptibility, which must be treated while they are actively growing
- weeds approaching the seeding stage, which must be prevented to avoid building up a seed bank.

**Actions**

The ground-storey weeds are winning the competition for resources against your native plants, and the woody weeds are sparsely scattered and not producing seeds or fruits.

Removing the ground-storey weeds first will have the most significant impact on your plantings. This will give your plants more access to sunlight and nutrients.

Once ground-storey weeds are treated, move on to treating the woody weeds throughout the project site.

## Woody weeds are shading out the plantings

**Think**

Your goal is to prevent weeds from seeding and from outcompeting desired plants for sunlight, water and nutrients.

**Assess**

How can you prioritise works to best meet these weed control objectives?

If woody weeds have taken over by growing in a thicket or forming a canopy, this can shade the project area and make it hard to walk through with a spray pack. In these circumstances, you might want to focus on treating the woody weeds first.

**Consider**

Disturbing the weed canopy will improve growing conditions for your plants. But be aware that this disruption may trigger a mass germination of weed species, which means you will need to do well-timed follow-up treatments to prevent a rapid reinvasion. To avoid feeling overwhelmed, consider breaking the site into manageable sections for a more organised approach.

Your next scheduled maintenance run plays a crucial role in determining your weed control priorities. Knowing whether it's planned for the next day, the next week, or not for a couple of weeks, will help you identify which areas and weeds need immediate attention.

**Actions**

Removing the woody weeds first provides the most significant benefit to your plantings, as it allows them to access more sunlight and nutrients while also making it easier for you to maintain the site.

Start by treating the woody weed infestation.

Then move on to managing the ground-storey weeds that are competing with your native plants.

## Re-emerging vine weeds are on the ground and some have grown into the canopy

**Think**

Your goal is to prevent vines from smothering native vegetation and outcompeting them for sunlight, water and nutrients.

**Assess**

How can you prioritise works to best meet these weed control objectives?

Treating the canopy vines first creates the biggest change for the plantings by preventing them from being smothered. It also helps control the spread of vines by inhibiting their seed production.

**Consider**

Different vine weeds require specific management strategies. For detailed guidance, see the vine treatment suggestions in Section 3. Weed control.

Native vines can be just as destructive of regenerating canopy as exotic vines. Pruning (but not poisoning) them can help reduce the competition. Be mindful that native vines can provide important resources and habitat value. Assess the ecological significance of the vine before management.

For both native and exotic vines, seek further information on specific vine management from reliable sources or professional bush regenerators.

**Actions**

Re-emerging vine weeds are on the ground and some have grown into the canopy.

Treat the vines that have reached the canopy first.

If you have time, treat ground-storey vines on the same day, to prevent them from reaching and potentially harming your desired plants.

If you do not have time, make sure to do a follow-up treatment quickly, as ground-storey vines can spread rapidly and climb onto nearby vegetation, including your plantings.

## Vine weeds have completely covered native vegetation

### Think

Your goal is to treat the vines so desirable plants are not being smothered, and you can get the site back to a more manageable state.

### Assess

How can you prioritise works to best meet these weed-control objectives?

You will need to:

1. Stop the vines from smothering native vegetation.
2. Prevent the vines spreading into other plants.
3. Treat the vines to reduce the weed load.

Skirting is a method of weed control often used when a vine is smothering a native tree.

### Consider

Different vine weeds require specific management strategies. For detailed guidance, see the vine treatment suggestions in Section 3. Weed control.

Native vines can be just as destructive of regenerating canopy as exotic vines. Pruning (but not poisoning) them can help reduce the competition. Be mindful that native vines can provide important resources and habitat value. Assess the ecological significance of the vine before management.

If there are only a few stems climbing the plant, the scrape and paint method of weed control is more efficient than skirting.

Skirting is a great option for vines like cat's claw creeper (*Dolichandra unguis-cati*) and morning glory (*Ipomoea indica*).

Skirting is not recommended for madeira vine (*Anredera cordifolia*) because it has aerial tubers.

For both native and exotic vines, seek further information on specific vine management from reliable sources or professional bush regenerators.

### Actions

**Skirting**

Vines have taken over canopy and are strangling native vegetation.

Using a pair of secateurs or loppers, cut each vine at waist height. Do this right around the tree to every vine, which will leave a 'skirt'.

The thicker, older stems at ground level can then be cut or scraped and painted (see Section 3. Weed control for these 2 methods). Thinner, younger stems can be left, to be sprayed at a later date.

Allow the aerial vines to wither and die.

When doing follow-up inspections, look for any surviving stems, as they may still be alive despite the aerial parts dying back. Treat any missed stems accordingly.

Monitor for any vine seedlings that resurface and administer a follow-up treatment.

# Getting the right help

Managing a bush regeneration project can be challenging, and it's not always easy to know when to seek professional assistance. Remember, you don't have to do it alone – whether you're facing a tricky patch of weeds, need help during your busiest times, dealing with complex site conditions, or simply require expert advice.

Confidence grows through hands-on involvement and absorbing knowledge from practice. If you encounter challenges, don't hesitate to ask for guidance from your Local Land Services office, Landcare, or a professional bush regenerator.

## Professional bush regenerators

Professional bush regenerators can provide the support you need to keep your project on track and ensure its long-term success. Contractors offer flexible support options to suit your needs. They can assist with one-off sessions to get your project back on course, provide regular scheduled visits for ongoing management, or tackle the more challenging areas until you feel confident enough to take over. With their expertise, you can tailor the level of help to match your situation and ensure the continued progress of your bush regeneration efforts.

## Landcare

Landcare provides valuable support to landholders and Landcare groups, offering resources and guidance on best practices for bush regeneration, weed control, riparian restoration, landslip management, and more.

Build your skills by attending workshops, working bees and field days, or stay informed by signing up for a newsletter to keep up with events and opportunities in your area.

For additional resources, and to access lists of native nurseries and bush regeneration contractors, visit your local Landcare network's website.

To find your local Landcare network visit northcoastlandcare.org.au/our-networks/

North Coast Regional Landcare

# 3. Weed control

## Choosing your strategy

There is no one-size-fits-all approach when it comes to weed control. Choosing your strategy depends entirely on the circumstances and the site.

Factors that influence your choice of weed control strategy include:

- **weed size** – new and emerging weeds are typically easier to manage than large, mature weeds
- **weed density** – the extent of the weed infestation will affect the scale and type of treatment needed
- **area size** – larger areas will require a broader-scale treatment than smaller areas
- **topography** – the land's features, such as slope and presence of waterways, can determine the most suitable technique
- **weather** – seasonal conditions can impact the success of certain weeding methods
- **species** – the presence of endangered or vulnerable species (both plant and animal) may limit some weeding options
- **personal preferences** – for example, you may prefer to minimise or avoid the use of chemicals.

This section:

- outlines some common weed control methods
- explains how to use herbicides and other chemicals safely and effectively for weed control
- provides guidance on managing some of the most common weeds found on the North Coast.

## Control methods using herbicides

Herbicides are commonly used for controlling weeds in agricultural and non-agricultural situations, and there are many types of equipment and techniques available for applying them.

The appropriate option for your site will be determined by the size of the infestation, your available resources, access and personal preferences. This section describes 4 of the most commonly used application techniques:

- cut and paint
- scrape and paint
- stem injection
- foliar spray.

Each method has different target weeds, pros and cons, and equipment requirements, summarised for comparison in Table 7 and explained in the pages that follow. Section 5. Equipment contains more details on the equipment mentioned here.

For further information on weed control methods for specific weed profiles, go to NSW WeedWise at weeds.dpi.nsw.gov.au

**Table 7. Methods of weed control**

| Method | Cut and paint | Stem injection | Scrape and paint | Foliar spray |
|---|---|---|---|---|
| **Best for** | • Small to medium-sized woody weeds less than 10 cm across at the base<br>• Accessible sites where removal poses few challenges | • Larger shrubs and trees above 10 cm across at the base<br>• Inaccessible sites where removal is a problem | • Small shrubs and vines with thin and relatively soft bark, as well as those with woody stems – e.g. madeira vine<br>• Actively growing plants that are not under stress | • Shrubs, grasses, herbs, woody weeds and dense vines<br>• Emerging weeds before they grow to knee height |
| **Equipment required** | • Cutting equipment: secateurs, loppers, saw<br>• Herbicide applicator | • Cordless drill with a 10 mm drill bit<br>• Herbicide applicator<br>• Stem injection backpack | • Cutting equipment: knife, hori hori knife, secateurs<br>• Herbicide applicaton | • Knapsack sprayer |
| **Pros** | • Efficient and less labour-intensive compared to other methods<br>• Uses a smaller amount of herbicide than spraying<br>• Reduces the chance of chemical drift, making it a good choice near waterways | • Most cost-effective and fastest way to kill larger plants<br>• Preserves integrity of forest structure<br>• Stags can be beneficial by providing habitat<br>• Reduces the chance of chemical drift, making it a good choice near waterways | • Directly targets the vine stems, avoiding damage to surrounding vegetation<br>• More effective take-up of herbicide, increasing the chances of successful control | • Most cost-effective and fastest way to treat small and emerging weeds |
| **Cons** | • Labour-intensive if infestation is extensive<br>• Can reduce the amount of habitat for birds and other tree dwellers | • Labour-intensive if infestation is extensive<br>• Drill requires power; battery life limits working time<br>• Can be aesthetically unappealing<br>• Can become dangerous when limbs start to drop<br>• Can take a long time for the dead parts to rot away | • Labour-intensive if infestation is extensive | • Potential for spray drift<br>• Potential for off-target damage<br>• Depends on right weather conditions |

## Cut and paint

A cut and paint treatment (also known as 'cut-stump' or 'cut-surface' treatment) is a widely used method for controlling woody invasive plants that involves:

- physically removing the above-ground portions of the target plants
- applying chemicals to the exposed stumps or cut surfaces to control the roots and prevent regrowth.

**Best used for:**

- Small to medium-sized woody weeds up to 10 cm across at the base (basal diameter)

**Equipment:**

- Cutting tool, such as secateurs, loppers, folding saw
- Herbicide applicator

### Method

**Step 1:** Use appropriate cutting tools like secateurs, loppers or a folding saw to cut the stem of the invasive plant as close to the ground as possible (1–2 cm), ensuring that soil does not come in contact with the cut surface (Figure 17). This ensures the removal of the above-ground portions.

**Step 2:** Within 10–15 seconds after cutting, apply herbicide to the cut stem using a dripper bottle or dabber bottle (Figure 18). This immediate application prevents the plant cells from closing and allows the herbicide to pass into the open cells. For larger tree stumps, apply the herbicide solution around the edge of the stump where the veins and sap are (sapwood).

**Step 3:** Repeat the cutting and herbicide application process on all the main stems of the invasive plant. This comprehensive approach ensures that all potential regrowth points are treated.

**Cut–scrape–paint** is a modification of the cut and paint method. The difference is that in step 2, you use a knife to scrape the sides of the stump thoroughly to expose the green tissue, and apply herbicide to the scraped area. Again, the herbicide must be applied within 10 seconds of the cut or scrape being made, for it to be fully effective. The depth of the scrape depends on the depth and thickness of the bark of the plant.

| | |
|---|---|
| **Pros** | • Efficient and less labour-intensive compared to other methods<br>• Uses a smaller amount of herbicide than spraying<br>• Reduces the chance of chemical drift, making it a good choice near waterways |
| **Cons** | • Labour-intensive if infestation is extensive<br>• Can reduce the amount of habitat for birds and other tree dwellers |
| **Considerations** | • Plants should be healthy and actively growing, so that the herbicide penetrates their cells.<br>• Cut as close to the ground as possible, as flat as possible, to prevent trip hazards and spearing risks.<br>• If large tools like a chainsaw are needed to cut the plant, consider using the stem injection method instead. |

## Stem injection method

The stem injection method aims to control trees and shrubs in their current location. Leaving stags (poisoned trees or shrubs) in place preserves the integrity of the forest structure and habitat.

**Best used for:**

- Larger shrubs and trees above 10 cm basal diameter
- Inaccessible sites where large plant removal is a problem

**Equipment:**

- Cordless drill with a 10 mm drill bit
- Herbicide applicator
- Stem injection backpack

### Method

**Step 1:** Start by drilling a hole at the base of the tree. When drilling, make sure you drill:

- at a **45-degree angle** into the sapwood, which is the soft layer just beneath the bark – this angle helps prevent the herbicide from spilling out of the holes, allowing it to be absorbed more effectively (Figure 19)
- **parallel to the bark**, not straight into the centre of the tree, so that it penetrates the sapwood, where it will move through the tree's vascular system (Figure 20).

**Step 2:** Immediately after drilling the hole, fill it with the appropriate herbicide. It is crucial to act swiftly to prevent the hole from sealing up and to ensure that the herbicide is applied directly into the sapwood.

**Step 3:** Repeat steps 1 and 2 by drilling and filling holes all the way around the tree. It is important to drill and fill each hole in turn – do not do all the drilling and then go back and fill, unless you are working in a 2-person team (Figure 21).

**Hole spacing and alignment**, as shown in Figure 20:

- Space each hole about **5 cm apart** around the trunk, to ensure the herbicide is evenly distributed along the sapwood layer.
- Align each hole so that the **angle of drilling is consistent**, creating a nearly continuous line of holes around the tree. This increases the surface area exposed to the herbicide, enhancing its uptake by the tree's vascular system.

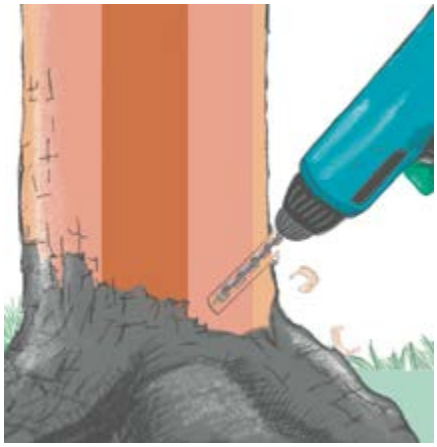


**Figure 19. Drilling a hole at a 45-degree angle into sapwood at a tree base**

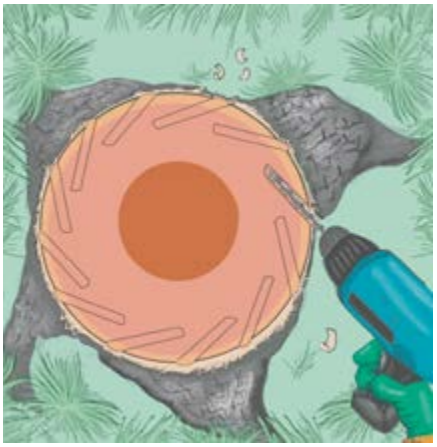


**Figure 20. Cross-section showing drill holes parallel to the bark at 5 cm intervals around the tree base**

**Figure 21. Two-person team: one drilling holes and the other filling holes with herbicide**

## Pros

- Most cost-effective and fastest way to kill larger plants
- Preserves integrity of forest structure
- Stags can be beneficial by providing habitat
- Reduces the chance of chemical drift, making it a good choice near waterways

## Cons

- Labour-intensive if infestation is extensive
- Drill requires power, so battery life limits working time
- Can be aesthetically unappealing
- Can become dangerous when limbs start to drop
- Can take a long time for the dead parts to rot away

## Considerations

- Plants should be healthy and actively growing, so that the herbicide can be absorbed into their systems.
- For multi-stemmed plants, inject below the lowest branch or treat each stem individually.
- While it can be tempting to drill at a height where little bending is required, going lower towards the base of the tree is more effective.
- For large trees a 2-person team – one doing the drilling and one applying herbicide – can be more efficient.

## Scrape and paint method

Stem scraping and painting is an effective method for treating small shrubs and vines with thin and relatively soft bark. It is most suitable for actively growing plants that are not under stress.

**Best used for:**

- Vines and scramblers with woody stems, especially where the cut and paint method will not effectively control cut stems
- Weeds with aerial tubers like madeira vine

**Equipment:**

- Cutting tools: knife, hori hori, secateurs
- Herbicide applicator

### Method

**Step 1:** Using a knife, scrape a 15–30 cm long section at the base of the stem. Be careful not to cut right through the stem. The aim is to expose the sapwood layer just below the bark (the green layer) (Figure 22).

For stems larger than 1 cm across, scrape both sides of the stem. Be careful to scrape only one-third or less of the way around, so as not to ringbark the stem.

**Step 2:** Immediately after scraping, apply the herbicide directly to the exposed sapwood (Figure 23).

**Step 3:** Repeat the scraping and herbicide application process on all the main stems of the target plant. This comprehensive approach ensures that all potential regrowth points are treated.

**Figure 22. Scraping a 15–30 cm section of the stem**

**Figure 23. Application of herbicide to sapwood exposed by scraping**

### Pros

- Directly targets the vine stems, avoiding damage to surrounding vegetation
- More effective take-up of herbicide, increasing the chances of successful control

### Cons

- Labour-intensive if infestation is extensive

### Considerations

- Plants should be healthy and actively growing, so that the herbicide is absorbed into their systems.
- Herbicide must be applied immediately so that it is absorbed before the plant cells close.

## Foliar spray

Foliar (spot) spraying is the fastest and most efficient approach to site maintenance. By consistently applying this method when revisiting your site, you can address all emerging weeds before they grow to knee height.

**Best used for:**

- Shrubs, grasses, herbs/forbs, woody weeds and dense vines where complete coverage can be achieved

**Equipment:**

- Knapsack sprayer
- Personal protective equipment (PPE)

### Method

Using a knapsack filled with an appropriate herbicide mix, spray herbicide directly onto the target plants, covering all leaves and stems to ensure they are thoroughly wetted (Figure 24).

Be sure to:

- spray close to target weed, keeping a controlled distance to avoid herbicide drift or splashing onto other plants
- be mindful of the wind to prevent spray from reaching nearby plants you want to protect
- take a systematic approach, to avoid reapplying to the same area.

Detailed procedures for preparing herbicide and using a knapsack sprayer are provided later in this section.

**Figure 24. Foliar spraying small weeds**

### Pros

- Most cost-effective and fastest way to treat weeds

### Cons

- Potential for spray drift
- Potential for off-target damage

### Considerations

- Before selecting the appropriate herbicide and PPE, it is crucial to read and understand herbicide labels and safety data sheets (SDS). See below in this section, and see Section 5. Equipment on PPE.
- Target plants should be healthy, actively growing and below knee height.
- Where weeds are too close to planted and native species, conduct an initial run of hand-weeding to allow for an effective spray run, without the need for intricate spraying.
- Some weather conditions can reduce the effectiveness of treatment. **Hot, dry weather** can increase the risk of the herbicide evaporating before it takes effect, as well as potential drift and off-target damage. **Rainfall** may also cause treatment to be less effective, as it washes the herbicide off, and also increases the risk of off-target damage. **Wind speed higher than 15 km/h** increases the risk of herbicide drift and off-target damage.

# Choosing the right herbicide

## Using the appropriate herbicide is crucial for effective weed control.

Having some understanding of their effects on plants can help you choose the most suitable herbicide for specific weed species.

When choosing a herbicide, ask yourself:

- Is a selective herbicide required to prevent damage to native species?
- Is the site located in a restricted area, such as near waterways?
- What is the optimal timing for treatment? Plants need to be actively growing for some herbicides to be effective.

Herbicides are chemical substances specifically designed to manage unwanted plant growth. They work by speeding up, slowing down, or changing a plant's natural growth pattern. They do this by various **modes of action**, such as:

- disrupting protein synthesis
- inhibiting enzyme activity
- interfering with photosynthesis.

### Plant species and growth stage

For herbicides to be effective, plants must be actively growing and vulnerable to treatment. The growth stage of the target weed is critical because certain herbicides are more effective at specific stages of plant development. Applying herbicides when plants are dormant or not actively growing will likely be less effective.

Some herbicides are only effective, or are more effective, on specific plant species. You will need to identify the invasive plant species you want to target before you decide which herbicide to use on it. Treatment of common weeds in the North Coast (below) provides details on specific herbicides used in the treatment of particular weed types. See also the weeds information in Section 6. Further resources and field guides and apps in Section 4. Plant identification.

### Types of herbicide

You should carefully tailor your herbicide selection to the specific characteristics of the site, including the weed species present and your management objectives. Understanding the mechanisms and modes of action of herbicides will enhance their effectiveness and sustainability as part of a comprehensive weed management strategy. Table 8 summarises the main types of herbicides available.

**Table 8. How different herbicides work**

| Herbicide type | Application |
|---|---|
| Contact | Contact herbicides kill the parts of the plants they are applied to – usually limited to leaves and stems. They are more effective on annual weeds or on seedlings of perennial weeds. Plants need to be actively growing when contact herbicides are applied, and good coverage is required to achieve effective results. |
| Systemic | Systemic herbicides are absorbed by plant tissues and spread throughout the plant, affecting various vital systems. This allows for more comprehensive control of the weed, including underground portions. |
| Selective | Selective herbicides are designed to target specific types of plants while minimising damage to desirable plants. For example, broadleaf herbicides target weeds like clover and bindis, while monocot herbicides target grasses and grass-like plants. |
| Non-selective | Non-selective herbicides are designed to control or kill a wide range of plant species. |
| Residual | Residual herbicides remain active in the soil for an extended period (usually months) and can act on successive weed germinations. |
| Non-residual | Non-residual herbicides have little or no soil activity and are quickly deactivated either by being broken down or bound to soil particles, becoming less available to growing plants. They also may have little or no ability to be absorbed by roots. |
| Pre-emergent | Pre-emergent herbicides are applied to soils to prevent new weeds from emerging. They can have a long residual effect in the soil, lasting for months or even years, hindering the establishment of not only weed seeds but also native plant seeds. For this reason, pre-emergent herbicides are rarely used in ecological restoration projects. |
| Post-emergent | Post-emergent herbicides are applied above the ground to treat seedlings or mature weeds. Most herbicides used in ecological restoration projects are post-emergent. |

## Environmental factors

Another factor to consider is the negative impact many chemicals have on the natural environment. Ecological restoration tends to take place in delicate natural environments, so you need to check that specific chemicals are registered for use in certain areas, for example near waterways.

## Permits

Some herbicides require you to have a permit to use them. These are **registered herbicides**.

All registered herbicides are registered for use on specific weeds, within specific circumstances, and must be used as per the directions on the label. Situations can arise where chemicals are needed for a use not specified on the label, termed an 'off-label' use.

You can sometimes obtain a 'minor-use permit' that allows you to use a registered herbicide for off-label use. The Australian Pesticides & Veterinary Medicines Authority (APVMA) issues minor-use permits after evaluating the herbicide's stability, efficacy, and potential economic, environmental and social risks.

Before using a herbicide in an off-label application, you must obtain the right permit from the APVMA and review it thoroughly to make sure you understand all its details, conditions and limitations. When you use the herbicide, you must comply with all the requirements of the permit, as well as the label instructions for use.

## More information

If you're uncertain about the best product to use for your site or target weed species, or whether a permit is needed, 2 good sources of information are:

- for comprehensive details on herbicide use – the NSW WeedWise website weeds.dpi.nsw.gov.au
- for information about individual chemicals – the SDS provided with each herbicide or available from its manufacturer.

# Using herbicides effectively and safely

The *Pesticides Act 1999* (NSW) is the main law that regulates pesticide use (including herbicides) in New South Wales and is enforced by the NSW Environment Protection Authority (EPA). The Act's key principle is that pesticides must only be used for the purpose specified on the product label, and all instructions on the label must be strictly followed. Therefore, it is important that users read or have the label instructions explained to them before each use of the pesticide.

Pesticide users are responsible for protecting their own health, as well as the health of others, when handling pesticides. They must also take all reasonable steps to avoid causing harm, such as by preventing off-target drift to sensitive areas and protecting endangered or protected species.

**Read the information provided on the herbicide label and safety data sheet (SDS), and follow all instructions carefully**, to:

- ensure your weed control efforts are effective
- minimise the risk of unintended consequences – for you and other people, for non-target plant species, and for animals on and near your site.

## Herbicide label information

The label provides detailed information on:

- group classification and active constituent of the herbicide
- the intended use
- directions for use, including recommended application rates and dilution rates
- safety precautions and any specific environmental considerations.

The **group** classification provides information about the herbicide's mode of action and chemical family. It helps identify the herbicide's target weeds and its effectiveness in controlling them.

The **active constituent** is the chemical ingredient responsible for the herbicidal activity. Knowing the active constituent helps identify the herbicide's specific properties and potential risks.

The **description of use** section sets out the intended use of the herbicide, such as pre-emergent or post-emergent weed control, selective or non-selective control (see Table 8 for explanation of these terms), and target crops or areas of application.

The **directions for use** section provides essential information on how to use the herbicide properly. It includes application rates, application methods, timing, mixing instructions (such as dilution ratios), and any necessary precautions or restraints for use.

**Mix rates** indicate the recommended amount of herbicide to be applied to a specific area, usually expressed in litres per hectare (L/ha). Follow these rates to ensure accurate application and to avoid underuse or overuse of the herbicide.

**Restraints** highlight any specific limitations or restrictions associated with the herbicide's use. These may include restrictions on specific crops, application timing, buffer zones, or environmental considerations.

## Safety data sheets (SDS)

Safety data sheets (SDS) – sometimes called material safety data sheets (MSDS) – are documents that provide important safety information about a chemical. They contain more information than is on a herbicide's label, including:

- first aid measures – what to do if the herbicide comes into contact with your skin or eyes, or you inhale or swallow it
- accidental release measures – what to do if the herbicide spills or escapes containment
- handling and storage – how and where to keep the herbicide safely
- exposure controls and personal protection – for example, whether you need to wear PPE such as gloves or a mask, and what type of PPE, when handling the herbicide
- toxicological and ecological Information – specific ways that the herbicide is toxic and where it can harm ecological systems.

If your herbicide is not supplied with an SDS, check the manufacturer's website. Most manufacturers have their products' SDS available for free download.

# Preparing herbicides for use

Most herbicides are concentrates that require mixing with water or another carrier solution before use. Some herbicides also need additives.

Take proper safety measures when preparing your herbicide:

- Do all measuring and mixing in an area that is well-ventilated, well-lit and level, and where there is a supply of clean water.
- Wear appropriate PPE.
- Follow all instructions on labels and SDS of herbicides, carrier solutions other than water, and additives.

## Dilution ratios

Herbicide dilution ratios refer to the recommended proportions for mixing herbicides with water or other carrier solutions before application, to optimise the herbicide's effectiveness while minimising risks.

Dilution ratios are shown as herbicide to carrier volume ratios – for example, 1:10, 1:50, 1:100. The first number indicates the amount of herbicide concentrate, and the second number shows the volume of water or carrier solution. For instance, a 1:50 dilution ratio means combining 1 part of herbicide concentrate with 50 parts of water or carrier solution.

These ratios can be found on the herbicide label with directions for use. The specific dilution ratio for a particular herbicide will vary depending on the product, the target weed species, and the desired level of control. Table 9 shows some common recommended dilution ratios, but be aware that these may not be the same for all herbicides. You must carefully read and follow the label's instructions for the correct dilution ratio for your specific application.

## Additives

Before mixing an additive into your herbicide, review the label. Some herbicide products already include these additives, potentially offering a more cost-effective and efficient solution. You might also need an off-label permit.

As with herbicides, some additives can be harmful to the environment, so always follow label directions.

Common additives and their purposes include the following:

- **Surfactants** reduce the surface tension of the herbicide solution, ensuring maximum contact between chemical droplets and the plant.
- **Spray marker dyes** act as a visual guide during chemical spray applications, so you can easily identify the treated areas.
- **Penetrants** enhance external-to-internal penetration of the plant, facilitating the herbicide's movement throughout the plant's systems.
- **Oils** enhance the herbicide's water fastness, reducing spray drift, increasing herbicide coverage, and minimising runoff.
- **Buffer solutions** prevent alterations in pH level (acidity) when the herbicide comes into contact with water (for example, in runoff to waterways).

**Table 9. Common herbicide dilution ratios**

| Ratio | Herbicide volume | Water volume | Application methods |
|---|---|---|---|
| 1:1 | 500 ml | 500 ml | Cut and paint, stem injection, scrape and paint |
| 1:1.5 | 400 ml | 600 ml | Cut and paint, stem injection, scrape and paint |
| 1:50 | 200 ml | 10 L | Foliar spray |
| 1:100 | 100 ml | 10 L | Foliar spray |
| 1:150 | 67 ml | 10 L | Foliar spray |
| 1:200 | 50 ml | 10 L | Foliar spray |

# Foliar spraying – a step-by-step guide

## Getting set up

1. Ensure that weather conditions are suitable for spraying, with a wind speed of less than 15 km/h and no rain forecast for the next 2+ hours.
2. Place the knapsack on flat ground or on a level surface, and open the lid.
3. Fill the knapsack sprayer with clean water to the desired level – for example, 10 litres.
4. Pump the handle and test the spray to check for leaks, then adjust the nozzle to the desired stream size. Avoid using a fan nozzle or wide stream when spot spraying.
5. Follow all herbicide product label instructions exactly, and follow the manufacturer's specific guidelines to add the appropriate amount of herbicide, including additives such as surfactant and spray dye if required.
6. Screw the knapsack lid back on securely and shake it on the ground. Check the lid is correctly adjusted and that there are no leaks.
7. If the knapsack is on the ground, lift it to a flat surface, like the tray of a ute, and then put it onto your back from the edge of that surface.

## Applying the herbicide

1. **Hold the spray nozzle to the side of your body.** This minimises the risk of directly walking through or over the area being sprayed.
2. **Spray at the required height above the target**, ensuring the herbicide is applied effectively to the target without unnecessary overspray or drift. Avoid spraying above knee height.
3. Spray to cover the plant but do not overspray.
4. **If unable to identify a plant, do not spray it**, because it could be a native. Come back at a later date and identify plant.
5. **Walk systematically through the area**. You may need several sweeps across the area to cover it completely.
6. **Ensure you are meeting up with previous work**. Consistency in coverage is important to achieve effective weed control. Using marker dye or points of reference helps maintain a systematic and organised approach, reducing the likelihood of overlapping or missed areas.
7. If off-target damage occurs, use water to wash off the herbicide.
8. **Clean out the knapsack and dispose of residue water appropriately**. Proper cleanup is essential to prevent herbicide contamination and to ensure the safety of future applications. For details, see *Safe use and storage of chemicals (including pesticides and herbicides) in agriculture* available from SafeWork NSW.

## Servicing and maintaining a knapsack sprayer

Proper servicing and maintenance of modern pressure sprayers and knapsacks are essential to keep the equipment in optimal condition.

1. Study the manufacturer's manual. The manual provides valuable information on maintenance requirements, recommended cleaning procedures, and any specific considerations for your equipment model.
2. After each use, it is important to clean both the interior and exterior of the sprayer.
3. Periodically disassemble the sprayer to clean each part thoroughly.
4. Inspect the O-rings, which are rubber seals found in various parts of the sprayer, such as the cap, wand or nozzle. Check for signs of wear, cracks and deterioration.
5. Ultraviolet (UV) rays can degrade plastic materials and shorten the sprayer's lifespan. When not in use, store the plastic sprayer in a shaded area or cover it with a protective cover.

## Tips for foliar spraying

- When you need to refill the knapsack, take the opportunity for a 5-minute break to stretch and drink water.
- Divide the spray area into realistic zones for the time you have allocated to spraying.
- Work methodically within each zone.
- For spot spraying, limit the knapsack volume to around 8 to 10 litres, to ease the strain on your back.

# Treatment of common weeds in the North Coast

## Vines

### Madeira vine (*Anredera cordifolia*)

Madeira vine is a vigorous, robust, fleshy, and extensive twining, hairless, perennial climber that can grow to more than 30 metres long. It features conspicuous aerial tubers along the stem and is capable of smothering and weighing down large mature trees.

#### Key characteristics

- **Leaves:** Alternate, fleshy, glossy, heart-shaped, bright green, 4–5 cm in length.
- **Stems:** Hairless and slender when young; woody when mature.
- **Aerial tubers:** Light brown, warty aerial tubers along the length of the stem produces.
- **Flowers:** Cream-coloured flower spikes approximately 10 cm long, from December to April.

Leaves

Plant

Tubers

Flower

Seedling

## Management

Preventing the spread of tubers and exhausting the tuber bank is the key to effective management of madeira vine. In the maintenance phase, the infestation should be manageable enough for regular follow-up control, typically 2 or 3 times a year.

### Scrape and paint

This method is effective for medium to large stems and safe for sensitive environments, but requires individual treatment of each vine, which can be labour-intensive. For this method:

- Scrape sections of the vine down to the white fibrous layer and apply concentrated herbicide within 15 seconds.
- Repeat this process as high up the stem as possible, scraping both sides if feasible (but avoid ringbarking).

Collect tubers near the scraped areas, as they may fall off during treatment.

### Foliar spray

Typically, foliar spraying is the most efficient secondary treatment to manage prostrate growth (that is, along the ground) and seedlings, once the primary stems have been treated using scrape and paint techniques.

Spraying is suitable for seedlings and for plants growing along the ground, over structures or over other non-desirable plants. For this method:

- Apply herbicide to all foliage to the point of visible wetness.
- If a vine does not have tubers and is climbing on desirable plants, pull it off gently and spray it on the ground.

### Manual removal

Manual removal is effective for smaller or immature infestation sites. For this method:

- Dig up and collect all plant parts, including tubers, leaves, and stems, as they can regrow if left in soil or exposed to sunlight.
- If host plants are stressed, cut and remove the vine from the canopy, laying tarps on the ground to catch falling aerial tubers. Cut vines can drop tubers for up to 2 years, so it's crucial to remove as much plant material as possible.
- Madeira vine can be composted, but choose a compost site that is easy to inspect and manage, avoiding flood-prone or easily disturbed areas. Consult your local council for additional disposal guidance.

**Table 10. Suggested herbicide applications for madeira vine**

| Herbicide | Mix | Comments | Method |
|---|---|---|---|
| Glyphosate 360 g/L<br>Permit no. PER9907* | Ratio: 1:100<br>100 ml to 10 L water<br>Additive: surfactant | Spot spray for seedling control. | Foliar spray |
| Glyphosate 360 g/L<br>Metsulfuron-methyl 600 g/kg<br>Permit no. PER9907* | Ratio: 1:50<br>200 ml glyphosate plus 1.5 g metsulfuron-methyl per 10 L water | Spot spray for seedling control.<br>Combination approach, more effective at being absorbed into tubers. | Foliar spray |
| Glyphosate 360 g/L<br>Permit no. PER9907* | Undiluted | Appropriate for medium-sized to well-established vines with tubers. | Scrape and paint |

* Verify permit number validity on the APVMA website apvma.gov.au.

# Vines

## Mile-a-minute (*Ipomoea cairica*) and morning glory (*Ipomoea indica*)

Mile-a-minute and morning glory vines are perennial climbers that tend to overtake and smother other vegetation, particularly along riverbanks.

### Key characteristics – mile-a-minute

- **Leaves**: Deeply divided leaves with 5 to 7 lobes.
- **Flowers**: Funnel-shaped and have a lavender colour. The throat of the flower is usually a deeper shade, adding to its visual appeal.

Mile-a-minute flower

Mile-a-minute leaves (mature)

Mile-a-minute seedling

### Key characteristics – morning glory

- **Leaves**: Heart-shaped or 3-lobed, 2–18 cm long.
- **Flowers**: Funnel-shaped, a violet-blue colour with paler lines on the petals.

Morning glory flower

Morning glory leaves

Morning glory plant

Mile-a-minute plant

## Management

In the maintenance phase, the infestation should be manageable enough to enable follow-up control of regrowth or seedlings 2 or 3 times a year.

### Foliar spray

Typically, foliar spraying is the most efficient secondary treatment to manage prostrate growth and seedlings, once the primary stems have been treated using scrape and paint techniques. Spray actively growing plants and ensure that all of the foliage is covered with the herbicide mix.

### Cut and paint

Cut stems close to the ground, preferably within 10 cm from the soil. Apply herbicide gel to the cut surface connected to the soil within 15 seconds of cutting. Climbing stems can be left in place to wither and die. If there are any stems touching the ground, collect them and either take them off-site for disposal, or leave them on-site to dry out without contacting the soil.

### Scrape and paint

Cut stems to within 1 metre of where the vine is firmly rooted in the soil. Use a sharp knife to scrape a very thin layer of bark from a 15–30 cm section of the stem. Apply the herbicide to the exposed soft underlying green tissue within 15 seconds of making the scrape. If there are any stems touching the ground, collect them and either take them off-site for disposal, or leave them to dry out on-site, without contacting the soil.

### Manual removal

Small plants and seedlings can be hand pulled. Some larger plants may be pulled out in soft sandy soils. Climbing stems can be cut and left above the ground to dry out and die. Make sure no cut stems have contact with the soil. Dig out the crown and roots carefully as they can regrow from parts left in the soil.

**Table 11. Suggested herbicide applications for mile-a-minute and morning glory vines**

| Herbicide | Mix | Comments | Method |
|---|---|---|---|
| Glyphosate 360 g/L<br>Permit no. PER9907* | Ratio: 1:50<br>200 ml to 10 L water | Spot spray for seedling control. | Foliar spray |
| Glyphosate 360 g/L plus metsulfuron-methyl 600 g/kg<br>Permit no. PER9907* | Ratio: 1:50<br>200 ml glyphosate plus 1.5 g metsulfuron-methyl per 10 L water | Spot spray for seedling control. | Foliar spray |
| Glyphosate 360 g/L<br>Permit no. PER9907* | Ratio: 1:1.5<br>1 part glyphosate per 1.5 parts water | – | Scrape and paint |
| Picloram 44.7 g/L plus aminopyralid 4.47 g/L (Vigilant II®) | Undiluted | Apply a 3–5 mm layer of gel for stems less than 20 mm.<br>Apply 5 mm layer on stems above 20 mm | Cut and paint |

* Verify permit number validity on the APVMA website apvma.gov.au

# Vines

## Cat's claw creeper (*Dolichandra unguis-cati*)

Cat's claw creeper is an invasive, woody vine with yellow flowers. It kills trees and shrubs, and reduces food and shelter for native animals.

### Key characteristics

- **Leaves**: Opposite, usually in pairs (occasionally up to 5 in young plants) on a stalk with a tendril at the end.
- **Tendrils**: Three-pronged with stiff, hook-like tips.
- **Flowers**: Yellow, often with orange lines, trumpet-shaped, 4–8 cm long with 2 cm petals, blooming in spring.

**Flower**

**Plant**

**Leaves**

**Tendrils**

**Seedling**

*All photos (excluding full plant):* J Hosking, NSW DPI

## Management

Successful weed control relies on follow-up after the initial efforts. This means looking for and killing regrowth or new seedlings. Using a combination of control methods is usually more successful than a single method. Actively check for new plants in uninfested areas and control these as soon as possible. Identify locations where cat's claw creeper occurs as isolated plants or sparse populations. Treat these plants first and remove nearby seedlings before working on dense infestations.

### Foliar spray

Where possible, when the vines have not grown too high, pull cat's claw creeper down from desirable plants as it may be difficult to spray the leaves of the vine without also spraying the host. Use hand-held equipment to spray regrowth, seedlings and stems with foliage that is less than 2 metres tall.

### Cut and paint

Cut and paint is the best method for large plants. Cut the climbing stems first, at about 1–2 metres above the ground, to clear a work area. Leave the aerial parts to die. Recut all stems as close to the ground as possible. Cut and also scrape the stumps of thicker stems. Apply each cut or scraped surface with herbicide within 15 seconds.

### Scrape and paint

Cut stems about 50 cm from where they emerge from the ground and leave the upper stems to die in place. Scrape a strip of bark off one side of the lower stems and apply herbicide within 15 seconds to the scrape. Use a dye in the herbicide mixture so you can see which stems have been treated. **Stem injection**

Thick vines can be treated by drilling holes approximately 10 cm apart around the woody stem of the plant using a 10 cm drill bit. Then fill these holes with herbicide within 15 seconds. If large tubers are found underground, drill and inject these with herbicide too. Spring to autumn, when new growth is present, is usually the most effective time for stem injection.

### Manual removal

Pull stems away from trees or buildings and cut them to create a gap between the ground and the upper vine parts. Avoid pulling stems from the tree canopy, to prevent damaging desirable plants and to avoid safety hazards.

Cut upper vine parts will eventually die. If growth persists, ensure all stems have been cut. Remove seedlings and small plants by digging out their tubers. For older plants, be cautious with removing large tuberous root masses, as this can cause significant soil disturbance and may not be suitable for all conditions.

**Table 12. Suggested herbicide applications for cat's claw creeper**

| Herbicide | Mix | Comments | Method |
|---|---|---|---|
| Glyphosate 360 g/L<br>Permit no. PER9907* | Ratio: 1:50<br>200 ml to 10 L water | Spray to kill regrowth. | Foliar spray |
| Glyphosate 360 g/L<br>Permit no. PER9907* | Ratio: 1:1.5<br>1 part glyphosate per 1.5 parts water | – | Cut and paint, scrape and paint, stem injection |
| Picloram 44.7 g/L plus aminopyralid 4.47 g/L (Vigilant II®) | Undiluted | Apply a 3–5 mm layer of gel for stems less than 20 mm.<br>Apply 5 mm layer on stems above 20 mm. | Cut and paint |

* Verify permit number validity on the APVMA website apvma.gov.au

## Shrubs

# Lady-of-the-night (*Cestrum nocturnum*)

Lady-of-the-night is toxic to people and animals, and its strongly scented flowers can cause irritation or breathing difficulties. It can also reduce livestock productivity by making infested pastures unsafe for grazing and may outcompete native plants by forming dense thickets.

### Key characteristics

- **Leaves**: Oval to spearhead shape, 10–15 cm long and 4–7 cm wide, supported by stalks 5–10 mm long, a **hairy midrib on the underside**.
- **Flowers**: Greenish, pale yellow or cream in colour; tubular with 5 triangular lobes that open at night, measuring up to 2.5 cm long, arranged in branching clusters at the ends of short stems; present during spring and summer.
- **Fruit**: Green when young, white when ripe, 8–12 mm wide, round or oval in shape, contain up to 10 seeds.

Flower

Leaves

Plant

Seedling

Fruit

## Management

When handling lady-of-the-night, wear personal protective equipment such as gloves to avoid poisoning. Always wash your hands before eating if you've touched the plant. Treat plants before they produce fruit, control regrowth from previously treated plants, and continuously check for new seedlings for several years, as seeds can remain dormant.

### Foliar spray

Spray plants to thoroughly cover all of the foliage. Spraying will not kill the fruit. If possible, collect the fruit and dispose of it. Contact your local council for disposal methods.

### Cut and paint

Cut the main stem and apply herbicide to the stump within 15 seconds of cutting.

### Manual removal

Dig out small plants. Do not leave stems in contact with the soil because they may sprout.

**Table 13. Suggested herbicide applications for lady-of-the-night**

| Herbicide | Mix | Comments | Method |
|---|---|---|---|
| Glyphosate 360 g/L<br>Permit no. PER9907* | Ratio: 1:50<br>200 ml to 10 L water | Spot spray. | Foliar spray |
| Glyphosate 360 g/L<br>Permit no. PER9907* | Ratio: 1:1.5<br>1 part glyphosate per 1.5 parts water | – | Cut and paint |

* Verify permit number validity on the APVMA website apvma.gov.au

# Shrubs

## Lantana (*Lantana camara*)

Lantana is a heavily branched shrub that can grow in compact clumps, dense thickets or as a climbing vine.

### Key characteristics

- **Leaves**: About 6 cm long; covered in fine hairs; bright green above, paler beneath; round-toothed edges.
- **Flowers**: Appear throughout most of the year in clustered, compact heads about 2.5 cm in diameter; colours vary from pale cream to yellow, white, pink, orange and red.
- **Fruit**: Round, berry-like fruit that turn from glossy green to purplish-black when ripe.

Flower

Plant

Leaves

Seedling

Fruit

## Management

Start at the edges of the infestation and manage sections progressively, ensuring follow-up on treated areas. Treat mature lantana plants during dry or frosty periods. Address regrowth or seedlings before they reach 1 metre in height. Control young plants before they turn 1 year old to stop new fruit and seeds.

### Foliar spray

Small plants less than 2 metres high can be sprayed at any time of year as long as they are actively growing. Stressed plants don't take up much herbicide. Treat regrowth when plants are 30 cm to 1 metre high.

Spray mature lantana (less than 2 metres high) between February and April or the first frost. Early morning or late afternoon is the best time to spray during autumn.

### Cut and paint

Cut stems off at about 15 cm from the ground. Apply herbicide to the cut surface of the stump within 15 seconds. Treat every cut stem because lantana regrows vigorously from untreated stems.

### Manual removal

Hand-pulling can work on small infestations, isolated plants and in steep areas that machinery cannot access. The best time is after rain when soil is moist. Wear gloves when hand-pulling. Grub out roots with a mattock or hoe, then roll and haul the stems and roots away. Remove the roots and stems or the lantana will regrow.

**Table 14. Suggested herbicide applications for lantana**

| Herbicide | Mix | Comments | Method |
|---|---|---|---|
| Glyphosate 360 g/L<br>Permit no. PER9907* | Ratio: 1:100<br>100 ml to 10 L water plus surfactant | Apply to plants that are actively growing with full foliage. Avoid summer stress. | Foliar spray |
| Picloram 44.7 g/L plus aminopyralid 4.47 g/L (Vigilant II®) | Undiluted | Apply a 3–5 mm layer of gel for stems less than 20 mm.<br>Apply 5 mm layer on stems above 20 mm. | Cut and paint |

* Verify permit number validity on the APVMA website apvma.gov.au

## Shrubs

# Ochna (*Ochna serrulata*)

Ochna, commonly known as the Mickey Mouse plant, is a small to medium-sized evergreen shrub or small tree.

### Key characteristics

- **Leaves**: Alternately arranged, oblong to lanceolate, finely serrated and often wavy margins, reaching up to 6 cm in length, glossy green with a slightly paler underside, new growth appears reddish-brown.
- **Flowers**: Present in spring; 5 yellow petals, each up to 10 mm long, and 5 green sepals, up to 8 mm long, which curve backward and turn red, remaining on the plant below the fruit.
- **Fruit**: Green, turning black when ripe, 5–8 mm long, oval-shaped, arranged in rings of up to 6 fruits surrounded by 5 red sepals up to 1.5 cm long; single-seeded; present from September to March, with most ripening in December.

Flower

Plant

Leaves

Seedling

Fruit (unripe)

Fruit (ripe)

## Management

Dig out small plants (under 20 cm high), ensuring all roots are removed. Control plants before they produce fruit (which takes at least 3 years), and consistently check and follow up on initial control efforts, as the weed is very hardy and often resprouts.

### Foliar spray

Spraying is best for plants below knee height. Apply to all foliage to the point of visible wetness.

### Cut and paint

This method is suitable for plants with thick stems. Cut trunks or stems of the plant as low to the ground as possible and apply herbicide to the stump within 15 seconds of cutting. For best results, dig below the cut and scrape the stem to expose the green layer under the bark. Apply herbicide to the scraped stem within 15 seconds of scraping.

### Scrape and paint

This method is suitable for small plants with thin stems. Scrape the stem gently to expose the green layer under the bark. Start at the base of the plant and scrape as high as possible. Apply herbicide within 15 seconds of scraping.

### Manual removal

Do not try to pull out plants as they will break off where the root kinks and the plant will regrow. Dig out small plants and seedlings (under 20 cm tall) if the soil is sandy or soft enough. Remove as much of the roots as possible.

For deeper-rooted species like ochna, a tree popper can be a more effective tool. It is designed to pull out trees with deep roots, particularly when soil moisture is adequate, making it easier to extract the entire plant, including its root system.

**Table 15. Suggested herbicide applications for ochna**

| Herbicide | Mix | Comments | Method |
|---|---|---|---|
| Glyphosate 360 g/L<br>Permit no. PER9907* | Ratio: 1:50<br>200 ml to 10 L water | Spot spray. Apply to seedlings, coppice shoots and shrubs. | Foliar spray |
| Glyphosate 360 g/L plus metsulfuron-methyl 600 g/kg<br>Permit no. PER9907* | Ratio: 1:50<br>200 ml glyphosate plus 1.5 g metsulfuron-methyl per 10 L water | Spot spray. | Foliar spray |
| Picloram 44.7 g/L plus aminopyralid 4.47 g/L (Vigilant II®) | Undiluted | Apply a 3–5 mm layer of gel for stems less than 20 mm.<br>Apply 5 mm layer on stems above 20 mm. | Cut and paint, scrape and paint |

* Verify permit number validity on the APVMA website apvma.gov.au

# Shrubs

## Small-leaf privet (*Ligustrum sinense*)

Small-leaf privet is a large shrub that grows to a height of around 4 metres, and is characterised by its small leaves and dense foliage. This shrub is known for its invasive nature and can quickly spread in various habitats.

### Key characteristics

- **Leaves**: Dull green, oval-shaped with wavy edges, 2.5 cm wide, covered in fine hairs underneath, arranged opposite at right angles to the stem.
- **Flowers**: Cream-colour, very small, arranged in dense sprays up to 10 cm long.
- **Fruit**: Berries are dark blue to black in colour, 5 mm wide.

Flower

Fruit

Plant

Leaves

Seedling

## Management

Wide dispersal of seed by birds cannot be controlled, so management requires removal of seed trees and young seedlings before they produce seed.

### Foliar spray

This method is suitable for plants up to 3 metres tall and those in dense infestations where there is no risk of spraying desirable vegetation. Spray actively growing plants that are not under any heat or moisture stress. Completely cover all the foliage for successful control.

### Cut and paint

This method is effective on plants of various sizes. Cut trunks or stems within 15 cm of the ground if possible. Spray or paint herbicide onto the stumps within 15 seconds of cutting. Treat every stump.

### Stem injection

This method is suitable for large plants. It is cost-effective in terms of labour and volume of herbicide required. Drill or make cuts into the sapwood and fill with herbicide within 15 seconds of making the cut. Treat every stem.

### Manual removal

Pull or dig out small to medium-sized plants by hand. If the root segments break, dig them out to prevent regrowth. Hang plants upside down to dry out the roots. This method minimises impacts on native plants and soil disturbance.

**Table 16. Suggested herbicide applications for small-leaf privet**

| Herbicide | Mix | Comments | Method |
|---|---|---|---|
| Metsulfuron-methyl 600 g/kg | Ratio: 1:10<br>1 g to 10 L water | Apply to bushes up to 3 m high; complete coverage is essential. | Foliar spray |
| Glyphosate 360 g/L | Undiluted (1–2 ml per cut) | Apply 1 ml per cut for trees with trunk diameter 25 cm or less at the base.<br>Apply 2 ml per cut for trees with trunk diameter over 25 cm and up to 60 cm at the base. | Stem injection |
| Picloram 44.7 g/L plus aminopyralid 4.47 g/L (Vigilant II®) | Undiluted | Apply a 3–5 mm layer of gel for stems less than 20 mm.<br>Apply 5 mm layer on stems above 20 mm. | Cut and paint |

## Shrubs

### Tobacco bush (*Solanum mauritianum*)

Tobacco bush is a small tree or shrub that grows to between 4 and 10 metres in height. It is commonly found in disturbed areas. All parts of the plant are covered in velvety hairs. Birds and flying foxes eat the ripe fruit and spread the seed. Seed from plants growing along watercourses can be spread by water.

#### Key characteristics

- **Leaves**: Large, oval, grey-green, covered with felt-like hairs.
- **Flowers**: Purple with a yellow centre, can appear all year round.
- **Fruit**: Round, 10–15 mm in diameter, green when young, dull yellow when ripe.

Flower

Plant

Leaf

Seedling

Fruit

## Management

Effective weed control depends on consistent follow-up after the initial treatment. It is important to target mature plants to minimise seed production and to address young plants before they have a chance to flower.

### Foliar spray

Spray seedlings and plants up to 2 metres tall. Spraying will kill the plant but not the viable seeds. Remove the fruit from each plant and dispose of it appropriately.

### Cut and paint

Large and small plants can be controlled by this method. Dispose of the cut plant after treating the stump, especially if fruit are present. Cut stems less than 15 cm above the ground. Apply herbicide to the cut and the sides of the stump immediately.

### Manual removal

Wear appropriate PPE to protect skin and airways from the fine irritating hairs. Pull out seedlings and smaller plants after rain when the soil is soft. Larger plants can be dug out.

**Table 17. Suggested herbicide applications for tobacco bush**

| Herbicide | Mix | Comments | Method |
|---|---|---|---|
| Glyphosate 360 g/L<br>Permit no. PER9907* | Ratio: 1:50<br>200 ml to 10 L water | Foliar application for seedlings. | Foliar spray |
| Glyphosate 360 g/L<br>Permit no. PER9907* | Ratio: 1:1.5<br>1 part glyphosate per 1.5 parts water | Cut stems less than 15 cm above the ground. Apply herbicide to the cut and the sides of the stump immediately. | Cut and paint |
| Picloram 44.7 g/L plus aminopyralid 4.47 g/L (Vigilant II®) | Undiluted | Cut stems horizontally, preferably no higher than 10 cm above the ground. Apply a 3–5 mm layer of gel for stems less than 20 mm and 5 mm layer on stems above 20 mm. | Cut and paint |

* Verify permit number validity on the APVMA website apvma.gov.au

# Shrubs

## Giant devil's fig (*Solanum chrysotrichum*)

Giant devil's fig is a shrub or small tree up to 4 metres tall. It has prickly stems and leaves, which are very hairy when young. Small, white flowers grow in clusters from autumn to spring. It has shallow roots. This shrub outcompetes native plants, competes with pasture grasses reducing productivity, contains toxins, and has sharp prickles that can injure people and animals.

### Key characteristics

- **Leaves**: Lobed, typically with 7–13 lobes per leaf, 17–30 cm long and 12–20 cm wide, hairy undersides, arranged alternately along the stem, with stalks 3–7 cm long.
- **Prickles**: Generally sparse, 3–9 mm long, up to 5 mm wide at the base, slightly curved; found on the stems, leaf stalks and along the mid-vein of the leaves.
- **Flowers**: Star-shaped, white, typically grow in clusters of up to 50.
- **Fruit**: Small, round berries, 10–15 mm in diameter, yellow or orange-yellow in colour, contains numerous pale yellow to light brown seeds approximately 2 mm wide.

Flower

Fruit

Leaves

Plant

Seedling

## Management

Giant devil's fig is spread when birds, flying foxes and other animals eat the fruit and spread the seed. Control is by physical removal and herbicides. Wear gloves and protective clothing to prevent prickle injuries.

### Foliar spray

Plants can be spot sprayed with herbicides. Spraying will not kill the seeds in fruit so it is important to collect the fruit and dispose of it. Contact your local council for advice on how to dispose of the fruit.

### Cut and paint

Cut the stem and then quickly apply the herbicide gel. Apply a 3–5 mm layer of gel for stems less than 20 mm. Apply a 5 mm layer on stems above 20 mm.

### Manual removal

Seedlings and small plants can be dug out with a mattock. Larger plants can be cut down and the roots dug up.

**Table 18. Suggested herbicide applications for giant devil's fig**

| Herbicide | Mix | Comments | Method |
|---|---|---|---|
| Glyphosate 360 g/L plus metsulfuron-methyl 600 g/kg (only products registered for aquatic use)<br>Permit no. PER12942* | Glyphosate 200 ml plus metsulfuron-methyl 1 g plus wetter 50 ml per 10 L water | Spray actively growing plants, ensuring all of the foliage is covered. For use in riparian areas. See permit for further critical comments. | Foliar spray |
| Picloram 100 g/L plus triclopyr 300 g/L plus aminopyralid 8 g/L (Grazon® Extra)<br>Permit no. PER12942* | 35–50 ml plus 50 ml wetter per 10 L water | Cut stems less than 15 cm above the ground. Apply herbicide to the cut and the sides of the stump immediately. | Cut and paint |
| Picloram 44.7 g/L plus aminopyralid 4.47 g/L (Vigilant II®) | Undiluted | Cut stems horizontally, preferably no higher than 10 cm above the ground. Apply a 3–5 mm layer of gel for stems less than 20 mm and 5 mm layer on stems above 20 mm. | Cut and paint |

* Verify permit number validity on the APVMA website apvma.gov.au

# Trees

## Camphor laurel (*Cinnamomum camphora*)

Camphor laurel is a highly invasive evergreen tree that has a tendency to form single species communities and exclude most other desirable native vegetation. It grows up to 20 metres in height, and has a large, spreading canopy and a short, stout bole or trunk up to 1.5 metres in diameter.

### Key characteristics

- **Leaves**: Alternate arrangement, 5–10 cm long and 2.5–5 cm wide, glossy green.
- **Flowers**: Very tiny, white, borne on panicles or heads near the ends of branches.
- **Fruit**: Round berries, 8 mm in diameter, green when young, black when ripe, contain a single seed about 5 mm in diameter.

Flower

Fruit

Individual leaf

Emerging leaves

Plant

## Management

A number of techniques are available to control camphor laurel. The technique used will depend on the situation, landscape, number of trees to control and resources available. It is important to plan your control program and take a long-term approach that includes follow-up treatments, control of other weed species, and planting of replacement species. Management should aim to increase competition, which will prevent invasion by camphor laurel.

### Foliar spray

Use foliar sprays for young trees up to 3 metres tall.

### Cut and paint

For small trees, cut each stem off as close to the ground as possible, and immediately (within 15 seconds) apply the herbicide mixture liberally to the cut surface.

### Stem injection

For trees taller than 6 metres, stem injection is the most practical method.

### Manual removal

Smaller seedlings can be hand-pulled.

**Table 19. Suggested herbicide applications for camphor laurel**

| Herbicide | Mix | Comments | Method |
|---|---|---|---|
| Glyphosate 360 g/L<br>Permit no. PER9907* | Ratio: 1:50<br>200 ml to 10 L water | Spray seedlings and coppice shoots. | Foliar spray |
| Glyphosate 360 g/L<br>Permit no. PER9907* | Ratio: 1:1.5<br>1 part per 1.5 parts water | Apply to stems of saplings after cutting or scraping stems.<br>Stem injection application for large trees and shrubs. | Cut and paint or cut–scrape–paint, stem injection |
| Glyphosate 360 g/L | 1 part per 1 part water, 2 ml per drill hole<br>Undiluted, 2 ml per drill hole | Stem injection for basal diameter up to 25 cm.<br>Stem injection for basal diameter 25–60 cm. | Stem injection |
| Glyphosate 360 g/L<br>Permit no. PER89544* | Undiluted | 4 ml per cut/drill hole.<br>Mid North Coast, Northern Rivers and Far North Coast of NSW only. | Stem injection |

* Verify permit number validity on the APVMA website apvma.gov.au

## Trees

### Cockspur coral tree (*Erythrina crista-galli*)

Cockspur coral tree is a deciduous shrub or tree with red flowers. It is a weed of waterways and floodplains, particularly in coastal areas. It looks similar to another weed called the common coral tree (*Erythrina x sykesii*), which has larger leaves and produces its flowers before new leaves appear in spring.

#### Key characteristics

- **Leaves**: Three leaflets, 3–6 cm long and 2–5 cm wide, oval with a narrow tip and hairless.
- **Flowers**: Scarlet red, 3–5 cm long, pea-shaped with the largest petal bent backwards when the flower is fully open, arranged in clusters 8–30 cm long at the ends of branches, present in spring.
- **Seeds**: Large curved pods, 8–22 cm long, green when young, dark brown or black when mature, slightly narrowed around each seed, 3–12 seeds per pod.

Flower

Seedling

Leaves

Plant

Seeds

## Management

Control mature trees to reduce seed production. Check for regrowth and control seedlings near mature trees each month for at least 6 months.

### Foliar spray

There is a permit for spraying but only in the Mid North Coast, Northern Rivers and Far North Coast of New South Wales. Apply herbicide from October to May by foliar application using a knapsack or handgun. Only apply to plants less than 4 metres tall or, if using a knapsack, only trees less than 1.5 metres tall.

### Cut and paint

Cut trunks or stems and apply herbicide to the stump within 15 seconds of cutting. Dispose of cut sections and check regularly for resprouting.

### Stem injection

Drill, saw or cut with an axe into the sapwood and fill with herbicide within 15 seconds of making the cut.

### Manual removal

Hand-pull or dig out small seedlings.

**Table 20. Suggested herbicide applications for cockspur coral tree**

| Herbicide | Mix | Comments | Method |
|---|---|---|---|
| Picloram 100 g/L plus triclopyr 300 g/L plus aminopyralid 8 g/L<br>Permit no. PER88282* | Ratio: 1:200<br>50 ml plus surfactant per 10 L water | This permit is only for Mid North Coast, Northern Rivers and Far North Coast of NSW. Apply from October to May by foliar application using knapsack or handgun. Read permit and label for more conditions. | Foliar spray |
| Glyphosate 360 g/L<br>Permit no. PER9907* | Ratio: 1:1.5<br>1 part glyphosate per 1.5 parts water | – | Cut and paint, stem injection |
| Picloram 44.7 g/L plus aminopyralid 4.47 g/L (Vigilant II®) | Undiluted | Apply a 3–5 mm layer of gel for stems less than 20 mm.<br>Apply 5 mm layer on stems above 20 mm. | Cut and paint |

* Verify permit number validity on the APVMA website apvma.gov.au

## Trees

# Broad-leaf privet (*Ligustrum lucidum*)

Broad-leaf privet is an evergreen shrub or small tree that grows to a height of 4 to 10 metres. Used in gardens, it now has extensive environmental, agricultural and human health impacts.

### Key characteristics

- **Leaves**: Pointed oval-shaped leaves, arranged in opposite pairs, 4–13 cm long and 3–6 cm wide, dark green and glossy or shiny upper surface, paler with distinct veins underneath, hairless.
- **Flowers**: Cream or white colour, tubular with 4 petal-like lobes, 3.5–6 mm long, arranged in branched clusters.
- **Fruit**: Berries, 9 mm long and 12 mm in diameter, green when young, turning red through to blue to glossy or purplish black as they ripen.

Flower

Fruit

Seedling

Plant

Leaves

## Management

Many attempts to control or remove privet have failed because of its ability to regenerate vigorously from root and stem suckers. Follow-up control measures are critical for successful removal. Revegetation with appropriate species, along with ongoing weed control, can assist with preventing reinfestation. Where privet is providing a replacement habitat and food source for fruit-eating birds, control efforts should ensure that removal is undertaken gradually in combination with revegetation with suitable species.

### Foliar spray

Foliar treatments can be made to flushes of seedlings and groups of plants up to 3 metres high. Plants should be actively growing, not under heat or moisture stress. Complete coverage of the foliage is necessary to ensure successful control.

### Cut and paint

For small trees, cut each stem off as close to the ground as possible and immediately (within 15 seconds) apply the herbicide mixture liberally to the cut surface.

### Stem injection

Appropriate for treating larger individual plants found among other vegetation. This method of control has been found to be the most cost-effective in terms of volume of herbicide and labour costs. It is also most effective in terms of reducing off-target herbicide damage to other vegetation.

### Manual removal

Broad-leaf privet is easy to pull up when it has a stem diameter of less than 2–3 cm, particularly after rain. When hand-pulling, try to minimise soil disturbance. Large areas of seedlings or regrowth can be slashed. These methods will reduce the seeding capacity of a large infestation, but will not eradicate it.

**Table 21. Suggested herbicide applications for broad-leaf privet**

| Herbicide | Mix | Comments | Method |
|---|---|---|---|
| Metsulfuron-methyl 600 g/kg | 1 g to 10 L water | Apply to bushes up to 3 m high; complete coverage is essential. | Foliar spray |
| Picloram 44.7 g/L plus aminopyralid 4.47 g/L (Vigilant II®) | Undiluted | Apply a 3–5 mm layer of gel for stems less than 20 mm.<br>Apply 5 mm layer on stems above 20 mm. | Cut and paint |
| Glyphosate 360 g/L | Undiluted (1–2 ml per drill hole) | Apply 1 ml per drill hole for trees with trunk diameter 25 cm or less at the base.<br>Apply 2 ml per drill hole for trees with trunk diameter 25–60 cm at the base. | Stem injection |

# 4. Plant identification

The ability to identify plant species is an important skill in rehabilitation projects. From a maintenance perspective, knowing whether a specific plant growing on your site is a desired native species or a weed is crucial.

Plants are normally described in terms of their habitat and distribution, and identified by 7 distinct types of features:

- habit
- leaves
- flowers
- fruit
- seeds
- trunk
- bark.

Plant identification can be daunting at first, especially if you are unfamiliar with the terms used to describe these features. There are 2 common aids to identifying plants: field guides and dichotomous keys.

**Field guides** describe plants in term of all of their features. How to use a field guide, and taking photographs to aid in identification, are covered later in this section.

**Dichotomous keys** present features in pairs, taking you down a different path each time you choose between a feature until you arrive at the correct species.

This section covers the basic features of plants so that you can identify them using a field guide or a dichotomous key. Whichever method you use, remember to always use multiple features of a plant to determine identity, instead of relying on a single feature. Occasionally there are variations in some of the rules or generalisations presented in guides and keys, as well as in the descriptions below. Looking at multiple features helps to avoid errors in identification.

With practice and experience, your plant identification skills will improve.

# Habitat and distribution

Plant habitat and distribution provide context about where a plant typically grows and under what conditions. Different species have specific habitat preferences, such as soil type, moisture levels, and light availability, which can help narrow down potential plant identities.

## Understanding the NSW vegetation classification hierarchy

The NSW vegetation classification hierarchy communicates information about native vegetation based on characteristics and patterns, becoming more detailed and complex as you move down through the levels.

### Vegetation formations

At the highest level in the hierarchy, vegetation formations are broad groups distinguished by major features, such as the overall structure of plants and the general landscape. There are 12 vegetation formations recognised across New South Wales. Some formations that are common in the North Coast are described below.

### Vegetation classes

Vegetation classes are groups of related plant communities that share similar features and growing conditions. There are 99 vegetation classes in New South Wales, each assigned to one of the 12 vegetation formations.

### Plant community types

At the lowest level in the hierarchy are plant community types (PCTs). PCTs identify and describe recurring groups of plants that grow together in specific environmental conditions, such as soil type, moisture and temperature. Each PCT is defined by a set of characteristics, including the types of plants found there, their structure, and where they are typically found across the state.

## Familiar North Coast vegetation formations

When thinking about vegetation in the North Coast, you might find these vegetation formations familiar.

### Rainforest

Rainforests are characterised by a closed and continuous tree canopy composed of relatively soft, horizontally held leaves, and very few eucalypts. This canopy blocks much of the sunlight from reaching the forest floor.

Beneath the canopy is a mix of ferns, shrubs and small trees, all adapted to low light and high moisture. The understorey can be dense and diverse.

### Sclerophyll forests

Sclerophyll means ‘hard leaf’. It describes plants with tough, thick leaves that help them survive in dry or nutrient-poor soils. These leaves don’t lose much water, making the plants good at handling heat and drought. Examples include eucalyptus trees and many Australian shrubs.

### Dry sclerophyll

Dry sclerophyll forests dominate drier, more exposed ridges and northerly slopes, and occupy soils of low fertility.

The canopy in dry sclerophyll forests is generally less dense than in wetter forests, with trees spaced farther apart. This allows more sunlight to reach the ground, creating a brighter and more open environment. The trees, often eucalyptus, may be smaller or more spread out compared to those in wet sclerophyll forest.

There are 2 subformations of dry sclerophyll forests: shrub/grass and shrubby.

- Shrub/grass subformations have a conspicuous grassy understorey, with intermittent shrubs.
- Shrubby subformations have typically Australian species such as waratahs, banksias, wattles, pea-flowers and tea-trees. There is a sparse groundcover of sedges, and grasses are rare.

### Wet sclerophyll

Wet sclerophyll forest occurs on protected moist, steep, often southerly slopes of foothills and ranges, and along creek systems.

Wet sclerophyll forests in northeast New South Wales feature a mix of tall, straight eucalyptus trees and a diverse understorey of shrubs and small trees.

The canopy is generally more open than in rainforests, allowing sunlight to filter through, which encourages a variety of groundcover, including grasses, ferns and flowering plants.

Wet sclerophyll forests can be divided into 2 subformations according to their understoreys: the shrubby subformation and the grassy subformation.

Both have a tall, straight-trunked eucalypt canopy and a leafy understorey. The grassy subformation is more open, with fewer shrubs and small trees, and occurs in slightly drier habitats.

## Forested wetlands

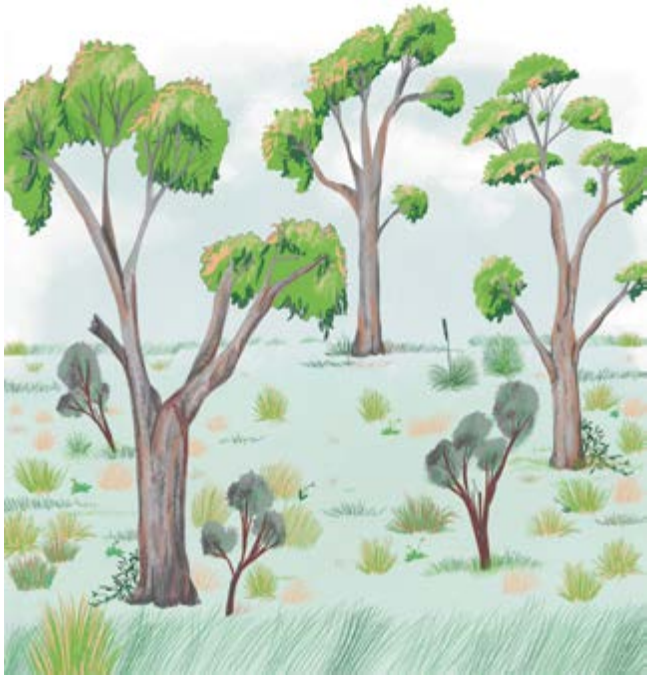
Forested wetlands are found across New South Wales, primarily along river corridors and floodplains. These wetlands are characterised by dense tree cover and are situated on fertile soils, usually at low elevations.

The canopy is typically dominated by eucalypts, tea-trees, paperbarks and she-oaks. The understorey consists mainly of grasses, sedges and rushes.

Both taller trees and understorey plants are adapted to occasional flooding.

## Grassy woodlands

In the North Coast, open forests and woodlands occur across various landscapes. Trees range from 20 to 35 metres in height. Scattered or clustered shrubs are predominantly sclerophyllous, with their density influenced by site conditions and past disturbances. The ground layer is rich and diverse, dominated by perennial tussock grasses, scrambling twiners and perennial herbs. In favourable seasons or following fire, geophytic orchids and lilies emerge, adding to the ecosystem's complexity.



## More information

Want to find out more about the vegetation on your patch? *Trees Near Me NSW* offers a fun way to explore the native vegetation around you. See treesnearme.app

And to find out more about vegetation classification in New South Wales visit the *NSW vegetation classification hierarchy* webpage at environment.nsw.gov.au/topics/animals-and-plants/biodiversity/nsw-bionet/the-nsw-vegetation-classification-framework

# Habit

The term 'habit' refers to the characteristic shape and growth form of a plant.

There are 9 habits: tree, palm, shrub, epiphyte, parasite, vine, fern, grass and herb (Figure 25).

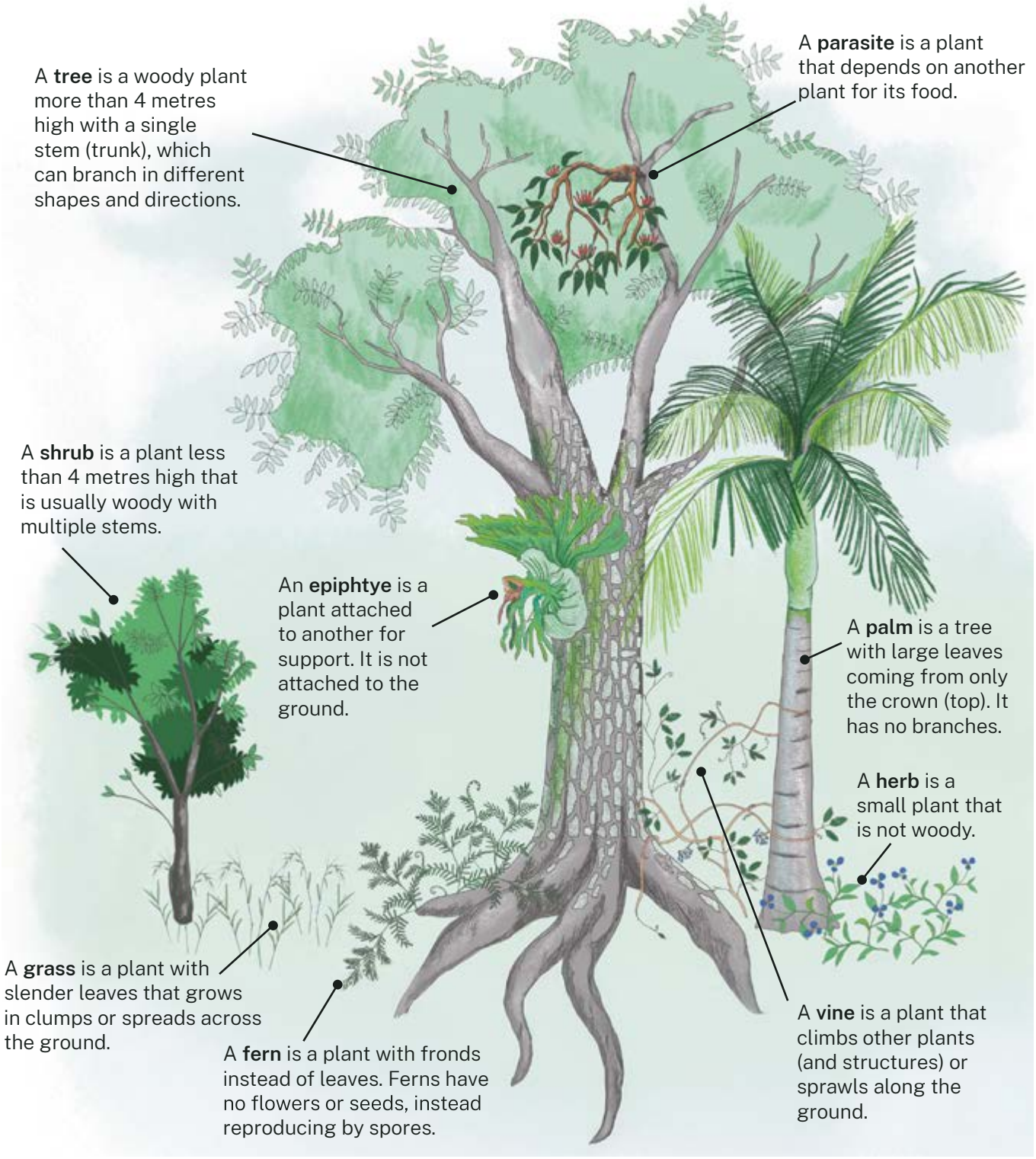



**Figure 25. The 9 different habits of a plant**

# Leaves

Leaves have specific features that will help identify the plant species, including:

- leaf type
- leaf arrangement
- leaf shape, described in terms of outline, margin (edge), tip (apex) and base
- leaf vein pattern (venation)
- other features like colour, hairiness and texture.

## Leaf type: simple or compound

Leaves come in 2 types: simple and compound.

A **simple leaf** (Figure 26) consists of 3 main parts:

- a leaf stalk called a **petiole**, which attaches the leaf to the stem of the plant
- a **leaf blade** (also known as the lamina), which is the broad part of the leaf
- an **axillary bud**, which is a tiny bud that has the potential to grow into a new branch or leaf
- the **stipules**, which are small leaf-like structures that protect the axillary bud at the base of the petiole where it joins the stem.

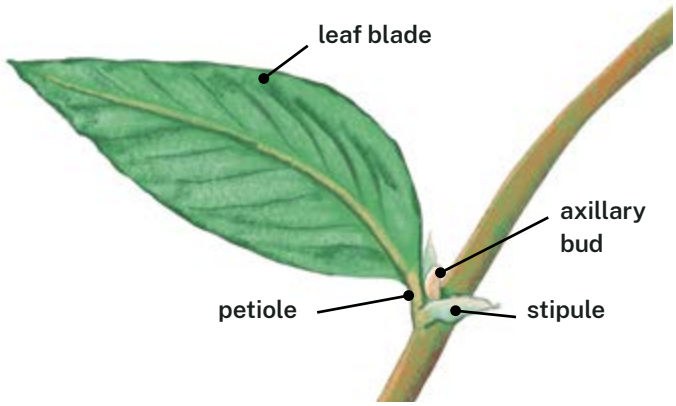



Figure 26. Simple leaf

A **compound leaf** (Figure 27) consists of multiple smaller leaf segments called **leaflets**, all attached to a single stalk. The **petiole** extends from the **axillary bud** to the first pair of leaflets, while the section of the stalk beyond this point is known as the **rachis**.

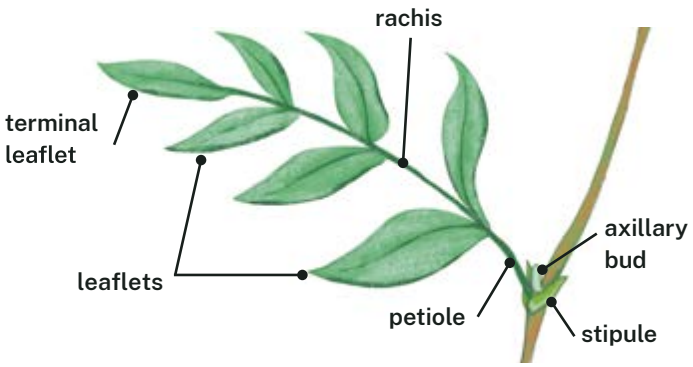



Figure 27. Compound leaf

Both the petiole and rachis are integral parts of the leaf, serving to connect it to the plant stem. The petiole links the leaf to the stem, whereas the rachis acts as the central support structure for the leaf blade.

Unlike leaves, leaflets lack stipules and axillary buds at their attachment points on the stalk. Instead, these features are located where the stalk connects to the main stem.

Leaflets do not have stipules or axillary buds where they join the stalk. Instead the stipules and axillary bud are found where the stalk joins the main stem.

Figure 28 shows the difference between each leaf type. On the right of the stem is a simple leaf – one leaf on a stalk – and on the left is a compound leaf made up of many leaflets.

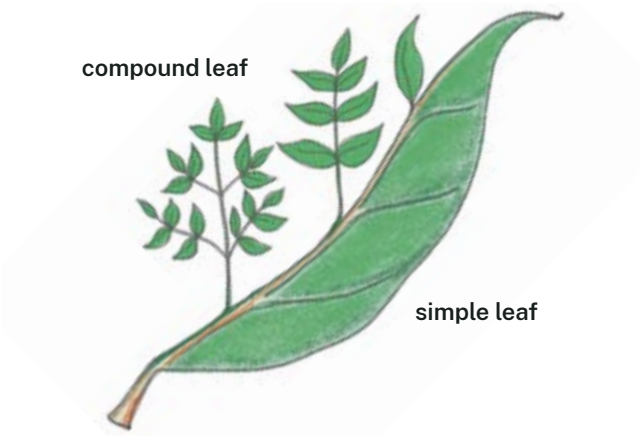



Figure 28. Compound leaf type (left) and simple leaf type (right)

## Compound leaf types

Common compound leaf types include:

1. In **pinnate** compound leaves, multiple leaflets are arranged along the central axis, resembling the appearance of a feather. The leaflets are attached to a single main stalk called the rachis.
2. **Bipinnate** compound leaves have the same feather-like appearance but the leaflets are arranged along a twice-divided stalk.
3. **Bifoliate** compound leaves have only 2 leaflets radiating out from the petiole.
4. **Trifoliate** compound leaves have 3 leaflets radiating out from the petiole.
5. **Palmate** compound leaves have at least 4 leaflets (often more) that radiate out from the petiole, similar to the fingers spreading out from the palm of a hand.

1. Pinnate 2. Bipinnate 3. Bifoliate 4. Trifoliate 5. Palmate

## Leaf arrangement

Common leaf arrangements include:

1. **Alternate** – each leaf arises at a different point on the stem, alternating on each side in a flat plane.
2. **Opposite** – 2 leaves arise at the same point but with leaves connecting opposite each other along the stem.
3. **Whorled** – the leaves arise at the same point in a circular arrangement around the stem.

1. Alternate 2. Opposite 3. Whorled

## Leaf shape

There are 8 different types of leaf shape:

1. **Linear** leaves are long and narrow with parallel sides.
2. **Oblong** leaves are about 2 or 3 times longer than broad, with parallel sides and rounded ends.
3. **Lanceolate** leaves are shaped like the head of a lance – tapered at the tip and base but distinctly longer than wide, and widest below the middle.
4. **Oblanceolate** leaves are also shaped like the head of a lance but inverted – tapered at the tip and base, and distinctly longer than wide, but widest above the middle.
5. **Elliptic** leaves are shaped like an ellipse – an oval – with equally rounded ends and widest at the middle.
6. **Ovate** leaves are shaped like an egg, rounded at both ends but wider at the base.
7. **Obovate** leaves are also oval but like an upside-down egg, with the wider end at the top.
8. **Orbicular** leaves are round, with no tip or base.

1. Linear 2. Oblong 3. Lanceolate 4. Oblanceolate

5. Elliptic 6. Ovate 7. Obovate 8. Orbicular

1. Entire

2. Crenate

3(a). Serrated – regular-toothed

3(b). Serrated – irregular

4. Undulate

5. Lobed

## Leaf margin (edge)

The term 'margin' describes the contour of a leaf along its outside edges. Here are some of the more common types of leaf margin:

1. An **entire** margin means the leaf edge is smooth.
2. A **crenate** margin is one that is crenated (scallop-shaped), with small regular bumps all the way around like a scallop shell.
3. A **serrated** margin means the leaf has angular protrusions. These might be (a) **regular-toothed**, spaced at regular intervals like the teeth of a saw, or (b) **irregular**.
4. An **undulate** margin is one that curves like waves (undulates).
5. A **lobed** margin has large, looping curves, like the lobe of an ear.

## Leaf tip (apex) and base

Leaf and leaflet tips (apices) and bases come in all sorts of shape. Below are 9 of the most common shapes of tip, and 9 of the most common shapes of base. Be aware that there are other shapes of tip and base not shown here.

Aristate tip | Long-acuminate tip | Short-acuminate tip

Attenuate base | Cuneate base | Obtuse base

Acute tip | Obtuse tip | Truncate tip

Cordate base | Truncate base | Oblique base

Emarginate tip | Retuse tip | Mucronate tip

Auriculate base | Sagittate base | Hastate base

## Leaf vein pattern (venation)

There are 4 types of leaf veins (Figure 29), but not all leaves and leaflets have all of the types.

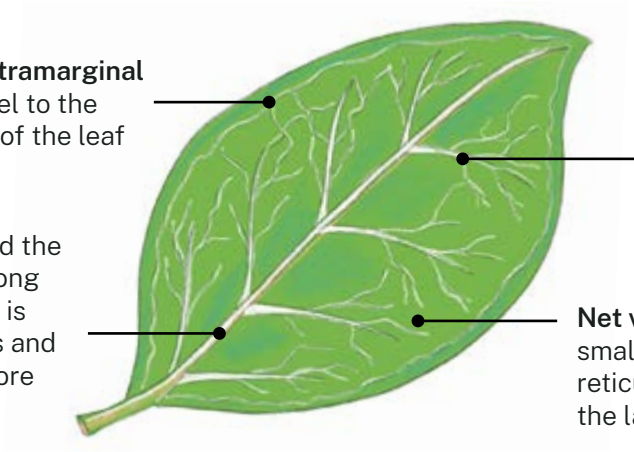



**Figure 29. Diagram showing veins on a leaf**

Leaf veins have different arrangements – they are not always in the pattern shown in Figure 29. Leaf vein arrangement refers to the presence of different vein types and the vein pattern (venation). There are 9 different vein arrangements:

1. **Only midvein** – only the centre vein is present.
2. **Penniveined** – the lateral veins are very closely spaced (and often faint) and run from the centre vein to the leaf margins.
3. **Pinnate** – the lateral veins run from the centre vein to the leaf margin at an angle, either alternating with or directly opposite the veins on the other side of the centre vein.
4. **Three-veined from base** – 3 main veins start at the base of the leaf blade and run out and up to the margins, covering more than half the length of the leaf.
5. **Pinnate and intramarginal vein** – lateral veins run from the centre vein, in an alternate or opposite pattern, to the leaf margin where they connect with the intramarginal vein.
6. **Palmate** – multiple main veins start from a single point at the base of the leaf and branch out towards the leaf margins.
7. **Longitudinal** – multiple main veins start from a single point at the base of the leaf, diverge and then join again at the apex.
8. **Parallel** – multiple main veins run along the length of the leaf without joining.
9. **Reticulate** – lateral veins do not run all the way to the leaf margin, but curve back and join. Net veins extend to leaf margins.


1. Only midvein


2. Penniveined


3. Pinnate


4. Three-veined from base


5. Pinnate and intramarginal vein


6. Palmate


7. Longitudinal


8. Parallel


9. Reticulate

# Flowers, fruits and seeds

## Flowers are easily identified by colour, size and shape.

Flowers contain reproductive parts of plants. The female reproductive part is the carpal, which produces seeds. Some flowers first develop into fruit that contains seeds. The type and shape of both fruit and seeds also assist in plant identification.

Grasses also have flowers and seeds, but not fruits. For grass identification, see below in this section.

## Fruit type

For plant identification purposes, fruits are either **simple** or **compound**. Simple fruits are formed from a single flower, and either split open to release seeds (dehiscent) or do not (indehiscent). Compound fruits form from multiple flowers or from multiple carpals of the flower. Fruits can also be fleshy or woody.

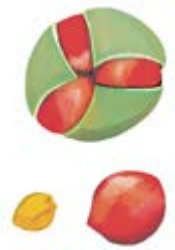
**Simple fruits** come in 5 types:

1. **Drupes** are a fleshy indehiscent fruit with one or more seeds enclosed in a hard, woody shell (endocarp) and surrounded by a fleshy or mealy layer (mesocarp), along with a soft or occasionally leathery outer layer (epicarp). An example is the fruit of the white beech (*Gmelina leichhardtii*).
2. **Berries** are a fleshy indehiscent fruit with the seed or seeds immersed in pulp. An example is the fruit of the lilly pilly (*Szyygium smithii*).
3. **Capsules** are a mostly dry fruit that splits open to release seeds. Examples are (a) the dry capsule of the teak (*Flindersia australis*) and (b) the capsule of the small-leaved tamarind (*Dipoglottis campbelli*) which is dry but with a fleshy covering (aril) over the seed.
4. **Follicles** are a dry fruit that splits open lengthwise along one side only to release seeds. An example is the fruit of the flame tree (*Brachychiton acerifolius*).
5. **Pods** are dry fruit like follicles except that they split along both sides. An example is the fruit of the black wattle (*Acacia melanoxlyn*).

1. White beech drupe

2. Lilly pilly berry

3(a). Teak capsule



3(b). Small-leaved tamarind capsule

4. Flame tree follicle

5. Black wattle pods

**Compound fruits** come in 4 types:

1. **Cones** are dry woody fruits that contain numerous seeds and that open to release the seeds at maturity. Cones are found on trees called conifers, such as the hoop pine (*Araucaria cunninghamii*) and bunya pine (*Araucaria bidwillii*).
2. **Aggregate** forms of fruit develop from more than one carpel in a flower. An example is the fruit of the native raspberry (*Rubus parvifolius*).
3. **Multiple** forms of fruit develop from more than one flower. An example is the fruit of the cockspur thorn (*Maclura cochinchinensis*).
4. **Figs** are a type of multiple fruit that has a fleshy recepticle formed from many flowers. Figs are found on fig trees, such as the creek sandpaper fig (*Ficus coronata*).

1. Bunya pine cone

2. Aggregrate fruit of the native raspberry

3. Multiple fruit of the cockspur thorn

4. Fig of the creek sandpaper fig tree

## Fruit shapes

Fruits come in 9 shapes:

1. **Globose** – round like a globe.
2. **Obolid** – spherical but flattened, as if pressed down from the top.
3. **Ellipsoid** – oval-shaped, broadest about the middle.
4. **Ovoid** – egg-shaped with the broad end below the middle.
5. **Obovoid** – egg-shaped with the broad end above the middle.
6. **Obcordate** – shaped like a heart.
7. **Urceolate** – one end is flat and open and the other is tapered, like an urn or a cup.
8. **Lobed** – round fleshy parts (lobes) joined together, being (a) 2-lobed, (b) 3-lobed or (c) 4-lobed.
9. **Moniliform** – in a casing that is constricted between seeds longitudinally, like a string of beads.

1. Globose fruit of the black walnut (*Endiandra globosa*)

2. Obolid fruit of the lillipilli satinash (*Syzigium smithii*)

3. Ellipsoid fruit of the kangaroo apple (*Solanum aviculare*)

4. Ovoid fruit of the black apple (*Planchonella australis*)

5. Obovoid fruit of the brush cherry (*Syzygium australe*)

6. Obcordate fruit of the twin-leaved coogera (*Arytera distylis*)

7. Urceolate fruit of the swamp turpentine (*Lophostemon suaveolens*)

8(a). 2-lobed fruit of the blunt-leaved tulip (*Harpullia hillii*)

8(b). 3-lobed fruit of the blunt-leaved steelwood tree (*Toechima dasyrrhache*)

8(c). 4-lobed fruit of the yellowwood tree (*Acronychia oblongifolia*)

9. Moniliform fruit of the thorny pea (*Pedleya acanthoclada*)

# Grasses

## Growth patterns

The majority of grasses in the North Coast are **perennials** (plants that live for more than one year), with **annuals** (plants that complete their lifecycle within one year) only forming a minor component of most pastures.

Each grass has 1 of 3 types of growth pattern: warm season, cool season or yearlong-green.

**Warm season** grasses are most active in the warmer months and tend to flower in summer and autumn. In autumn and winter, perennials become dormant (or growth dramatically slows) and annuals die off, in response to the short days, cooler temperatures and frosts.

**Cool season** grasses have the opposite cycle to warm season grasses, growing most actively in the cooler months, flowering in spring to early summer, and becoming dormant or dying off in summer.

**Yearlong-green** grasses have a cycle that falls between the warm and cool season grasses, growing throughout the year if conditions are suitable and tending to flower in both spring and autumn.

In their vegetative state, grasses can be very difficult to tell apart, so the flowering stage is when there are distinct differences, making it easy to recognise a particular grass type.

## Grass structure

Grass structure is shown in Figure 30.

All grasses consist of one or more **tillers** (leafy shoots).

- If tillers grow together at the plant base, then the plants are called **tufted grasses**.
- If the tillers are joined by **rhizomes** (below-ground runners) or **stolons** (above-ground runners), then the plants are called **mat grasses**.

The leaf of a grass consists of a **sheath** that wraps around the stem and a **blade** that attaches to the top of the sheath. At their junction is the **collar region**, where the **ligule** (rim of hairs or membrane) and **auricles** (ear-like appendages) can be found.

Leaf sheaths arise from swollen stem joints called **nodes**; these may be hairy, hairless, or coloured differently to the rest of the stem.

When a grass enters its reproductive stage, it forms a **flowerhead** at the top of the stem.

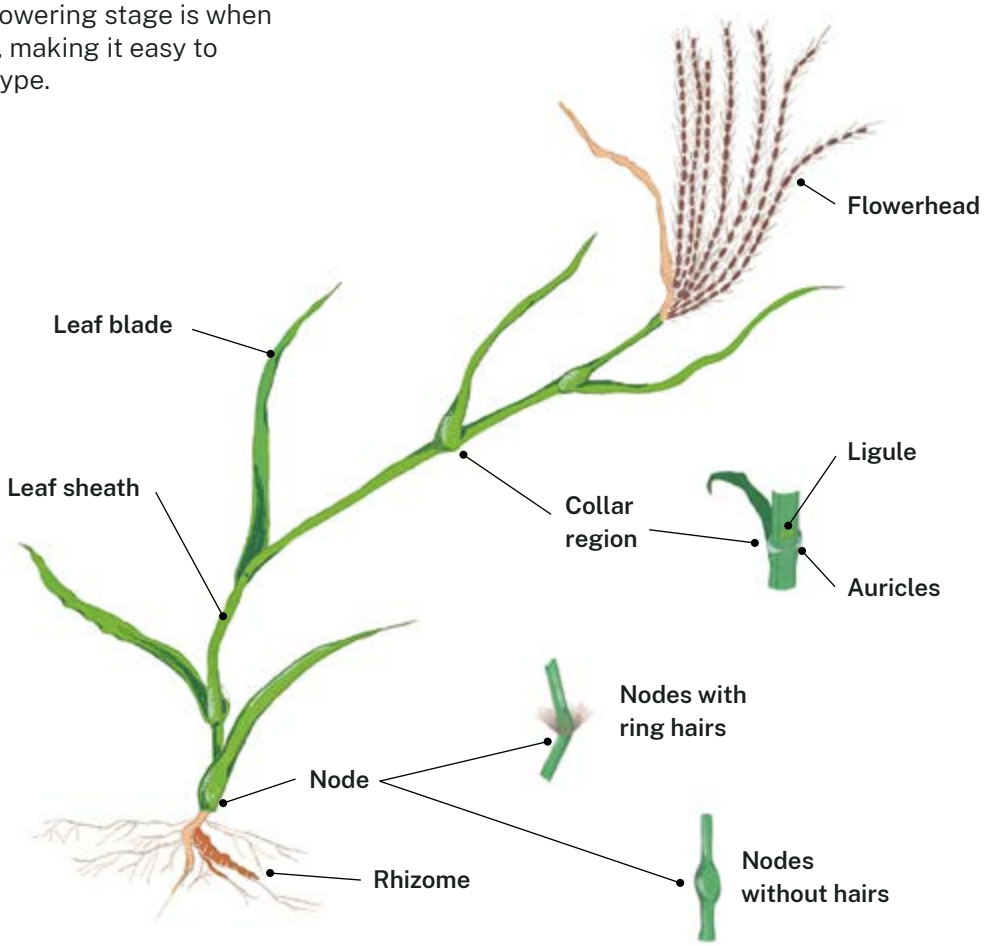



**Figure 30. Grass structure**

## Grass flowerheads

Not all grasses have flowers, but those that do have flowerheads that emerge at the end of a stalk.

Each flowerhead is made up of **spikelets** that contain one or more florets in a cluster, an upper and lower glume sitting below the florets, and hairs, bristles or awns (longer hairs or bristles), as shown in Figure 31.

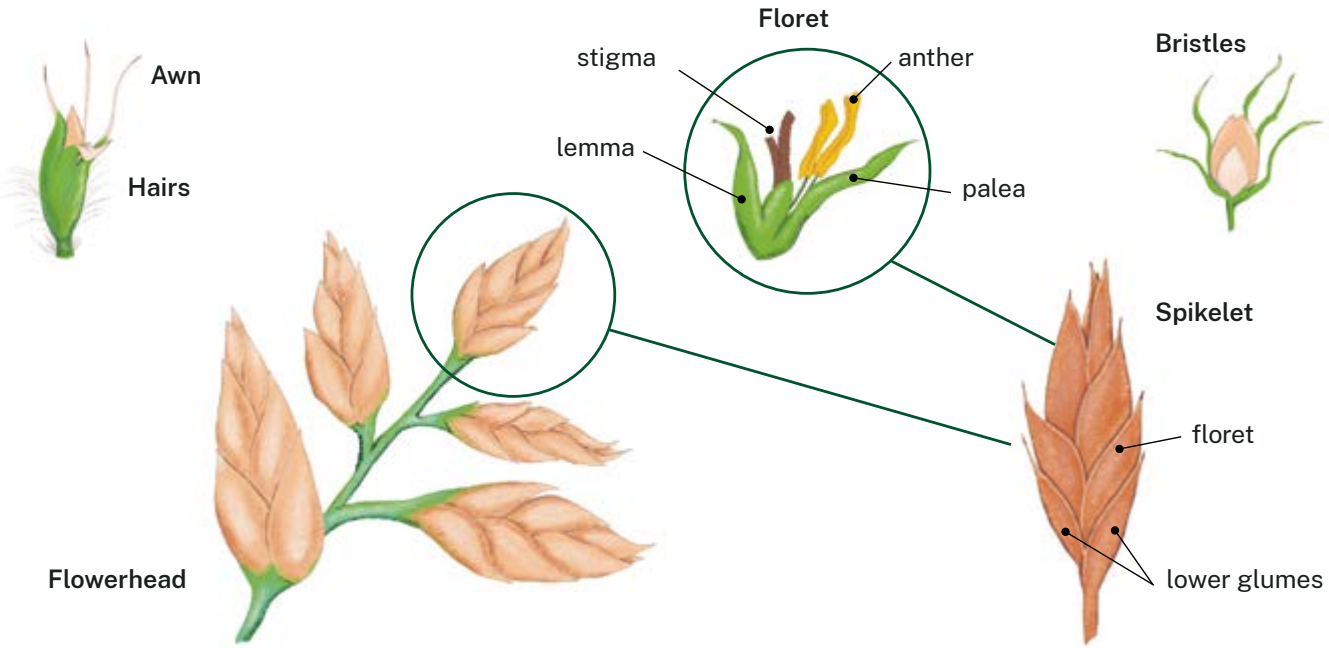



**Figure 31. Grass flowerhead structure**

The differences between the spikelet features and their arrangement in the flowerhead helps identify the grass species.

There are 5 main types of **flowerhead arrangement**:

1. **Digitate** – the spikelets all radiate from one point on the stalk (axis), like fingers on a hand. There is also a **subdigitate** arrangement, which is similar, but the spiklets arise along a short main axis.
2. **Spike** – the spikelets are directly attached to the main axis.
3. **Raceme** – the spikelets are on short stalks that are directly attached to the main axis. Some arrangements have a primary axis of racemes, where the stalks and spikelets arise along an elongated main axis.
4. **Panicle** – the main axis is further divided into branches that each have an arrangement of spikelets. Panicles may be (a) closed, where the spikelets are tightly clustered, making it difficult to see the branching; or (b) open, where the branching is easily seen.
5. **Spatheate** – there are leaf-like bracts (spathes) within the flowerhead.

1. Digitate

2. Spike

3. Raceme (primary axis)

4(a). Closed panicle form

4(b). Open panicle form

5. Spatheate

# Identifying plants – what to do in the field

There are 4 key stages to identifying a plant.

**1. Record the setting**

Different plants are found in different habitats and produce flowers, fruit and seeds at different times of year. Before you begin identifying a specific plant, note the kind of habitat – rainforest, wet or dry sclerophyll forest, forested wetlands or grassy woodlands – and the specific month or season in which you are making your observations.

**2. Observe the plant**

Examine the plant closely, noting what it looks like and – if it is safe to do so without damaging the plant or hurting yourself on any spiky parts – what it feels like and whether it has any smell. You might want to take photographs for a visual record – see below on how to do this effectively for identification purposes.

**3. Identify key features**

Either in the field or using your photographs, note the plant's specific features. If specific features are present, make a note of their characteristics – type, shape, colour and so on.

**4. Consult a field guide or identification key**

Field guides provide concise and illustrated guides to identify plants. Keys tend to be apps. Find one that you can take into the field and consult while you are making your notes, or use your photographs and your notes to consult one when you are back at a computer. See Section 6. Further resources for a list of useful apps and field guides.

## Recording plant features

Following is a template that you can use for this purpose, with prompts for the kind of information you might note.

### Habit type

**Type:** Tree, palm, shrub, epiphyte, parasite, vine, fern, grass or herb?

### Leaves and leaflets

**Type:** Simple (a single, undivided blade) or compound (multiple leaflets per leaf stalk)? If compound: pinnate, bipinnate, bifoliate, trifoliate or palmate?

**Arrangement:** Alternate, opposite or whorled?

**Outline:** Linear, oblong, lanceolate, oblanceolate, elliptic, ovate, obovate or orbicular?

**Margin (edge:** Entire, crenate, serrated (and if so, regular-toothed or irregular), undulate or lobed?

**Tip (apex) shape:** Aristate, long-acuminate, short-acuminate, acute, obtuse, truncate, emarginate, retuse, mucronate or something else?

**Base shape:** Attenuate, cuneate, obtuse, cordate, truncate, oblique, a sagittate, hastate or other?

**Veins and venation:** Presence and number of main veins, lateral veins, net veins, intramarginal veins? Pattern: only midvein, penniveined, pinnate, 3-veined from base, pinnate and intramarginal vein, palmate, longitudinal, parallel or reticulate?

**Surface and texture:** Smooth, rough, glossy, matte, waxy, velvety, papery?

**Other features:** For example, any distinctive scent or colour?

## Trunk (trees, shrubs and palms only)

**Type:** A single trunk, or a main trunk with small branches, or multiple main branches?

## Bark (trees and shrubs only)

**Texture:** Smooth, furrowed, scaly, papery?

**Colour:** Colours, including any patterns of colour.

**Other features:** For example, small pores (lenticels), distinctive patterns, visible sap?

## Flowers, fruit and seeds

**Fruit type:** Simple – drupe, berry, capsule, follicle or pod? Or compound – cone, aggregate, multiple or fig?

**Fruit shape:** Globose, obovoid, obolid, ellipsoid, oblong, obcordate, urn-shaped or lobed (2, 3 or 4 lobes)?

**Other fruit features:** For example, colour, arrangement, scent.

**Seed features:** For example, colour, shape, arrangement, scent.

**Flower shape:** For example, tubular, bell-shaped, star-shaped or something else?

**Flower arrangement:** For example, solitary or in clusters?

**Flower colour**: Colour, including any patterns of colour, and whether there is more than one colour or pattern on the same plant.

## Stems

**Texture:** Smooth, rough, hairy or spiky?

**Colour:** Colours, including any patterns of colour.

**Other features:** For example, any hairs or other growths, such as scales, thorns or fronds?

## Grass

**Tiller connection:** Tufted or mat? If mat, rhizomes or stolons?

**Flowerhead arrangement:** Digitate, spike, raceme, panicle, spatheate?

**Flowerhead colour:** Colours, including any patterns of colour

**Leaf blade texture:** Smooth, rough, hairy or rigid?

**Leaf sheath:** For example, closed, open or overlapping? Hairs or no hairs?

**Auricles and awns:** Present or absent? Shape and length.

## Other features

## How to photograph plants for identification

Photographs provide a comprehensive visual record that aids in accurate plant identification. To ensure your photos are clear and useful, follow these guidelines:

- **Focus**: Make sure your photos are in focus to capture the plant's details accurately.
- **Lighting**: Natural light provides a more accurate representation of the plant's colours and texture, so turn off the camera flash. Avoid taking photos in direct sunlight or during extreme light conditions like midday, early dawn or twilight. Overcast days offer ideal lighting for plant photography as they provide even, diffused light.
- **Whole plant**: Start by taking a photograph of the entire plant. Frame the shot so that the top of the plant and the ground or soil are visible. This full-view image helps in understanding the plant's overall structure and size.
- **Leaves**: Take detailed close-up photos of both the upper and lower surfaces of the leaves, as well as where the leaves attach to the stem. Pay attention to leaf arrangement, shape, colour and pattern, texture, and any hairs or other distinguishing features.
- **Flowers, fruit and seeds**: If the plant has flowers, fruit or visible seeds, take close-up shots of each on its own, including where it attaches to the plant. Pay attention to arrangement, shape, colour and any other distinguishing features. If fruit or seeds have fallen to the ground, take photos of these too.

### Tips

Familiarise yourself with basic botanical terminology to better understand descriptions in your field guide or identification key.

Have a comprehensive field guide specific to your region. Look for ones with clear illustrations or photographs.

Use a key or app to identify fruit and flowers.

Find an online plant identification forum to help you with identification if you get stuck.

# 5. Equipment

## Personal protective equipment (PPE)

When you engage in bush regeneration tasks, you will be exposed to environmental factors that may cause you potential harm.

The main risk factor is sun exposure, but other risk factors are:

- sharp objects, such as broken branches, spiky bushes and thorns
- bites and stings from snakes, insects and other animals.

For these reasons, you must wear appropriate clothing and personal protective equipment (PPE), such as:

- fully enclosed, durable shoes or boots
- a long-sleeved shirt with a collar, and long trousers or coveralls
- gloves
- a wide-brim hat
- eye protection appropriate to the task
- sunscreen.

In some situations you will also need additional protection, such as:

- insect repellant
- face shield or visor
- ear protection.

PPE for use with herbicide applications generally includes products that prevent absorption of chemicals through the skin, eyes or through inhalation. Guidance on what PPE to wear for each application situation can be obtained from product labels and safety data sheets (SDS) (see Section 3. Weed control).

To help you decide what kinds of clothing and PPE you will need for a specific task, this section provides a list of PPE items, what each is used for, and some pros and cons.

## General PPE

### Forestry visor

For face and hearing protection when used with chainsaws and brushcutters.

- Adjustable
- Protects against liquid spray but not vapours

### Gaiters

Lower leg coverings that rovide protection against snake bite and abrasion.

### Gloves – anti-vibration

Lightweight glove for use with power tools to reduce the amount of vibration absorbed.

### Gloves – nitrile-dipped gloves

General work gloves that provide good protection against most abrasions, grease and oils.

- Lightweight, washable, highly flexible and sensitive
- Will not protect against spikes
- Not registered for use against chemicals

### Gloves – rigger

Heavy-duty work gloves for handling rough materials.

- Long-lasting, good grip
- Leather protects against spikes
- Become stiff if left wet or coated in mud
- Less flexibility and sensitivity for dexterous tasks
- Not registered for use against chemicals

## Herbicide PPE

### Clear face shield

Protects full face from spray, for example mild pesticides and herbicides.

### Gloves – nitrile chemical

Chemical safety gloves (100% nitrile) providing maximum chemical and abrasion resistance for use with herbicide application.

### Gloves – nitrile disposable

Chemical protection, for example when undertaking weed control using chemicals.

- Can be worn under other gloves
- Flexible and sensitive, allowing dexterity of movement
- Will not protect against spikes or abrasions
- Will not reduce vibrations
- Not reusable or recyclable (that is, one use only)

### Respirator

Protects against inhalation of harmful fumes when using toxic chemicals, for example spraying herbicides.

### Waterproof boots

Rubber or PVC boots to protect feet.

# Tools of the trade

There are many tools specific to bush regeneration tasks. This section outlines the most common tools that you might use to carry out your maintenance work.

Tools can be obtained from a range of suppliers such as:

- **forestry suppliers** that specialise in forestry and arboriculture supplies, such as Arborgreen
- **farm supply stores** that carry a wide range of equipment for farming
- **agricultural cooperatives** that carry a wide range of equipment for both farming and forestry
- **hardware stores**, which usually have a variety of tools and equipment.

## Cutting and digging tools

### Boning knife/bush knife

For cutting through weed roots, into bark for herbicide application, and many other uses.

### Brushcutter

For cutting down weeds and clearing areas for planting.

- Suitable for areas where grass needs to be kept short but mowers cannot access
- Non-chemical way to control weed growth
- Weeds often grow back quickly compared to chemical control
- Risk of cutting native plantings as well as weeds – requires experienced operators

### Cordless drill with 10–14 mm wood drill bit

For drilling holes for herbicide treatment in stem injection method.

- Suitable for large woody weeds such as small trees and shrubs
- Battery life can be an issue for extended use

### Folding saw

For cutting down or pruning small trees and shrubs.

- Folding design makes it easy to carry around
- Great for stems and branches that are awkward to reach
- Not suitable for large trees

### Hori hori knife

For cutting weed roots, scraping vine weeds, and excavating tubers and taproots.

- Multi-use – features a serrated edge on one side and a sharpened edge on the other, like a combined saw and narrow trowel
- Lightweight

### Loppers

For cutting most small trees and shrubs.

- Good for cut and paint method of weed control
- Fairly lightweight
- Not suitable for large trees

### Mini mattock

For digging holes for planting, cutting through roots and stems, and digging out weeds.

- Multi-use
- Lightweight

### Pruning saw – powered

For pruning shrubs and small trees.

- Lightweight, compact
- Dangerous for inexperienced users
- Battery life can be an issue for extensive use

### Secateurs

For cutting down or pruning small trees and shrubs; scraping vine weeds.

- Lightweight, easy to carry
- Great for stems and branches that are awkward to reach

### Tool belt

For carrying and storing small tools while working.

- Ideal for tools used in bush regeneration
- Knife pouch has nylon filet to prevent the knife blade from wearing through the leather

### Tree popper

For manual removal of woody weeds (as an alternative to chemical methods of weed control).

## Herbicide equipment

### Herbicide applicator – stem-injection kit

For precision application of herbicide from a backpack, for ease of moving through natural areas.

- Lightweight
- Multi-use – suitable for cut and paint and stem injection methods
- Needs regular maintenance to work well
- Recommend purchasing backpack holder for stability and extra padding on shoulders

### Herbicide applicator – bottle sprayer

For targeted spraying of herbicide.

- Multi-use – suitable for cut and paint, cut–scrape–paint, and stem injection methods
- Larger volume so less time needed refilling

### Herbicide applicator – dabber bottle


Best for applying herbicide to surfaces, for example in cut and paint method of weed control.

- Small and lightweight
- Less likely to leak
- Even application

### Herbicide applicator – twist-top cap/dripper bottle


Best for applying herbicide to surfaces in the scrape and paint method; can also be used for applying to holes in the stem injection method.

- Twist cap for easy application
- Releases more herbicide, making it useful for vine weed application

## Knapsack – powered kit

Battery-powered knapsack for application of herbicide in foliar spray method.

- Continuous pressure throughout spray
- Can select flow rate
- Less labour-intensive than pump knapsack – no need for manual pumping
- Needs charged battery to operate
- Less control over pressure

## Knapsack – pump kit

For application of herbicide in foliar spray method.

- Manual pumping allows pressure control
- Can be used for both spot-spraying and blanket-spraying applications
- Carrying a knapsack sprayer on your back can lead to fatigue and ergonomic problems, especially for extended use
- Requires pumping to maintain even pressure
- Requires regular maintenance to prevent issues such as nozzle clogging, pump malfunctions, and wear and tear of components, which can hinder productivity

## Knapsack harness

For carrying foliar spray kit on your back.

- Features a well-padded back panel, waist belt and adjustable shoulder harness
- Prevents injury and discomfort during spraying

# 6. Further resources

## Bush regeneration and technical information

**Australian Association of Bush Regeneration** aabr.org.au

*Guide to photo monitoring of ecological restoration projects funded by the NSW Environmental Trust* environment.nsw.gov.au/resources/grants/180068-Ecological-Monitoring-Guide.pdf

*National standards for the practice of ecological restoration* seraustralasia.org

*Restoring natural areas in Australia* tocal.nsw.edu.au/publications

*Southeast Queensland Ecological Restoration Framework: Manual* weeds.brisbane.qld.gov.au/resources

*Subtropical rainforest restoration: A practical manual for Landcare groups, land managers, and rainforest regenerators* bigscrubrainforest.org

## Chemicals

**Australian Pesticides and Veterinary Medicines Authority (APVMA)** – Australian Government regulator of agricultural and veterinary chemical products apvma.gov.au

**Drummuster** – recycling for empty chemical containers drummuster.org.au

**ChemClear** – provides agricultural and veterinary chemical users with opportunities to dispose of their unwanted, surplus, or obsolete chemicals in an environmentally safe and responsible way agsafe.org.au/cc-program-overview

**NSW Environmental Protection Agency (EPA)** – regulates the use of chemicals in New South Wales under Acts and Regulations to reduce harmful effects on people and minimise environmental impacts epa.nsw.gov.au

**NSW Poisons Information Centre** – provides the latest poisons information to the public, and toxicology advice to health professionals on the management of poisoned and envenomed patients. **Hotline 13 11 26** poisonsinfo.nsw.gov.au

**SMARTtrain** – training courses in chemical handling, application, and safety tocal.nsw.edu.au/courses/short-courses/smarttrain

## Organisations

**Biodiversity Conservation Trust** bct.nsw.gov.au

**Land for Wildlife** cen.org.au/projects/land-for-wildlife/

**Local Land Services** lls.nsw.gov.au

**NSW Environmental Trust** environment.nsw.gov.au/funding-and-support/nsw-environmental-trust

**NSW Department of Primary Industries** dpi.nsw.gov.au

**North Coast Regional Landcare Network** northcoastlandcare.org.au

## Plant identification books

*Australian rainforest plants*, 6 vols – field guides, each volume containing over 100 species of rainforest trees, shrubs, vines, ground covers and epiphytes. rainforestpublishing.com.au/shop/australian-rainforest-plants-vols-i-vi-the-set/

*Australian rainforest seeds: A guide to collecting, processing and propagation* – A–Z guide with instructions for collecting, storing and propagating the seeds of 300 subtropical rainforest species. rainforestpublishing.com.au/shop/australian-rainforest-seeds/

*Barks and trunks: Rainforest trees of South-Eastern Australia,* vol 1, 2nd ed – field guide to help identify mature rainforest trees by their bark and trunk, and records these trees in their natural environment for their identity, natural heritage and value. barksandtrunks.com/books/barks-trunks-rainforest-trees-eastern-australia/

*Grasses of coastal NSW* – an easy-to-use reference, including methods of identifying species, colour photographs, and notes on appearance and management. shop.regional.nsw.gov.au/products/grasses-of-coastal-nsw-b935

*Mangroves to mountains: A field guide to native plants of south-eastern Queensland*, 3rd ed – field guide for identifying the native plants in northern New South Wales as well as Queensland. mangrovestomountains.com

*Plants of subtropical eastern Australia* – field guide with over 500 species, with an overview of ecosystems, in the north coast of New South Wales and coastal South-East Queensland. publish.csiro.au/book/7974/

*Rainforest climbing plants: A field guide to their identification*, 2nd ed – field guide covering from central Queensland through New South Wales down to Victoria. catalogue.nla.gov.au/catalog/4200795

*Rainforest trees and shrubs: A field guide to their identification*, 2nd ed – field guide covering from central Queensland through New South Wales down to Victoria. rainforests.net.au/product/rainforest-trees-shrubs-second-edition/

*Rainforest trees of mainland south-eastern Australia* – field guide to 402 rainforest tree species in Victoria and New South Wales. rainforestpublishing.com.au/shop/rainforest-trees-of-south-eastern-australia/

*Weedlings and seedlings: A field guide to seedling identification for bush regeneration* – field guide with 168 species in total, with a focus on environmental weed seedlings and look-alike native plants. Each species has a dedicated page that includes a clear image of each species at the seedling stage. lfwseq.org.au/weedlings-and-seedling-a-field-guide-to-seedling-identification-for-bush-regeneration/

## Vegetation classification apps and resources

*AusGrass: Grasses of Australia* – an interactive information system and key for the 1,323 native and naturalised species of grass in Australia. keys.lucidcentral.org/search/ausgrass-grasses-of-australia/

*iNaturalistAU* – app to help identify the plants and animals around you inaturalist.ala.org.au/pages/about+australia

*NSW BioNet* – repository for biodiversity data products managed by the NSW Department of Climate Change, Energy, the Environment and Water environment.nsw.gov.au/topics/animals-and-plants/biodiversity/nsw-bionet

*Ocean shores to desert dunes: The native vegetation of New South Wales and the ACT* – companion to plant field guides, with over 100 maps and species lists for vegetation classes. shop.regional.nsw.gov.au/products/ocean-shores-to-desert-dunes-2004

*PlantNET: NSW flora online* plantnet.rbgsyd.nsw.gov.au

*Restore Trees NSW* – app that helps you learn how to look after and replant vegetation throughout New South Wales. restoretreesnsw.app

*Rainforest plants of Australia: Rockhampton to Victoria* – interactive identification key (desktop or mobile app) rainforestplantsofaustralia.com

*Trees Near Me NSW* – app for exploring all plant community types across New South Wales. treesnearme.app/info

## Weeds

*Weeds of the North Coast of NSW: A guide to identification and control* – a practical manual to support land managers to identify and manage weeds and understand their obligations under the NSW *Biosecurity Act 2015*. lls.nsw.gov.au/regions/north-coast/articles,-plans-and-publications/weeds-of-the-north-coast-of-nsw

*NSW WeedWise* – database containing over 300 weed profiles, describing weed profile, control (including registered herbicide options) and biosecurity duty (under the *Biosecurity Act*). weeds.dpi.nsw.gov.au

*NSW weed control handbook: A guide to weed control in non-crop, aquatic and bushland situations.* dpi.nsw.gov.au/biosecurity/weeds/weed-control/management-guides/noxious-enviro-weed-control

*Weeds Australia* – website designed to connect you with knowledge to make informed decisions about managing invasive weeds within Australia. weeds.org.au

# 7. References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