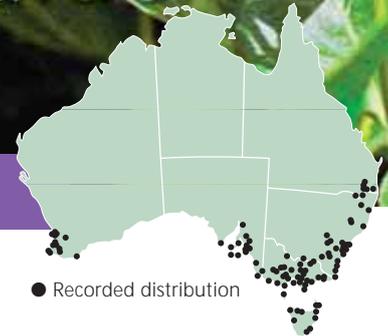


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Weed Management Guide

Managing weeds for biodiversity



Periwinkle (*Vinca major*)

The problem

Periwinkle, also known as blue periwinkle (*Vinca major*) is a creeping plant that is native to Europe and northern Africa and has been introduced to other continents as an ornamental plant or medicinal herb. In the higher rainfall regions of southern Australia it has escaped from cultivation and is invading native vegetation where its broad-leaved runners form a dense mat over other plants. It competes with native plants for moisture, light, nutrients and recruitment niches. Its growth is particularly vigorous in riparian and other moist habitats. Invasion of riparian habitats by weeds is among a range of factors contributing to their decline. That is why this is a very significant issue for biodiversity, landscapes and river health. In East Gippsland Victoria, periwinkle has

invaded temperate rainforest and has been identified as a threat to endangered and vulnerable plant species. A dense canopy of periwinkle can also alter fauna habitat.

Weeds such as periwinkle that reproduce vegetatively can establish rapidly from stem fragments at disturbed sites such as flood zones and areas recently cleared of dense weed infestations. In a recent experimental study of native tree seedlings in riparian zones invaded by periwinkle in Victoria, survival of native manna gum (*Eucalyptus viminalis*) seedlings was greater in plots initially cleared of periwinkle to a diameter of 120 cm. Blackwood (*Acacia melanoxylon*) seedlings were taller in similar sized plots cleared of periwinkle than in uncleared plots.

Invasion and establishment of exotic vines and scramblers is a key threatening

process under the NSW *Threatened Species Conservation Act 1995* of which periwinkle is one of the species listed. Periwinkle is spreading in southern Australia at the site level through expansion of existing patches, and more widely through pieces of plant taking root at new locations. Continued planting of periwinkle in gardens could contribute to its further spread. Once established, periwinkle's rampant growth is very difficult to control, especially in bushland. Restrictions on its sale and transport are under consideration in the Victorian noxious weeds review.

Key points

- Periwinkle's broad-leaved runners form a dense mat, shading out native plants and competing for moisture and nutrients.
- It mainly spreads vegetatively but some patches also produce seeds.
- Very small isolated patches (<1 m²) can be dug out. Stem and root fragments can resprout so all plant material needs to be removed from the site and disposed of appropriately.
- Herbicide treatment can be effective if applied when plants are actively growing and followed up.
- Along waterways, particular care is needed with physical or chemical treatments to prevent erosion and contamination. There may be restrictions on chemical use.
- All treatment needs to be followed up for several years.
- Integrated control of periwinkle and other weeds, and perseverance are essential for restoring native vegetation.



Blue periwinkle (*Vinca major*) can form a carpet in native vegetation, NSW.
Photo: Jackie Miles and Max Campbell

The weed

Periwinkle has a woody crown bearing runners up to 1 m long with large, stalked, opposite leaves (15–60 mm long, 14–45 mm wide). Each leaf pair is generally at right angles to those above and below. The upper leaf surface is glossy and there are generally very short hairs along the leaf margins. Flowers are large, 30–40 mm across and blue-purple or sometimes white, with 5 lobes from a basal tube 16–17 mm long. They are borne on upright stems to 50 cm long. The root system is hardy and fibrous, forming a mat 15–30 cm deep in the soil. Most populations only reproduce vegetatively, but some produce viable seeds. Fruits (follicles) are 35–40 mm long, tapered at both ends and usually paired. They contain 1–10 textured seeds, 7–8 mm long.

Periwinkle mats grow to about 0.5 m high and are shade tolerant but will grow in full sun where there is adequate moisture. The foliage contains a toxin, but is not generally grazed. Forms with variegated leaves are also invasive. The mature leaf surface has a waxy cuticle that resists uptake of herbicide. Periwinkle can increase rapidly after other weeds such as blackberry have been controlled, however, when periwinkle is removed, other weeds could take its place.

Weed identification and similar native species

Related species

Other introduced plant species related to blue periwinkle have also escaped from gardens in Australia. For example:

- Lesser periwinkle or common periwinkle (*Vinca minor*) is similar in appearance but with smaller leaves and flowers and its leaf margins are not hairy. It was also introduced to Australia from Europe and has escaped in one or two locations in



Madagascar periwinkle (*Catharanthus roseus*) is a weed of northern Australian coastal areas, related to blue periwinkle.

Photo: Colin Wilson



Lesser or common periwinkle (*Vinca minor*) flowers are 2.5–3 cm across. These are smaller than *V. major* flowers.

Photo: Dan Tenaglia, MissouriPlants.com

Victoria. Its spread appears to be largely vegetative and it may be a local weed problem.

- Madagascar periwinkle (*Catharanthus roseus*) is a garden escapee that has been nominated as one of the 10 worst weeds currently available for sale in Queensland and it has a weed history overseas. It prefers sandy soils and tropical conditions and is widespread in coastal regions of northern Australia. It spreads by seed and has the potential to spread further. Its current distribution is New South Wales, Queensland, Northern Territory and Western Australia.

Similar native climbing species

No native plants closely resemble blue periwinkle but examples of native plants with similar sized leaves and climbing habit are:

- Bearded tylophora (*Tylophora barbata*) has opposite leaves and small purple-red flowers in groups of 3–5 that are rarely seen. It is a climber, while periwinkle rarely climbs. Its native range is New South Wales and Victoria.
- Purple coral pea, happy wanderer or native sarsaparilla (*Hardenbergia violacea*) has alternate, leathery leaves and clusters of small purple or pink pea flowers. It may climb onto low vegetation but doesn't

spread from runners and generally occurs in open conditions in sclerophyll forest and grassy woodlands. Its native range is New South Wales, Queensland, South Australia and Victoria.

- Mountain silkpod (*Parsonsia brownii*) has opposite leaves that are elongated and its flowers are small and cream in colour. It is a climber related to periwinkle and grows in wet forests of southeastern Australia. Its native range is New South Wales, Tasmania and Victoria.

How it spreads

Patches of periwinkle expand by means of creeping stems that take root at the nodes and tips. New infestations can establish from plant fragments when broken off and transported by dumping of garden waste, soil movement or floods. It spreads from gardens, roadsides, nature strips, firebreaks, fencelines and neglected rubbish dumps into the bush and along waterways. Periwinkle is commonly available as a garden plant, readily propagated from cuttings and popular as a ground cover. It tends to overrun garden beds and the excess runners are thrown out in garden waste. Vegetative reproduction is most common, but in some situations periwinkle may produce viable seed.

In Australia this occurs in riparian rainforest in East Gippsland where numerous seedlings may emerge after mats have been removed.

Where it grows

Periwinkle is native to the Mediterranean region. It occurs in southern Australia and into southeastern Queensland in regions with winter, summer or year-round rainfall, but its distribution does not extend into the semi-arid or alpine zones or the tropics. Extensive infestations have generally been recorded in regions receiving more than 600 mm annual rainfall. In drier areas it occurs along watercourses and drainage ditches and there are isolated records associated with plantings such as old or existing gardens.

Periwinkle occurs in all states and the Australian Capital Territory. It has been recorded in a wide range of habitats including sclerophyll forest, coastal and riparian vegetation and warm temperate rainforest.

Periwinkle is a significant weed in New Zealand and is seen as invasive in California and Tennessee in the USA. Its spread in the USA has been largely or wholly through vegetative means but recently there have been reports of viable seed. It is also naturalised in the UK and South Africa.

Potential distribution

Climate modelling based on periwinkle's distribution in Victoria indicates that periwinkle could become more widespread in regions with adequate rainfall and a temperate or Mediterranean climate. Observations from around Victoria indicated that many of the known infestations occurred along rivers and most were estimated to cover less than 10 hectares. It is likely to spread downstream from such infestations, but long-distance

dispersal between catchments could also occur as a result of human activities.

Growth cycle

Periwinkle can grow at any time of year, while soil temperature and moisture conditions are favourable. If the foliage is burnt off by frost or drought, it can readily recover through resprouting. Flowers have been recorded throughout the year, but mainly in spring and summer. Seed germination has been observed in autumn and spring.

What to do about it

A range of strategies is needed to minimise the impacts of periwinkle on biodiversity and to prevent it from spreading. In regions where numerous infestations exist, areas of high biodiversity significance are the priority for both these objectives. Both long-distance dispersal and localised spread need to be addressed as it is more practical and cost-effective to prevent weed infestations than to control them.

Prevent periwinkle spreading

Isolated plants or patches of periwinkle in or near bushland need to be identified and removed before they spread. New infestations of periwinkle could result from continued propagation and

planting as well as accidental dispersal. Programs to increase community awareness about weedy garden plants such as periwinkle are needed to target gardeners, landscapers and nursery suppliers. In public and private gardens, it is preferable to replace periwinkle with alternative non-weedy ground covers. Appropriate facilities for public disposal of garden waste and weedy material are needed. Established patches occurring in slashed areas need to be identified and weed hygiene practised to prevent propagules being carried to new locations.

Reduce established infestations

At the local or property scale a long-term management program can reduce periwinkle's harmful effects; help to contain its spread; and encourage native vegetation to recover. Both native plants and weeds may regenerate after primary treatment. A planned, strategic approach is essential to ensure that the patch is replaced by native plant cover rather than periwinkle or other weeds. As well as the information presented in this guide on periwinkle biology and control methods, a plan needs to be based on specific knowledge about the site—including the distribution and biology of other major weeds.



Periwinkle (*Vinca major*)

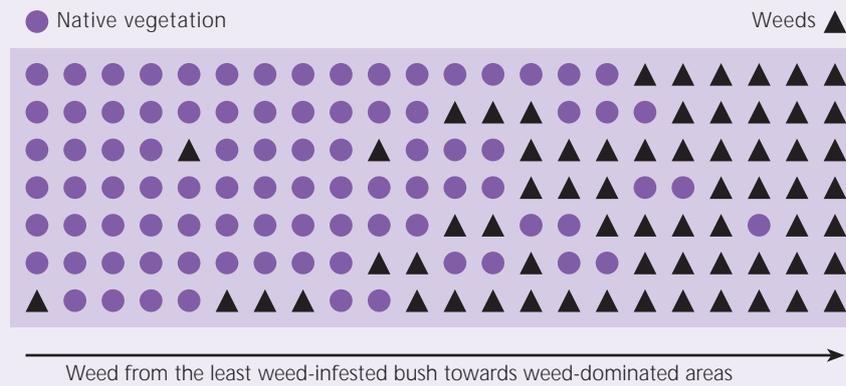


Flowers are 3–4 cm across and leaves are heart shaped, glossy and in opposite pairs.
Photo: Jackie Miles and Max Campbell



Petals are fused into a tube at the base.
Photo: Matthew Baker, Tasmanian Herbarium

Strategic weeding in native vegetation



Riparian environments are generally dynamic and favourable for colonising plants, including weeds, because they are relatively moist, high in nutrients, water can import weed propagules and flood damage to riverbanks provides recruitment sites. Weed invasion is often a symptom of ongoing problems such as altered hydrology or land degradation upstream, and these need to be addressed. Rehabilitating native vegetation in riparian zones is often complex and a range of issues needs to be considered carefully during the planning phase, including potential for streambank erosion, preventing chemicals entering waterways and the impacts of a range of weeds. General goals should be clear at the start. Guidelines are available on using herbicide and on planning rehabilitation in riparian habitats.

Develop and implement a **long-term** weed management plan.

1. Investigate the site

- **Identify all plant species:** weeds that could occupy the site after periwinkle has been removed and native plants that need to be protected during treatments.
- **Map periwinkle infestations:** indicate density throughout the site. Identify patterns of dispersal and whether periwinkle is producing viable seed locally.
- **Map native vegetation condition:** assess its capacity for recovery after

periwinkle is removed and identify sites of high biodiversity value, such as rare flora and fauna habitats.

- **Values and risks:** identify high-risk sites for erosion potential and other factors. Determine whether herbicide and additives can be used safely and legally at this location.

2. Develop the site action plan

- Identify goals and priorities based on the site information.
- Define priority areas for control by overlaying maps of weed density, native vegetation, site values and risks.
- Plan to weed strategically:
 - protect the better quality native vegetation first and consider the needs of rare fauna and flora
 - work from isolated periwinkle patches towards core infestations
 - control plants from upstream to downstream.
- Work in stages. The size of the area targeted at each stage should be manageable enough to follow up thoroughly. Weed control that is not followed up is wasteful and can cause a bigger problem.
- Include control of other weeds so that they do not establish where periwinkle has been removed.
- Select the most suitable control method in each area. Plan appropriate disposal of weed material.
- Prepare a weed management calendar to maximise the effectiveness of treatments and of follow up.

3. Implement the action plan

- Remove periwinkle from the edges of infestations into the more infested areas. Ensure that pieces of runners are not dispersed or native ground cover disturbed.
- Apply herbicide treatment when periwinkle is actively growing. Shield native plants from contact with chemicals. Adapt to local seasonal conditions.
- Inspect treated areas after a few months. Follow up periwinkle regrowth in all previously treated areas before moving further into the infestation.
- Observe regeneration of both native plants and weeds in cleared areas after primary weeding and plan the next stage accordingly.
- Coordinate control programs with neighbouring landholders to maximise effectiveness and reduce ongoing spread.

4. Monitor and evaluate outcomes and adapt the plan accordingly

Include monitoring of native plant regeneration. In weed management programs there is often a tendency to focus on the removal of weeds as a goal, but at the site level the ultimate goal is restoration of native vegetation.

Control methods

Established infestations of periwinkle in native vegetation are difficult to remove because:

- they have a dense network of runners above ground that can become entwined with native understorey and a tough, matted root system
- plants reproduce vegetatively from root and stem fragments and crowns
- uptake of herbicide by mature leaves may be reduced due to the waxy cuticle
- they often grow in fragile riparian environments





Periwinkle (*Vinca major*) grows entangled with native understorey plants as well as other weeds, making its removal difficult.

Photo: Matthew Baker, Tasmanian Herbarium

- plants are tolerant of shade and may thrive under a native tree canopy.

In selecting the most suitable control techniques it is essential to minimise adverse impacts on native vegetation and waterways and to encourage subsequent recovery. Physical and chemical control measures may be combined to remove patches of periwinkle effectively. All treatment needs to be followed up and may need to be repeated. There are no known biological control agents for this species in Australia.

Physical removal of small patches

Small patches, up to a few metres across can be dug out. All runners, roots and the crown should be removed and disposed of safely. Larger patches should be removed in stages from the edges, folding the runners inwards towards the weed as work progresses. Cleared areas where the soil has been disturbed will be prone to invasion by periwinkle regrowth or other weeds.

In sunny locations, small patches can be weakened by covering them with black plastic over the summer for at least an entire growing season, up to

a year. The goal of this first stage is to overheat the weeds so that plants will then be easier to dig out. This method is unsuitable for areas containing native plants.

Chemical control

The main herbicide treatment for periwinkle in native vegetation is foliar spray of actively growing plants using systemic, non-residual herbicide. A treatment program should be carefully tailored to each situation. Generally spring is the recommended season for spraying. Plants should not be under moisture or cold stress. Find and shield native plants from contact with herbicides. Various site and seasonal factors may reduce treatment effectiveness at times. Follow up and perseverance are needed to prevent the infestation recovering rapidly through regrowth.

For spraying to be successful, there must be sufficient uptake of chemical by periwinkle leaves, translocation to its roots and recovery of native vegetation. Addition of a penetrant or increased herbicide concentration involves increased risk to native plants and watercourses. Refer to guidelines for herbicide use in riparian zones, where certain chemicals or application methods may be restricted or prohibited.

Registered herbicides for blue periwinkle

Periwinkle is not listed on the label of any registered herbicide in Australia. A 'Permit to allow minor use of an AGVET chemical product' may be issued to allow registered products to be used for a specified purpose or in a manner that is not included on the approved label. Permits that include treatment of blue periwinkle (NSW) or environmental weeds generally with non-residual, systemic herbicides in some non-crop situations exist in NSW, Qld, SA, Tas. and WA. Refer to the Australian

Pesticides and Veterinary Medicines Authority website to find the relevant permit for your state or territory and obtain advice on local conditions from the permit holder. Refer to the fact sheet 'Off label chemical use in Victoria' for sources of advice in that state.

Glyphosate is widely used for treatment of individual weeds in native vegetation by community groups, landholders and public land managers. It is not selective and care is needed to avoid contact with non-target plants, especially where a penetrant has been added. Special aquatic formulations are available for use over water. No penetrant or other surfactants should be added in this situation.

Selective herbicide may be suitable for some situations where native grasses are at risk and may be included in a permit. Permits may specify the training required by users.

When using herbicides always read the label and follow all instructions carefully and refer to conditions on the relevant permit. Follow the herbicide label advice regarding compatible surfactants for any product and situation. At least one member of a group should have formal training in the safe storage, handling, preparation and use of the chosen herbicides.

Legislation

In the Australian Capital Territory blue periwinkle (*Vinca major*) is a declared pest plant and its propagation and supply are prohibited. In Victoria, phase two of the noxious weeds review is considering 10 species, including *V. major* that are not currently declared, but have been recognised in regional weed plans. Restrictions on its sale and spread are under consideration in the review.

Periwinkle is banned from propagation and sale in some districts of New Zealand.



Contacts

State / Territory	Department	Phone	Email	Website
ACT	Dept of Territory and Municipal Services	(02) 6207 511 or 132281	N/A	www.tams.act.gov.au/live/environment
NSW	Dept of Primary Industries	1800 680 244	weeds@dpi.nsw.gov.au	www.dpi.nsw.gov.au/weeds
	Dept of Environment and Climate Change	131555	info@environment.nsw.gov.au	www.environment.nsw.gov.au
Qld	Dept of Primary Industries and Fisheries	132523	callweb@dpi.qld.gov.au	www.dpi.qld.gov.au
SA	Dept of Water, Land and Biodiversity Conservation	(08) 8303 9620	N/A	www.dwlbc.sa.gov.au
Tas.	Dept of Primary Industries and Water	1300 368 550	weedsenquiries@dpiw.tas.gov.au	www.dpiw.tas.gov.au
Vic.	Dept of Primary Industries	136186	customer.service@dpi.vic.gov.au	www.dpi.vic.gov.au
	Dept of Sustainability and Environment		customer.service@dse.vic.gov.au	www.dse.vic.gov.au
WA	Dept of Agriculture and Food	(08) 9368 3333	enquiries@agric.wa.gov.au	www.agric.wa.gov.au
Australia-wide	Australian Pesticides and Veterinary Medicines Authority (APVMA)	(02) 6210 4700	N/A	www.apvma.gov.au

Contact details for state and territory agencies with responsibility for weeds are listed above, along with the APVMA. The APVMA website hosts the PUBCRIS database which contains information on all herbicides that are registered in each Australian state and territory, including minor use permits.

Consult the natural resource management organisation for your region or local council to find local contacts on managing weeds for biodiversity, including community groups working on periwinkle.

Refer to the CRC for Australian Weed Management website (www.weedsrc.org.au) for weed management guides in this series, as well as guides for Weeds of National Significance and Alert List species. The Introductory Weed Management Manual (also available from this website) may assist in developing a plan tailored to your situation.

Acknowledgments

Map: Australia's Virtual Herbarium, (*Vinca major*), via Royal Botanic Gardens Melbourne, Council of Heads of Australian Herbaria.
www.rbg.vic.gov.au/cgi-bin/avhpublic/avh.cgi

Information and review: Dr F. Ede, Victorian DPI; Dr N. Ainsworth, Victorian DPI.

Case study: Bill Peel, East Gippsland Catchment Management Authority.

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Knowledge gaps

The impact of periwinkle on different components of native ecological communities, including understorey and fauna species is little understood.

Research is needed into these areas as well as into effective methods for removing periwinkle with minimal damage to native vegetation in various environments and under a range of seasonal conditions.



Restoring rainforest on the Snowy River

Rainforests in southeastern Australia generally occur as relatively small pockets and provide habitat for many threatened plant and animal species. Weeds are among a range of threats to rainforest biodiversity and periwinkle is a significant weed problem in warm temperate rainforest along the Mitchell, Snowy and Tambo Rivers in East Gippsland, Victoria. At some sites, it is replacing formerly intact rainforest, and even the trees are dying.

Established infestations of this weed are generally treated with glyphosate containing a penetrant (two passes). Usually large soil-stored seed germination events occur in the following spring and again in autumn. If there is significant natural regeneration in rainforest, then follow up consists of minimum disturbance, manual weeding rather than herbicide treatment to minimise damage to emerging native species.

A rare salt-tolerant type of rainforest on Second Island in the Snowy River estuary has been invaded by periwinkle and tradescantia (*Tradescantia fluminensis*), another weedy creeper that carpets the forest floor. Prior to weed control, it was estimated that two thirds of the rainforest canopy had died. After the canopy collapsed, conditions became favourable for sunlight-loving weeds such as Cape ivy (*Delairea odorata*) and kikuyu (*Pennisetum clandestinum*).

Funding was received from the Australian Government's Natural Heritage Trust to assist Moogji Aboriginal Council, Marlo Coast Action / Coast Care and Parks Victoria to undertake weed control to conserve these nationally significant rainforest stands on First and Second Islands. The first phase in 2005 involved four people working over 6 months, initially treating periwinkle and tradescantia with



Cape ivy (*Delairea odorata*), tradescantia (*Tradescantia fluminensis*) and periwinkle (*Vinca major*) compete with native species in mature Littoral Rainforest. Second Island, Marlo Estuary, Victoria. Photo: Bill Peel

herbicide, then the regrowth was removed by hand.

Abundant natural regeneration followed the removal of periwinkle and large-scale revegetation has so far not been necessary. Trees that are native to the island such as muttonwood (*Myrsine howittiana*), common boobialla (*Myoporum insulare*) and lilly pilly (*Acmena smithii*) have all regenerated. Boobialla was strategically planted in some areas to block entry of salt-laden winds into the interior of the recovering rainforest stand. It was also necessary to plant southern mahogany (*Eucalyptus botryoides*) because the remaining trees were in poor condition and were not setting seed. However, the other native rainforest trees (and a wide range of other life-forms) regenerated naturally from soil-stored seed and seed dispersed from remnants elsewhere on the islands, following removal of most of the weeds.

Restoration of these warm temperate rainforest stands requires patience and careful observation of weed ecology to match the rate of recovery to the pace of works. In particular, seaberry saltbush (*Rhagodia candolleana*), a



Periwinkle (*Vinca major*) seedlings from one square metre following primary weeding. Snowy River Rainforest, East Gippsland, Victoria. Photo: Bill Peel

rampant native ground cover plant was initially held back to assist with follow up, as this species tends to hide the regenerating periwinkle. The potential for periwinkle regeneration was largely exhausted after 12–18 months and the saltbush was then allowed to establish.

Given the islands' position at the confluence of the Snowy and Brodribb Rivers, it has been necessary to remain vigilant in the face of weed re-invasion following the June 2007 floods. A more strategic approach to periwinkle and other rainforest weeds is being planned, working gradually downstream from the top of the catchment.



Strategic management of blue periwinkle

Regional / local status of periwinkle	Not yet established	Small, isolated outbreaks	Widely established
Management goals	Prevent establishment	Eradicate	Contain infestations and mitigate threats
Strategies required	Prevent propagation, supply and new plantings Provide safe disposal options for garden refuse Monitor, detect and identify possible new infestations Prevent import of weeds in soil	Manual or herbicide treatment with follow up Dispose of plant material safely Prevent periwinkle re-establishment or invasion by other weeds through site restoration	<p>Native vegetation: Identify high priority biodiversity assets threatened by periwinkle Protect them through implementing long-term site management plans</p> <p>Riparian zones: Plan management of periwinkle and other weeds at the catchment level</p> <p>Gardens: Plant alternative non-weedy ground covers in place of periwinkle Monitor and contain existing plantings</p> <p>Slashed areas: Map infestations and practise weed hygiene to prevent spread from slashings</p>

Vegetation management or weed control?

A weed removal program can be judged successful if the weeds are ultimately replaced by vegetation that is valued. Adopt a strategic, integrated, long-term approach to restore native vegetation that is self-sustaining and minimise reinvasion by periwinkle or other weeds. Natural regeneration of native plants is the best form of restoration, but in sites dominated by weeds over many years, there may be no native plants or seed remaining. In such cases, revegetation will be needed.

Adapt the control method to the situation

Small patches can be dug out. Controlling periwinkle in native vegetation and riparian environments

requires particular care. Remove the weed in stages to avoid leaving large, bare areas at risk of erosion.

Apply herbicides during periods of active growth

Herbicide should only be applied when plants are actively growing. Avoid hot or wet conditions, or periods when plants are under stress, as specified on the herbicide label.

Dispose of plant material safely

After physical removal, runners and seedlings should not be left in contact with the soil. If this material cannot be removed from the site altogether, it needs to be bagged until completely dead.

Follow up

It is essential to monitor for regrowth from root and stem fragments after physical or chemical treatment and follow up thoroughly. Wait for regrowth, then dig out or spot spray during active growth.

Prevent periwinkle re-establishment

Once plants have been killed, the focus is on preventing re-establishment from fragments of roots and runners. If the population was seeding, seedlings may appear for several years.

- Identify likely sources and patterns of re-invasion such as dumping sites and water or soil movement.
- Monitor weed-free areas every year to detect and remove new patches.
- Restore healthy native understorey vegetation.

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