Pest Plant Field Trip Notes

Aotearoa Biodiversity Conservation

Field Trip Date: 29 April 2023
Host: WaiP2K
Presenter: Peter Russell
Sites: RW Tate Scenic Reserve (DOC), O'Connor's Bush (DOC), and Pāpāwai/Mangarara Stream (privately owned), Greytown area
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Introduction

The original intention for these notes was merely to provide control methods for the weeds discussed during the field trip. During the preparation of those notes, however, it became clear that those control methods need to be accompanied by a minimum of related information. This is necessary to enhance understanding of what is meant by the terms "weed" and "pest plant", and how to control and manage them effectively and efficiently while maximising biodiversity gains, minimising negative consequences of the work, and managing health and safety hazards appropriately. Much of the following information was touched on during the field trip.

Please note that it is impossible to provide weed control methods that will be optimal or appropriate in all situations. Unfortunately, there is no single, comprehensive source of information on weed control methods for New Zealand. The control options provided below are based on decades of obtaining and refining "best practice" methods from New Zealand networks, including central and local government agencies. They are generally appropriate for controlling the specified weeds away from wetlands and water bodies and where negligible non-target damage is possible as a result of using them.

If weed control is not done well it can make matters worse! Unless care is taken, weeds (and other unwanted organisms) can easily be spread to, from, or within work sites. Unnecessary physical disturbance can enhance opportunities for weed establishment and spread. There are many situations in which it would be also inappropriate to use the herbicides recommended below, such as in or near wetlands and water bodies, in or near plants or animals that are rare (nationally, regionally, locally, or within the site itself), and in weather conditions that mean the dispersal of herbicides cannot be controlled adequately.

While being familiar with weed control methods is obviously essential, other aspects of weed management are equally important. Many other critical aspects of weed management were introduced during the Pest Plant Workshop in Carterton on 16 March 2023 (hosted by WaiP2K and presented by the author). This document provides particularly pertinent information regarding weed management that should be considered before implementing the weed control methods provided below. It would be inappropriate to provide you with weed control methods without mentioning these. It is hoped this information answers most of the questions that would have been asked if had not been provided. Requests for clarification and additional questions are inevitable and welcome.

Pest Plants or Weeds?

Whether we call them “pest plants”, “environmental weeds” (to distinguish them from other kinds of weeds), or simply “weeds”, we are concerned about “plants that can significantly and adversely affect *the long-term survival of native species, the integrity or sustainability of natural communities, or genetic variation within indigenous species*” (as the Department of Conservation recently defined them) - for convenience, the italicised subject can be expressed simply as “biodiversity.” The term “weed” can relate to *any* kind of plant, including algae, mosses, ferns, grasses, cacti, shrubs, vines, palms, trees, and all other herbaceous (non-woody) plants. While Pest Management Strategies overseen by MAF and councils categorise a limited number of organisms as official “pests”, that term will continue to be used in a broader sense that remains valid. As the context is clear, we can simply refer to the plants we are concerned with here as “weeds” for the sake of convenience.

Introduced and Native Weeds

The term “native” is best used in association with a specific geographical area that has an ecological context, i.e. the range within which an organism occurs naturally. No plants occur naturally throughout the entire NZ political region. About 2,500 native plants have been described in the NZ ecological region, along with an estimated 40,000 introduced plants. Of the introduced plants, at least 2,500 have become established in the wild, but most are not considered a major problem because they generally only become abundant in disturbed, human-induced “waste” areas, e.g. roadsides.

Numerous introduced plants are commonly considered weeds in agricultural, horticultural, or garden environments. Unless such plants also threaten biodiversity we are not particularly concerned with them here, although they may be controlled for other reasons e.g. to meet Pest Management Strategy obligations, help protect neighbouring farms from invasion, or for aesthetic considerations. DOC has recognised 328 plants as environmental weeds, but the total is likely to be closer to 500. Most were introduced to NZ as garden plants and escaped into the wild. Several are NZ natives that have been spread well beyond their natural range by people and established in the wild to an extent that threatens local biodiversity.

When developing weed management plans a good starting point is to consider the need to manage all introduced plants at any given site, i.e. plants introduced, not native, to a local Ecological District (e.g. Aorangi, Eastern Wairarapa, Puketoi, Tararua, or Wairarapa). One may then categorise each plant as either relatively benign or a weed that needs to be managed to some degree. Eradication is not necessarily an appropriate goal and it is often only realistic to manage some weeds to some degree. One may consider introduced plants to be on a spectrum from those that are benign to those that present a major threat to biodiversity.

Indicative Environmental Weed Biodiversity Threat Spectrum

This table represents a generalised spectrum indicating the environments in which introduced plants have primarily become wild and their level of threat to biodiversity. In reality, some weeds are established in multiple environments, but less than c.10% are considered a major threat to more than one.

*As the context is clear, we may simply refer to environmental weeds as “weeds” for the sake of convenience.

Biodiversity threat	Nil	Very minor	Minor	Moderate to Major	Total
Primary environment concerned	N/A (not thought to be wild)	Disturbed, human-induced “waste” areas, roadsides, etc.	Agricultural, horticultural, aquatic, and garden environments, etc.	Natural and semi-natural areas, and areas in which ecological restoration is desired	
No. (est.)	37,000	2,000	500	500	40,000
Common labels				Environmental weeds*	
			Official pest plants (only those declared “pests” by councils and MAF)		
		Naturalised plants, wild plants, weeds (in a broad sense)			
	Introduced plants (including NZ natives beyond their natural range)				

Aims

Having one or more long-term aims is essential for projects involving the protection and restoration of biodiversity. People with a wide variety of backgrounds, motivations, and assumptions often work together on biodiversity-related projects. Having clear aims helps to ensure everyone’s work, including weed control, is consistent with each other’s and will generate the outcomes they desire, along with those of site owners and managers. Clear goals for the management of each weed deemed worthy of management at a site provide a necessary basis for action. Additional weed-related goals will be necessary e.g. focussing some attention on protecting the most important parts of each site and enhancing native plant diversity (see below). Once several short and medium-term weed management goals have been achieved they should lead towards the achievement of overall, long-term aims for a site.

Aims and goals serve us best when they are specific, measurable, achievable, realistic, and time-framed (SMART). When developing aims and goals it is important to distinguish between them and the means of achieving them or any restrictions on how they can be achieved, i.e. avoiding confusing aims with methods helps to provide a clear starting point. Policies are best specified separately.

Most of the land between Pukaha and Kawakawa was once dominated by native forest, so it is no surprise that most of our work involves the protection and restoration of native forest. This enables us to make good use of our greatest natural ally in the war on weeds: shade. A common, and appropriate, long-term goal for such sites is: “to restore, to the extent possible, the kind of forest that existed at the site prior to human arrival, notwithstanding allowances for protecting sites of cultural significance, and human access and enjoyment of the site”. Similar aims can be developed for other environments, such as shrublands and wetlands, although such environments present different

challenges that may require different aims and methods.

Much of our work involves Scenic Reserves administered by the Department of Conservation. Many aspects of the Reserves Act 1977 affect how scenic reserves are to be managed, but the Act implies they are primarily about “protecting and preserving their indigenous flora and fauna, ecological associations, and natural environment as far as possible” and states that “for this purpose, exotic flora and fauna shall as far as possible be exterminated”. More specific aims and policies may be provided in a management plan developed for each scenic reserve, although it is likely some could be updated to reflect current values. Most, if not all, scenic reserve management plans are likely to provide aims that are consistent with that provided above for sites dominated by native forest.

Occasionally aims that deviate from an ecological restoration theme are desired, such as those involving managing vegetation to favour particular species. An example of this would be a shrubland managed in a way that prevents it from developing naturally into forest to maintain habitat for rare plants or lizards that require short, sun-drenched vegetation for their long-term survival in the area. Such aims may be appropriate, but they involve maintaining vegetation that is more susceptible to weed invasion than it would be if allowed to regenerate into taller, shady forest.

Health and Safety

To manage human health and safety risks, all individuals and community groups should meet basic standards before weed control commences. Most, if not all, landowners and managers explicitly require this. This generally includes ensuring that an appropriate health and safety plan is in place that addresses all significant risks associated with weed control (involving all people that may enter the work site, including visitors).

Health and safety plans generally include matters such as the minimum number of people required at work sites; fitness levels (including medical conditions); the need to isolate work sites from the public; communications (including seeking help if something goes wrong); transporting people, materials and equipment to and from work sites; transport and use of hand and power tools; moving through hazardous terrain and vegetation (including dead-standing trees); the use of herbicides; and the use of personal protective equipment. Common requirements are proof of first aid certification, Growsafe certification (herbicides), chainsaw use, and tree felling certification and competence.

Non-target Impacts

To avoid or minimise non-target impacts most, if not all, landowners and managers require individuals and community groups to meet certain requirements before weed control commences. This often involves using “best practice” control methods for an approved list of weeds, along with appropriate goals and timeframes for the management of each weed. Proper consideration, experience, training, or expert advice are generally required to avoid or minimise non-target impacts on native plants, animals (including invertebrates), fungi, and other life forms. Special consideration should be given to large or old plant specimens, plants or animals that are rare (nationally, regionally, locally, or within the site itself), and aquatic life and introduced organisms considered to have historic value.

Clear agreement on target weeds, goals, time-frames, and methods should generally be

reached with landowners or managers before weed control commences, along with an understanding of what level of disturbance and non-target impacts are acceptable.

Herbicides

In NZ herbicides (and additives) are used more readily for conservation work than in many other countries. This seems likely to be connected with NZ's liberal use of herbicides in agriculture, which has dominated our economy and culture to a large extent. It is often said that "in NZ conservation means killing things" and this is also true to a greater extent than it is in most other countries. This is so because having been isolated from the rest of the world for millions of years and only being colonised by humans relatively recently, we have many sensitive ecosystems that have suddenly been exposed to numerous introduced organisms that threaten their survival.

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Given the nature and scale of the threat posed by weeds to biodiversity and the limited tools and resources available to address this, the careful use of a limited range of relatively low-toxicity herbicides seems justifiable. They must, however, be used with caution because they can potentially have significant impacts on non-target plants, animals, and other life forms.

Herbicides used commonly in New Zealand include glyphosate (Roundup etc.), picloram (Vigilant, Tordon, etc.), metsulfuron-methyl (Escort, Meturon, MetGel, etc.), and trichlopyr (Grazon, Tordon, etc.). Incidental exposure to herbicides can harm or kill sensitive plants. When herbicides are applied near the roots or bark of susceptible plants they can harm or kill them, especially through repeated exposure or if they are stressed due to other factors. Herbicides can also disrupt symbiotic relationships between plants and mycorrhizal fungi (which are important for nutrient uptake and plant growth) and disrupt ecological processes. The extent of the harm caused by herbicides depends on several factors, such as the dose, timing, method of application, and the susceptibility of the plant species.

Several sources of information are available regarding the unintended impacts of herbicides. One of the most comprehensive databases is the Pesticide Properties Database developed by the University of Hertfordshire in the UK. Another is the National Pesticide Information Center in the US. Several scientific journals and research papers provide information on the unintended impacts of herbicides. These studies often focus on specific herbicides and non-target species.

Weed Management in Wetlands and Water Bodies

Most of the sites that groups care for are forest remnants, and they are our current focus in relation to weed management. Shade is a great means of helping to suppress most weeds and preventing their establishment in forest environments, including swamp forests and streams under a forest canopy. Wetlands with short vegetation and water bodies in open, sunny environments present an altogether different challenge because they are very susceptible to weed invasion and/or because herbicides cannot be used so readily in them.

Herbicides commonly used in New Zealand, including those mentioned above, can have serious and long-lasting negative impacts on wetlands and water bodies. The use of herbicides in wetlands and water bodies is particularly problematic because it is difficult to control where they migrate to and accumulate. Herbicides can also migrate from application sites to wetlands and water bodies through runoff or leaching. Although the use of some herbicides in water bodies is approved in New Zealand, there is cause for hesitancy. The label of Weedmaster G360, for example, describes that

formulation of glyphosate as suitable for aquatic areas, but also describes it as “toxic to aquatic organisms with long-lasting effects.”

Once they enter wetlands and water bodies, herbicides can have a range of negative impacts, such as:

1. Toxicity to aquatic organisms: Herbicides can be toxic to a range of aquatic organisms, including fish, invertebrates, and algae. Glyphosate, for example, can be toxic to some species of fish, affecting their behaviour and reproduction. Trichlopyr and picloram can also be toxic to some aquatic organisms, particularly invertebrates.
2. Reduced oxygen levels: Some herbicides, such as glyphosate, can stimulate the growth of algae in water bodies, leading to eutrophication. When algae dies and decomposes, it uses up oxygen in the water, which can lead to low oxygen levels and harm aquatic organisms.
3. Disruption of food webs: Herbicides can affect the abundance and diversity of aquatic plants and algae, which form the base of the aquatic food web. Reductions in plant and algae

abundance can affect the entire food web, leading to declines in populations of fish and other aquatic organisms that depend on them.
4. Changes to water chemistry: Herbicides can alter the chemistry of water bodies, which can have negative impacts on aquatic organisms. For example, metsulfuron can increase the pH of water bodies, which can harm some species of fish and invertebrates.
5. Bioaccumulation: Some herbicides, such as glyphosate, can bioaccumulate in the tissues of aquatic organisms. This means herbicide levels can increase as they move up the food chain, potentially reaching toxic levels in top predators such as fish and birds.

The author plans to investigate weed management and use the use of herbicides in wetlands and water bodies further in the near future and share findings with WaiP2K.

Some Guidelines for the Use of Herbicides (and Additives)

- Herbicide gels should only be applied under the supervision of someone with Growsafe certification.
- Other forms of herbicide use, such as spraying foliage, should only be applied by someone with Growsafe certification.
- Manufacturer labels should be read and fully understood before use.
- The least amount of the least toxic herbicide required should be used.
- Carefully consider potential risks and harm caused by herbicides before applying them, and use alternative control methods when possible.
- Herbicides should not be sprayed on sapling or tree trunks (especially if they contain a penetrant), except those of target weeds, because they can penetrate the bark of some species and seriously harm or kill them.
- Herbicides containing the active ingredient Metsulfuron-methyl (e.g. Escort, Meturon) should generally be avoided because they remain particularly active in the soil, through which they can be carried by water, and some natives are particularly sensitive to them e.g. podocarps, and *Coprosma* and *Griselinea* species (including large trees).
- Herbicides containing the active ingredient Picloram (e.g. Vigilant gel, Picloram gel, Tordon) should not generally be used close to valued plants because it can damage or kill them through soil or root contact.
- In general, herbicides should not be used over or near water bodies, except carefully selected herbicides used by qualified personnel with appropriate consents.

Disturbance Associated with Weed Control

The disturbance associated with killing weeds throughout a large proportion of a reserve in a short timeframe can potentially have negative consequences for biodiversity. At most sites, it will be unrealistic to eradicate many weeds in one season for a variety of reasons, including the resources available. It must therefore be accepted that doing so is a gradual process, and this often enables the work to be done in a gradual manner that minimises the disturbance. In very weedy areas the best results are generally achieved by consciously adopting an approach of *facilitating a gradual transition from one vegetation type to another*. This will often involve a transition from vegetation dominated by weeds to vegetation dominated by a diverse range of native plants and may involve a period of five to ten years or more.

Disturbance created by the sudden death of large areas of weeds, especially trees in small reserves, can create significant opportunities for other weed species to thrive – especially if their seed has been dormant in the soil or seed sources occur nearby. Killing a large area of weeds in a short time frame can significantly damage remaining native vegetation through sudden exposure to wind and greater sunlight penetration. This could cause the most exposed parts of native trees, or entire trees of particularly sensitive species, to die - which is likely to create further opportunities for weed invasion, leading to the need for more weed control work, more herbicide, and extended time frames compared with a more gradual approach.

Larger forest remnants may have a sufficient abundance and diversity of native plants that a variety of them are likely to colonise areas disturbed by weed control. In contrast, disturbed areas in small remnants with low native diversity are more likely to be colonised by introduced plants, including weeds and less significant introduced plants e.g. black nightshade and fleabane (which are not particularly shade tolerant and do not particularly need to be controlled because they can only thrive in disturbed sites where they will eventually be displaced by forest regeneration). The latter sites require a more gradual approach to weed control which should involve the human-assisted re-establishment of native plants, e.g. planting, and seed scattering.

Poisoning Weedy Trees

The control of weedy trees by poisoning them is often a good option from an ecological perspective because it is very efficient and results in fewer negative impacts on adjacent vegetation. This is a particularly useful option for weedy trees that can take root when freshly severed stems come to rest on damp soil. For most species, it is effective for holes to be drilled with a 14mm spade bit about 5cm apart and 30-40mm deep, angled downwards, as low to the ground as possible (to severe the connection between root and stem tissue). For maximum impact, each hole should be filled with herbicide immediately after it has been filled (before the vascular system shuts off). Gel-based herbicides should be used because they are less concentrated than neat herbicide concentrate (and therefore much cheaper) and emits little, if any, vapour (so it is unnecessary to wear a respirator). While glyphosate gel works well on most species, different hole spacings and herbicides are better for some species.

Dead-standing trees generally fall apart gradually as they decompose, rather than falling in one piece. By the time they break off, falling rotten limbs are light compared with their green weight and cause negligible damage to adjacent plants as they fall. Scattered poisoned trees surrounded by dense native forest are unlikely to expose the vegetation to sunlight and wind to an extent that

causes significant damage to it. Poisoning several adjacent trees in a small forest remnant, on the other hand, may expose the vegetation to the elements to an extent that causes significant damage - especially by strong wind.

Although sunlight penetration will increase in areas where trees have been poisoned, it does so to a far smaller extent than would have been the case if they were felled, especially individual trees surrounded by native forest. The leaves dropped by poisoned trees cover much of the soil and their trunks and branches cast a significant amount of shade, limiting opportunities for weed establishment and growth.

In large forest remnants with a broad diversity of native plants, native vegetation will rapidly take advantage of the favourable environment and gradually fill the gap as the leaves, branches, and trunks of poisoned trees decompose. It is common for natives to thrive to such an extent in these sites that they become unrecognisable within two or three years, by which stage the poisoned trees may have fully decomposed. In smaller forest remnants with a lower diversity of native plants disturbed sites are less likely to be colonised quickly by natives and human-assisted establishment of native plants may be required to prevent colonisation by introduced plants and fill the gap to prevent harmful exposure to the elements.

Dead-standing trees may, however, be considered an artificially created health and safety hazard that needs to be addressed because they, or parts of them, could potentially fall on visitors or workers in the area. The risk is heightened if several large trees within falling distance of each other are poisoned simultaneously in small reserves with a track network and volunteers frequently present off-track. A common precautionary approach is to avoid creating dead-standing trees within twice their height from tracks (because one dead tree could fall onto another, causing it to fall also).

In small reserves with track networks, a precautionary approach could rule out poisoning weedy trees altogether. Workers off-track should be warned about the presence of dead-standing trees, avoid disturbing them (e.g. by leaning on them) and keep away from the area on days with strong wind or heavy rain. Drawing workers' attention to dead-standing trees with a map of their distribution and by marking them (e.g. with fluorescent spray paint, flagging tape or danger/ caution tape) may also be wise. Alternatively, weedy trees could be felled instead of being poisoned, or be felled soon after poisoning (but before decomposition makes them hazardous to fell), by which stage they may be somewhat lighter.

Enhancing Native Plant Diversity

Most forest remnants contain a limited number of the native plants that are likely to have existed in the local area prior to human arrival. Small, lowland forest remnants commonly contain 50 to 100 native species, whereas the same sites may have contained something in the order of 300 to 500 species when they were part of a vast forest. Enhancing the diversity of native plants in an area is a key part of ecological restoration. Enhanced diversity strengthens the stability of ecosystems, along with their ability to recover from severe climatic events and resist weed invasion.

Many slower-growing native plants need plenty of sunlight to thrive, and it is often in short supply in forest remnants. Weed control provides valuable opportunities to establish light-demanding native plants. This particularly applies to species that are missing or rare at the site. In small, isolated forest remnants, means of re-establishing native plants should be planned carefully to make the most of opportunities to do so. This means a reasonable idea of the desired vegetation is required before weed control commences, along with personal, organisational and financial

commitment in the medium to long term.

It is generally unwise to begin planting before weeds are well under control at any given site, if not completely eliminated from it. It is generally very difficult to control weeds efficiently when they are growing among young native plants without killing the natives. Other means of establishing native plants may be appropriate, e.g. scattering seed.

Biosecurity

In a strict sense, the term biosecurity can refer to controlling the movement of unwanted organisms over a boundary e.g. a national border or the boundary of a nature reserve. In a broader sense, biosecurity can apply to any matter regarding pest management. For the purposes of this discussion the term is used in the latter sense.

The accidental movement of unwanted organisms to, from or within the sites we work in is a significant threat to their biodiversity. The greatest risk is associated with weeds (seeds, spores and fragments) and micro-organisms which can easily be spread on contaminated footwear, clothing, materials and equipment. People who work in natural areas present the greatest biosecurity risks because we are more likely to work in sites where pests occur (e.g. nature reserves, farms and gardens) and we frequently work off-track. It would be particularly unfortunate if people working to protect and restore an area introduce a new pest to it, especially one that is difficult to control e.g. a fast-growing weed with long-lived seed/spores.

Unless we pay special attention to biosecurity, examples of weeds that are likely to be spread by us (because they are widespread and/or produce numerous small seeds/spores) include: African clubmoss (*Selaginella kraussiana*), bindweed (*Calystegia silvatica*), hedge Stachys (*Stachys silvatica*), pale galingale (*Cyperus eragrostis*), pellitory of the wall (*Parietaria judaica*), Spanish heath (*Erica lusitanica*) and veldt grass (*Ehrharta erecta*). If any of these weeds are not already established in areas you are looking after, it is well worth making special efforts to keep it that way!

It is difficult to eliminate 100% of biosecurity risks, but relatively easy to reduce them by 99%, and certainly worthwhile doing so compared with managing pests after they reach new sites. Biosecurity risks can be reduced significantly by ensuring footwear, clothing, materials, equipment and vehicles are clean and free of soil, seed, spores and weed fragments before visiting natural areas. Ideally, this would be done between visiting *all* the sites we work in, including farms and gardens, to limit weed spread generally.

Biosecurity risks are also associated with soil, potting mix and seedlings taken to nature reserves. While plants themselves may harbour unwanted organisms such as fungi and invertebrates, the soil or potting mix containing their roots is likely to present a greater risk through their potential to contain weeds (including seeds), micro-organisms, and the eggs of animal pests such as Argentine ants (*Linepithema humile*) and Australian plague skinks (*Lampropholis delicata*). All the weeds mentioned above are common in home, community and commercial nurseries. Such pests can easily hitch a ride to nature reserves in potting bags with native seedlings. This has happened far too many times in the past, including plants propagated by council nurseries taken to island scientific reserves managed by DOC! We have an opportunity to learn from these mistakes.

Nurseries, along with potting mix and soil suppliers, should be asked what protocols they have in place to minimise biosecurity risks. Many currently have no such protocols so plants and materials should not be sourced from them. Many Australian nurseries meet strict biosecurity standards and

it is not asking too much for NZ suppliers to make similar efforts. An option is to create our own potting mix and propagate our own plants while following appropriate biosecurity protocols.

Control Methods for Weeds Found During the Field Trip

The following control methods are options likely to be effective at most ecological restoration sites, but they must be considered in conjunction with the above information (for health and safety and to minimise negative consequences of control work, among other reasons). Some of the methods and comments below may not be applicable to other situations e.g. garden and farm environments, but that is not our focus.

Please note that we have no choice but to accept the presence of many introduced plants that are wild in NZ and, while we might prefer them to be absent, many are not a significant threat to biodiversity. Often their reputation as weeds flow from a farming or gardening perspective. Most are no more of a threat than the many pasture grasses introduced to NZ, about 95% of which have escaped into the wild.

Note: Most plants have more than one vernacular ("common") name. Scientific names, while generally more reliable, are subject to change. The NZ Plant Conservation Network provides reasonably up-to-date scientific names for wild plants in NZ, along with obsolete scientific names ("synonyms") and a selection of vernacular and Maori names.

Bay Tree *Laurus nobilis*
Identification: https://www.nzpcn.org.nz/flora/species/laurus-nobilis/
Control options:
Small plants: Carefully hand pull small plants by gripping the stem close to the ground so it does not snap. Plants up to 20cm diameter: cut as low to the ground as possible and paste the stump immediately with glyphosate gel.
Larger plants: Fell, cut the trunk to ground level and treat stump immediately with glyphosate gel. Drill and fill with glyphosate gel and leave dead-standing.

Bindweed *Calystegia silvatica*
Identification: https://www.rainbowbrown.co.nz/Bindweed
Control options:
All areas: mark the perimeter of all sites with red flagging tape at 1m spacings (at least half of the tape will disappear within a year due to wind, fading, fallen branches etc.), replace tape as necessary, record all sites on a map (this is essential for checking all sites frequently, before they recover).
Small areas: dig out, ensuring all stolons (underground stems) are removed. If not possible to dig e.g. because of roots or stones, spray as follows.
Larger areas: spray with 1% trichlopyr or 0.5% glyphosate at least twice in late spring to early autumn.
Notes: Has been said not to produce seed in NZ, but is most definitely does. Often called Convolvulus, although it is not in that genus.

Blackberry *Rubus fruiticosus* agg.
Identification: https://www.nzpcn.org.nz/flora/species/rubus-fruticosus-agg/
https://www.weedbusters.org.nz/what-are-weeds/weed-list/blackberry/
Control options:
Very small plants: pull or dig out

Larger plants:
Cut close to ground level and treat stump immediately with picloram gel.
Spray foliage from late spring to late summer with 1%trichlopyr and penetrant. Leave and allow native plants to displace it.
Cut back, plant fast-growing, 80cm tall, leafy natives and continue cutting until blackberry is overwhelmed by natives
Notes: Thrives most in rich, damp soil where natives will gradually displace it (if sufficient seed sources are nearby). A good option may be to leave such sites, plant fast-growing, leafy natives around the edges, and control scattered plants elsewhere.

Black nightshade *Solanum nigrum*
Identification: https://www.nzpcn.org.nz/flora/species/solanum-nigrum/
Control options:
Carefully hand pull small plants by gripping stem close to ground so it does not snap.
Larger plants: cut stem close to ground and treat stump immediately with glyphosate gel.
Notes: Often confused with deadly nightshade (*Atropa bella-donna*), which is rare in NZ (apparently only in Canterbury), and similar to a few other *Solanum* species, including natives and not nearly as toxic as deadly nightshade. Not a significant threat to biodiversity and unnecessary to control. Primarily a weed of disturbed, marginal sites, waste areas etc. Not very shade tolerant and only thrives at sites where it will gradually be displaced by natives. Often colonises sites within a year after major disturbance (e.g. storm damage, floods, fallen trees) and gradually disappears within a few years as other vegetation displaces it. Very widespread and abundant, so preventing reinvasion very difficult. Rarely worthy of control.

Buttercup *Ranunculus repens*
Identification: https://www.nzpcn.org.nz/flora/species/ranunculus-repens/
Control options: Difficult to control.
Notes: Primarily an agricultural weed. Not very shade tolerant and gradually displaced by native vegetation in most situations. Not worthy of attempting to control other than by displacing it with native plants.

Climbing dock *Rumex sagittatus*
Identification: **https://www.weedbusters.org.nz/what-are-weeds/weed-list/climbing-dock/**
Control options: Hand pull and allow native vegetation to gradually displace it. Densely-planted, fast growing native trees are best.
Notes: Only climbs to about 3m high and is not very shade tolerant. Can be displaced by native vegetation in some situations without any control work. In shorter vegetation, hand pulling, removal of tubers and prevention of seeding may be sufficient.

Elder *Sambucus nigra*
Identification:
https://www.weedbusters.org.nz/what-are-weeds/weed-list/elder/
Control options:
Small plants: Carefully hand pull small plants by gripping with two hands, one close to ground so it does not snap.
Plants up to 20cm diameter: cut as low to ground as possible and paste stump immediately with glyphosate gel.
Larger plants: Fell, cut trunk to ground level and treat stump immediately with glyphosate gel. Drill and fill with glyphosate gel and leave dead-standing.

English ivy *Hedera helix*
Identification:
https://www.weedbusters.org.nz/what-are-weeds/weed-list/ivy/
Control options:
Vines: Cut a section of each vine as low to ground as possible and paste stump immediately with glyphosate gel. Also apply gel to the upper cut, except in autumn/early winter when ivy fruit may transfer toxins to birds and other animals. Place cut section of vine above ground to prevent it taking root.
Notes: Only fruits when it climbs trees, fence posts, fences etc. and develops different foliage. Vines attach to bark with root-like structures that absorb nutrients and moisture, enabling severed vines to continue to grow and fruit for a year or more.

English Spindle berry *Euonymus europaeus*
Identification: https://www.nzpcn.org.nz/flora/species/euonymus-europaeus/ note there is a Japanese Spindle Berry that is similar
https://www.nzpcn.org.nz/flora/species/euonymus-japonicus/
Control options:
Small plants: Carefully hand pull small plants by gripping with two hands, one close to ground so it does not snap.
Plants up to 20cm diameter: cut as low to the ground as possible and paste the stump immediately with glyphosate gel.
Larger plants: Fell, cut trunk to ground level and treat stump immediately with glyphosate gel. Drill and fill with glyphosate gel and leave dead-standing.

Fleabane *Conyza floribunda*
Identification: https://agpest.co.nz/?pesttypes=fleabanes
Control options: Hand pull
Notes: Not a significant threat to biodiversity and unnecessary to control. Primarily a weed of disturbed, marginal sites, waste areas etc. Not very shade tolerant and only thrives at sites where it will gradually be displaced by natives. Often colonises sites within a year after major disturbance (e.g. storm damage, floods, fallen trees) and gradually disappears within a few years as other vegetation displaces it. Very widespread and abundant, so preventing reinvasion very difficult. Rarely worthy of control.

Glossy privet/tree privet *Ligustrum sinense*
Identification:
https://www.weedbusters.org.nz/what-are-weeds/weed-list/chinese-privet/
https://www.weedbusters.org.nz/what-are-weeds/weed-list/tree-privet/
https://www.nzpcn.org.nz/flora/species/ligustrum-lucidum/
Control options:
Small plants: Carefully hand pull small plants by gripping with two hands, one close to ground so it does not snap.
Plants up to 20cm diameter: cut as low to ground as possible and paste stump immediately with glyphosate gel.
Larger plants: Fell, cut trunk to ground level and treat stump immediately with glyphosate gel. Drill and fill with glyphosate gel and leave dead-standing.

Houhere/northern lacebark *Hoheria populnea*
Identification: https://www.nzpcn.org.nz/flora/species/hoheria-populnea/
Control options:

Small plants: Carefully hand pull small plants by gripping stem close to ground so it does not snap. Plants up to 20cm diameter: cut as low to ground as possible and paste stump immediately with glyphosate gel.
Larger plants: Fell, cut trunk to ground level and treat stump immediately with glyphosate gel. Drill and fill with glyphosate gel and leave dead-standing.
Notes*:* native from North Cape to the northern Waikato and Coromandel

Jerusalem Cherry Solanum pseudocapsicum
Identification: https://www.nzpcn.org.nz/flora/species/solanum-pseudocapsicum/
Control options: Carefully hand pull small plants by gripping stem close to ground so it does not snap.
Larger plants: cut stem close to ground and treat stump immediately with glyphosate gel.

Karaka *Corynocarpus laevigatus* (native to Northland)
Identification:
https://www.nzpcn.org.nz/flora/species/corynocarpus-laevigatus/
Control options:
Small plants: Carefully hand pull small plants by gripping with two hands, one close to ground so it does not snap.
Plants up to 20cm diameter: cut as low to ground as possible and paste stump immediately with glyphosate gel.

Larger plants: Fell, cut trunk to ground level and treat stump immediately with glyphosate gel. Drill and fill with glyphosate gel and leave dead-standing.
Notes: native to Northland and possibly north Auckland.

Monkey musk Erythranthe guttata
Identification: https://www.nzpcn.org.nz/flora/species/erythranthe-guttata/
https://www.weedbusters.org.nz/what-are-weeds/weed-list/monkey-musk/
Control options:
Small areas: hand pull and dispose of plants off-site.
Larger areas: Spray with 1% glyphosate.
Moist soil and aquatic areas: cover (e.g. with polythene or corrugated iron) to block *all* sunlight for at least one year and/or plant area with native plants that will out-compete it, e.g. rautahi (*Carex geminata)*. Start upstream and work your way downstream.

Montbretia Crocosmia aurea x C. potsii
Identification:
https://www.nzpcn.org.nz/flora/species/crocosmia-crocosmiiflora/
Control options:
All areas: mark the perimeter of all sites with red flagging tape at 1m spacings (at least half of the tape will disappear within a year due to wind, fading, fallen branches etc.), replace tape as necessary, record all sites on a map (this is essential for checking all sites frequently, before they recover). Spray at least once annually in spring/summer with 1% trichlopyr and, in areas with grass or other vegetation that shelters it, 1% glyphosate (to expose it for future spraying).

Old man's beard *Clematis vitalba*
Identification: https://www.weedbusters.org.nz/what-are-weeds/weed-list/old-mans-beard/ Control options: spray foliage with 1% glyphosate or, if among native vegetation 0.5% glyphosate (to reduce damage to natives). Cut vines as low to ground as possible and paste stumps immediately with glyphosate gel.

Notes: Vines take root when in contact with soil. Often difficult to locate and treat all stumps. Difficult to kill all plants in large infestations in first season. Rip up as many vines as possible, treating stumps as you go, and repeat process annually until all dead. This at least prevents seed production.

Pale galingale *Cyperus eragrostis* (an exotic umbrella sedge)
Identification: https://www.nzpcn.org.nz/flora/species/cyperus-eragrostis/
https://agpest.co.nz/?pesttypes=umbrella-sedges
Control options: Spray with 1% glyphosate in spring/summer (before seed production in autumn). If present, spray seed heads liberally to kill seed.
Notes: Produces large amounts of small, dry seed easily transported on footwear, clothing, equipment and vehicles and remains viable for more than 10 years. Digging out plants is likely to stimulate germination of seed in soil and result in spreading seed elsewhere. Difficult to eradicate once established, especially in sunny environments, shrublands, wetlands etc. Not very shade tolerant, so can displaced by natives in a dense forest environment.

Periwinkle Vinca major
Identification: https://www.nzpcn.org.nz/flora/species/vinca-major/
Control options:
All areas: mark the perimeter of all sites with red flagging tape at 1m spacings (at least half of the tape will disappear within a year due to wind, fading, fallen branches etc.), replace tape as necessary, record all sites on a map (this is essential for checking all sites frequently, before they recover). Spray foliage with 0.5% Tordon Brushkiller and 0.2% penetrant at least once annually until gone.
Notes: Spreads vegetatively. Thought to produce very little, if any, seed in NZ. Requires several years of treatment to eradicate.

Pōhuehue, large-leaved Muehlenbeckia *Muhlenbekia australis*
Identification: https://www.nzpcn.org.nz/flora/species/muehlenbeckia-australis/
Control options: Where pōhuehue is smothering native vegetation to an unacceptable degree cutting back all vines in shady sites is often enough to retard growth or kill it. In sunnier sites spray all reachable foliage with 1% trichlopyr with penetrant and later cut all vines, cut the largest vines as close to ground level as possible immediately apply glyphosate gel to stumps. Follow up annually until adequately controlled.
Notes: native to most of NZ. A very light-demanding species that would only have occupied forest edges and disturbed sites in the past. Human activity has created edges everywhere, including small, disturbed forest remnants that can often be entirely described as containing edge-type vegetation. Pōhuehue is perhaps the only native plant for which control is often appropriate, even in its natural range. Provides important habitat and food for native invertebrates and lizards. Rarely, if ever, appropriate to eradicate entirely from any site.

Stinking Iris Iris foetisdissima
Identification: https://www.nzpcn.org.nz/flora/species/iris-foetidissima/
Control options:
Very small plants: carefully pull or dig out.
Large plants and large infestations: Spray at least once annually with 1% trichlopyr and, in areas with grass or other vegetation that shelters it, 1% glyphosate (to expose it for future spraying).
Notes: Spray often takes a few months to have full effect. Fast growing seedlings often emerge from same place as adult plants due to large amounts of seed dropped there (which can produce the impression the original plant did not die).

Veldt Grass Ehrharta erecta

Identification: https://www.nzpcn.org.nz/flora/species/ehrharta-erecta/

Control options: spray with 0.6% Halox 100 EC and penetrant (to limit non-target impacts don't use penetrant)

Notes: probably NZ's most shade-tolerant introduced grass. Wind and human dispersed. Absent from large areas, but spreading gradually to increasingly remote areas. Especially invasive in coastal areas. Densely planted areas of young trees and shrubs and diverse natural regeneration are generally resistant to invasion, but as the canopy lifts and more sunlight penetrates the vegetation veldt grass can colonise and suppress further growth. Best to keep out of new restoration projects and disturbed sites, at least until native vegetation has become well established in them. Difficult to eradicate once established, but can be confined to forest margins.

Wandering Willy Tradescantia fluminensis

Identification:
https://www.nzpcn.org.nz/flora/species/tradescantia-fluminensis/

Control options:

All areas: mark the perimeter of all sites with red flagging tape at 1m spacings (at least half of the tape will disappear within a year due to wind, fading, fallen branches etc.), replace tape as necessary, record all sites on a map (this is essential for checking all sites frequently, before they recover)

Very small areas: Carefully pull out by hand (using a trowel if necessary to gently dig out buried stems without breaking them) ensuring *all* nodes are removed, collect and remove in bags avoiding dropping *any* fragments and dispose of carefully (green waste, burn, freeze or hot compost off site)

Larger areas: spray with 1% Trichlopyr and penetrant every two to three months (but avoid spraying when stressed, e.g. by drought, as it absorbs much less spray then)

Moist soil and aquatic areas: cover (e.g. with polythene or corrugated iron) to block *all* sunlight for at least one year.

Notes: Not thought to produce seed in NZ but spreads quickly vegetatively. Gravity and water spread fragments. Birds occasionally spread partly dried stems as nesting material. Can survive in 1% of normal sunlight and without moisture for at least one year. Can grow from tiny fragments (containing nodes, the structures leaves develop from). Particularly difficult to control in moist soil and aquatic areas as it regrows from buried or submerged foliage not exposed to spray. Hand pulling rarely removes 100% of plants despite sincere efforts. Spraying generally kills 95-99% of plants, but surviving plants are widely scattered, meaning all patches need to be followed up. After two or three thorough treatments, little should remain (except in moist soil or aquatic areas).

Plants Not Considered Environmental Weeds

Poroporo Solanum aviculare and S. laciniatum
Identification: https://www.nzpcn.org.nz/flora/species/solanum-aviculare-var-aviculare/ ‘
Notes: Both species native throughout most of NZ. Control unnecessary for biodiversity protection and restoration. Related to other nightshades, appears weedy, but native and an important coloniser of disturbed sites, forest margins etc., assisting with forest regeneration and providing food sources for native invertebrates and birds.

Other Resources

Auckland Council https://www.aucklandcouncil.govt.nz/pages/search.aspx?k=weeds

Bay of Plenty Regional Council
https://www.boprc.govt.nz/environment/pests/pest-plants

Northland Regional Council
https://www.nrc.govt.nz/environment/weed-and-pest-control/

New Zealand Plant Conservation Network https://www.nzpcn.org.nz/

Waikato Regional Council
https://www.waikatoregion.govt.nz/services/plant-and-animal-pests/

Weedbusters https://www.weedbusters.org.nz/

Tools and Consumables

Herbicide gels: Cut’n’Paste gives all community groups a 10% discount on its wide range of products. To order email sales@cutnpaste.co.nz and tell Nic your order and that you are a community group and you’ll get 10% off. For a full product list go to www.cutnpaste.co.nz