Environmental Weed Workshop
Answers to Post-it Note Questions

Aotearoa Biodiversity Conservation

Workshop Date: 16 March 2023
Host: WaiP2K
Presenter: Peter Russell
Venue: Deerstalkers Hall, Claireville, Wairarapa
Date: 5 July 2023

Introduction

These questions were submitted to the author after an Environmental Weed Workshop hosted by the Wairarapa Pūkaha to Kawakawa Alliance in Claireville, Wairarapa, on 16 March 2023. Some were more difficult to answer than others. This is an attempt to respond to those questions in a manner that best serves the people who asked the questions and others interested in the topic. These notes must be read in conjunction with information contained in the Environmental Weed Workshop presentation[1] and the Pest Plant Field Trip of 29 April 2023[2].

"What has changed in Wairarapa in the past 50 years that has caused a massive explosion of pest plants like blackberry, old man's beard, along riverbanks?"

I'm not particularly familiar with scenarios like that in Wairarapa, but here's an intelligent guess based on similar observations elsewhere:

1. It takes time for weeds to reach their biological potential (see graph below). Aotearoa is still at an early stage of colonisation by most environmental weeds. In one study, the average time it took for weeds to reach their maximum range in similar-sized countries

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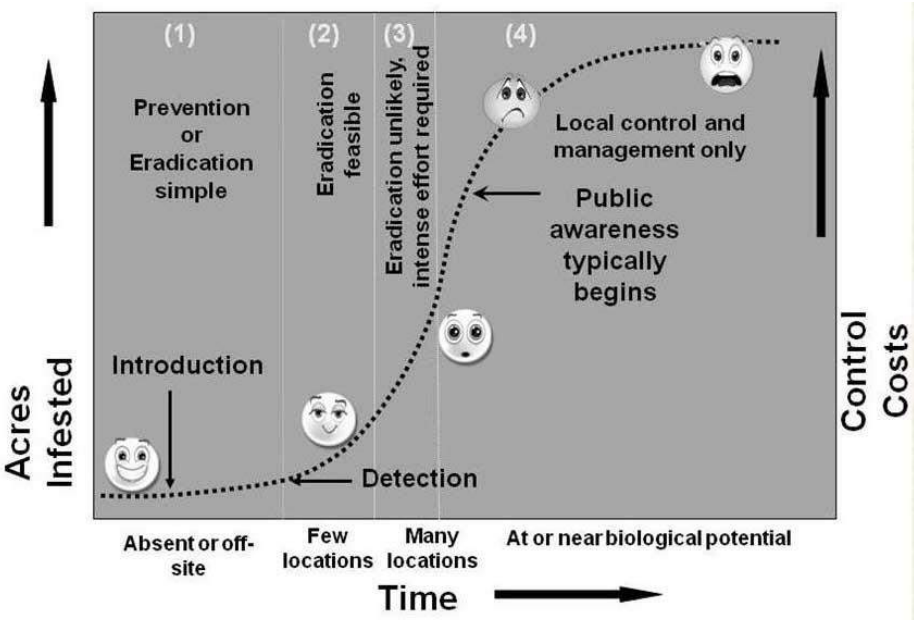
[1] Russell 2023. Environmental Weed Workshop - Date: 16 March 2023, Host: WaiP2K, Presenter: Peter Russell Venue: Deerstalkers Hall, Claireville, Wairarapa, Revised: 9 June 2023

[2] Russell 2023. Pest Plant Field Trip Notes, 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. 13 May 2023

(Spain, Ireland, Britain, Germany and Czech Republic) was 150 years[3]. Blackberry and OMB have been present in Aotearoa longer than most environmental weeds, with the earliest wild records being 1867 and 1940 respectively[4]. Many riverbanks will simply not have been reached by these weeds until recent decades. Some remote riverbanks have still not been reached by them despite having a suitable environment for their establishment. Invasive organisms generally follow similar growth patterns as they spread in the wild. After what can be a relatively slow "establishment phase" weeds generally undergo an "exponential growth phase" before reaching their "biological potential" (see graph below). Areas where a weed is undergoing an exponential growth phase will look very much like an "explosion" of that weed.



Invasive Organism Growth Curve[5]

2. The adoption of neoliberal economic policies in the 1980s had severe impacts on farming in New Zealand, especially with the elimination of agricultural subsidies[6]. In the 1980s there was little emphasis on environmental weeds, but as blackberry is more of an agricultural weed the removal of noxious weed control subsidies is likely to have enabled it to spread faster than it had been spreading. Although not particularly palatable to cattle and sheep, blackberry and OMB growth and fruit production can be seriously limited by regular browsing and trampling. Both are likely to have benefitted from a general decline in stock numbers since the 1980s and this in turn is likely to have enabled them to become more abundant and widespread in riverbeds and elsewhere.

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[3] Gassó et al. 2010. Spreading to a limit: the time required for a neophyte to reach its maximum range, in Diversity and Distrubutions 16, 310-311. Blackwell Publishing Ltd

[4] https://floraseries.landcareresearch.co.nz/pages/Index.aspx

[5] Adapted from Humphries & Hobbs 1995, An Integrated Approach to the Ecology and Management of Plant Invasions, in *Conservation Biology, Volume 9,* Issue 4, August 1995, 761-770.

[6] Farming in the Economy - Te Ara

3. The 1980s also brought growing public awareness and advocacy for concern about the environmental impacts of livestock grazing on riverbeds, particularly in terms of sedimentation, water quality degradation, and loss of habitat for native species. In response to these concerns various regulations and policies were implemented, e.g. regional councils developed plans and regulations to manage land and water resources more sustainably. These efforts aimed to restrict or prohibit grazing in certain areas, implement riparian planting, and establish "buffer zones" along waterways to protect water quality and habitat. Many farmers have also voluntarily made changes to their farming practices to reduce their impact on riverbeds and waterways. An unfortunate consequence of the removal of livestock from riverbeds is that it can enable environmental weeds to thrive.

4. Despite growing awareness and concern about the environmental impacts of blackberry and OMB, they are commonly not regarded as an imminent threat to pasture because they are somewhat palatable. Both weeds are, however, capable of becoming established in rough pasture with refugia such as patches of bush, logs and stream sides. Farmers and regulators often regard blackberry and OMB as unimportant or a low priority for control. Control efforts are commonly limited to within 20m of property boundaries, which does little to reduce dispersal by birds (blackberry) and wind (OMB). As blackberry and OMB spread, inadequate efforts to control them have resulted in a rapid increase in their abundance and distribution, making colonisation of riverbanks from nearby seed sources more likely.

Unless given greater attention, environmental weeds released in Aotearoa more recently than blackberry and OMB are likely to continue colonising riverbanks, particularly as they are generally highly disturbed, sun-drenched environments that are very favourable for weed growth. The use of herbicides in or near waterways is also problematic. Riverbeds and riverbanks are therefore among the most challenging environments to control weeds in.

"What are the most effective and cheapest weed suppressant methods for riparian strips?"

This is a difficult question to answer because there are so many variables involved. The most efficient and effective way to suppress riparian weeds depends on the nature of the site, what vegetation is ultimately desired and what weeds are involved. The following discussion presents the main variables involved as a general guide to riparian weed management. It does not cover all possible scenarios and there will be exceptions to the concepts and examples provided.

One of the first things to consider is the extent to which native vegetation can be used to help suppress the weeds present. The revegetation of sites adjacent to small streams that would once have been shrouded in forest are relatively straight-forward, assuming restoration to a forested state is the goal. Those sites involve minimal natural disturbance and the gradual development of shade through reforestation can be used to help suppress weeds, which are generally not very shade tolerant. Sites adjacent to large rivers are among the most challenging in which to control weeds because they are subject to frequent disturbance in which weeds thrive and native forest cannot establish. At a site where forest is the natural, climax-state vegetation, establishing and maintaining anything other than forest will make it more difficult to control weeds and prevent reinvasion. Doing so maintains abundant opportunities for weeds to thrive in and is rarely justifiable from a conservation point of view.

At sites containing shade-intolerant weeds (e.g. alder, barberry, bindweed, blackberry, broom, buddleia, Cotoneaster, German ivy, gorse, hawthorn, Himalayan honeysuckle, pale galingale, pampas, Spanish heath, wattle and willow) where a forest canopy can be established over the water body it *may* be sufficient to simply allow natives to gradually replace weeds naturally (assuming seed sources occur nearby and livestock has been excluded), perhaps with a little selective pruning to favour the natives. The wider the water body the more sunlight will penetrate the site and the more such weeds will be able to thrive, so unless a forest canopy can be established overhead some may need to be controlled.

At sites where it is desirable to establish dense native forest as quickly as possible, planting a <u>wide variety</u> of hardy and fast-growing species at close spacings (1m apart) may be necessary. It is often difficult to accurately predict which species will thrive and which will not. Planting a wide variety of species will maximise the chances of the entire site becoming dominated by natives quickly by filling gaps, blocking out sunlight and creating seed sources that will enable any other gaps to be filled quickly. Avoid planting native species that do not grow particularly tall (e.g. flax and toitoi) which are incapable of out-competing most weeds, make weed control very difficult once established, and will be outcompeted by native forest later anyway.

At sites where more tenacious and shade tolerant groundcovers, climbers or tall tree weeds are present (e.g. Agapanthus, African clubmoss, banana passionfruit, climbing Asparagus, cherry laurel, English ivy, holly, Japanese honeysuckle, Japanese walnut, jasmine, mile-a-minute, montbretia, old man's beard, periwinkle, Plectranthus, privet, stinking Iris and *Tradescantia fluminensis*) native vegetation cannot be expected to out-compete them and planting is generally futile. It is generally difficult to control weeds (especially groundcovers and climbers) effectively while avoiding damage to native seedlings. Attempting to do so has often involved several years of efforts that ultimately resulted in the death of most plantings and the continued spread of weeds. It is a far better use of resources to delay planting until weeds are well under control, and ultimately this produces the desired result faster. Three to five years of consistent weed control work are often required before it is sensible to begin planting riparian sites.

There is a significant risk of non-target damage associated with the use of herbicides over and adjacent to water bodies. See the notes from the 29 April 2023 field trip for a general discussion about herbicides, their potential non-target impacts, weed management in and adjacent to wetlands and water bodies, and some guidelines for their use. Alternatives to spraying weeds may include treating stumps of woody weeds and hand-puling or digging out weeds. Careful hand removal of *Tradescantia fluminensis* in riparian areas is often required, especially as it is often submerged in water (where herbicides will not reach it anyway). Many riparian weeds are dispersed through the downstream movement of seeds and fragments. It will therefore generally be wise to begin controlling those weeds as far upstream as possible.

In some cases riparian areas, or parts of them, can be covered in opaque material such as polythene or corrugated iron for a year or more to block out sunlight and kill weeds. This has been effective for *T. fluminensis* (not thought to produce seed in Aotearoa) and water celery (*Apium nodiflorum*), although the latter is likely to regrow from seed unless a canopy has formed over the site. Planting natives that thrive in riparian areas, such as rautahi (*Carex comans*), can result in the gradual displacement of weeds such as water celery and is worth experimenting with in areas where a forest canopy is unlikely to form.

"How to get rid of Agapanthus, blackberry, buckthorn, duckweed, gorse, pampas"

Optimal weed control methods depend on the situation. Refer to the notes from the field trip on 29 April 2023 for a general discussion on this topic, including clarifying your goals, the use of herbicides, and alternative sources of control methods. It's difficult to "get rid of" some weeds entirely overnight because of some may need more than one treatment, some may remain as seed in the soil (the seedbank), and others may reinvade from surrounding areas. Here are the control options I generally use:

***Agapanthus praecox* subsp. *praecox* (a.k.a. *A. orientalis*)**
Identification: https://www.nzpcn.org.nz/flora/species/agapanthus-praecox-subsp-orientalis/
Control options:
Spray foliage with 1% trichlopyr and penetrant
Notes: This is a very reliable control method which results in decomposition of the entire plant, including all roots, provided there is good spray coverage. Follow up spray may be required, especially for larger plants. Seedlings may arise from seed in the soil for a few years. Similar to *A. praecox* subsp. *minimus* but, to date, the latter seems to be much less invasive in NZ and is also drought tolerant and popular with gardeners for its smaller and "tidier" growth habit. I err on the side of caution and recommend avoiding both subspecies altogether.

Blackberry *Rubus fruiticosus* agg.
Identification: https://www.nzpcn.org.nz/flora/species/rubus-fruticosus-agg/
Control options:
Very small plants: pull or dig out
Larger plants:
Cut close to ground level and treat entire stumps 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: Follow-up usually required. 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.

Italian/evergreen buckthorn *Rhamnus alaternus*
Identification: https://www.nzpcn.org.nz/flora/species/rhamnus-alaternus/
Control options:
Small plants: hand pull or dig out
Larger plants: cut to ground level and treat entire stump immediately with CutNPaste Bamboo Buster (24% glyphosate)
Notes: Control female plants first to minimise seed production. Can be left on site to decompose, unless soil will remain damp, in which case avoid leaving main part of stem in contact with ground.
I have not had the pleasure of making acquaintance with this weed so the control methods provided are based on various sources. Ordinary strength glyphosate gel such as CutNPaste's Original Weed Gel (12% glyphosate) is unlikely to work, except perhaps on very small plants.

Purple-backed duckweed *Landoltia punctata*
Identification: https://www.nzpcn.org.nz/flora/species/lemna-disperma/
Control options: ?
Notes: Thrives with high nutrient levels. Difficult to control and prevent reinvasion through waterfowl. I have never controlled this aquatic species and suspect it would be difficult to do so. Reducing nutrient entry may be a good solution. High in protein and may be harvested as a food source for humans or livestock. Solutions will depend on the scale of the problem. One would need to clarify the point of controlling it first: is it for ecological restoration purposes (which is my focus), aesthetics (which is not my focus) or something else? Some herbicides are approved for use on duckweed, but physical removal by skimming the surface of the water may be as effective while avoiding impacts on non-target organisms such as native aquatic plants, fish and invertebrates. Has two or more roots arising from each platelet, unlike the similar-looking native common duckweed *Lemna disperma* which has one root.

Gorse
Identification: https://www.nzpcn.org.nz/flora/species/ulex-europaeus/
Control options:
Small plants: hand pull or spray
Larger plants: spray with 1% trichlopyr and penetrant ensuring at least 80% coverage of green foliage or cut as close to ground level as possible and treat entire surface immediately with glyphosate gel.
All plants: Minimise soil disturbance. Seed lasts or 100 years or more and germinates when exposed to sunlight or fire. Stamp down all disturbed soil to minimise seed exposure. Carefully place uprooted or severed material on ground to cover all bare soil and block out sunlight. As the gorse decomposes grass generally replaces it, blocking sunlight from the seedbank. Shading out with plantings may be a good option. Doing nothing and allowing native forest to regenerate through gorse is a common solution (a process that can take 10 to 20 years).
Notes: Primarily an agricultural weed. May need to be controlled on the edge of native forest restoration sites to keep neighbouring farmers and council happy. Dry seed, not bird

or wind dispersed, generally falls within 2m of parent plants. Mostly spread by livestock and machinery. Can be left on site to decompose, unless in particularly wet climates, in which case avoid leaving main part of stem in contact with ground. Unnecessary and counter-productive to control gorse in an environment where native bush regeneration is desired. Not very shade tolerant and does not regenerate under its own canopy. Provides shelter for native seedlings and is gradually shaded-out by taller vegetation. In many situations this process can be accelerated by selectively pruning gorse to favour natives. An environmental weed in open, sun-drenched environments e.g. riverbeds and sand dunes. Can be a problem in native shrublands and relatively "open" native forest types, but the latter are uncommon.

Pampas *Cortaderia selloana* and purple pampas *C. jubata*
Identification:
https://www.nzpcn.org.nz/flora/species/?scientific_name=cortaderia&common_name=pampas
Control options:
Small plants: hand pull or dig out
Larger plants: spray with 1% glyphosate and penetrant, ensuring good coverage of leaf tips or cut with chainsaw and spray regrowth. May require two or three treatments.
Notes: May be wise to remove seed heads to reduce spread. Often sufficient to leave seed heads on ground, ideally under other vegetation nearby (where they will generally stay damp and decompose rather than dry out and blow away). Avoid accidentally spreading seed.

"Has climate change increased the growth rate of invasive weeds?"

Regardless of their cause and the likely severity of their impacts, climate change and increased atmospheric carbon concentration are clearly occurring[7] and are having a range of impacts on weeds, including increasing their growth rates. Additionally, climate change and increased atmospheric carbon concentration are likely to affect nearly every aspect of terrestrial ecosystem function in Aotearoa in ways that are likely to make them more susceptible to weed invasion. Molly and Walker (2011) prepared for DOC an assessment of the most likely biodiversity outcomes of climate change on Aotearoa's biodiversity[8]. The following information is largely sourced from that review.

Climate change will put more pressure on biodiversity through permitting weeds to expand their range. Climate stress will impact fragmented habitats in which some native biota will already be reduced, making their spread to more climatically favourable locations difficult. This will create more opportunities for weed establishment and spread. An increased frequency of fire will also encourage weed spread, especially in fragmented habitats.

[7] The fact that frosts have become less frequent in many places is perhaps the most obvious change.
[8] McGlone and Walker 2011. *Potential effects of climate change on New Zealand's terrestrial biodiversity and policy recommendations for mitigation, adaptation and research, Science for Conservation 312*, Department of Conservation, Wellington

The emergence of new weeds and increased invasiveness of existing weeds is perhaps the most troubling likely consequence of climate change. Once frosts cease to be significant a much greater range of weeds will be able to compete with natives. The net outcome of CO_2 increase and global warming is predicted to be higher local plant diversity, nearly entirely driven by naturalisation of weeds. There is a large reservoir of introduced plants in Aotearoa (many of which are weeds elsewhere) that could potentially establish in the wild, and the rate of that naturalisation is not slowing.

Not all weeds currently invasive in Aotearoa will benefit from climate change, e.g. broom (*Cytissus scoparius*) favours cooler climates, but a large number of cold-sensitive species in the country are likely to benefit from it. Annual minimum temperatures are highly variable, are likely to be a key influence on the distribution of some native species, and are a key restraining influence on the spread of exotic weeds and other pests. Warmer and northern areas are where the phenomenon of "greenhouse weeds" should first manifest.

> "The most cost-efficient way of containing weeds is to prevent them establishing or, failing that, preventing them reaching the exponential spread phase (Mack et al. 2000). An example of how difficult this is to achieve is provided by woolly nightshade (*Solanum mauritianum*), an important woody weed in warm, oceanic climates. A review of control efforts undertaken in the Bay of Plenty (Stanley 2003) concluded that its biology was poorly known, control efforts had been unsuccessful and expensive ($6m), the plan of eradicating or substantially reducing the weed unrealistic, and monitoring and follow-up control after operations hit-and-miss. Additionally, in focussing on a single weed, incursions of other important weeds (e.g. kiwifruit, *Actinidia* spp., and lantana, *Lantana camara*) were not discovered soon enough, and their control was delayed.
>
> ***Whole-landscape approaches to weeds are the only ones likely to succeed and, in particular, strategies that are focused on controlling or eliminating weeds in sensitive areas or preventing them becoming established.*** Most weeds likely to become greenhouse weeds are already in the country, and have been introduced for ornamental purposes or as warm climate crops (e.g. kiwifruit).
>
> The social and economic resistance to pre-emptive control should not be underestimated. For instance, in Auckland, mere discussion of listing bangalow palm (*Archontophoenix cunninghamiana*, distribution Queensland to just south of Sydney) in the Auckland Regional Pest Management Strategy because of its preference for habitats also preferred by New Zealand's endemic palm nïkau (*Rhopalostylis sapida*) led to organised protests and legal threats from nursery owners (Thompson 2006).
>
> There has been much emphasis in the recent literature on the need to develop better tools (often statistically based) to identify weeds with a

> high propensity to become invasive (Gordon et al. 2008). However, this presupposes an effective surveillance mechanism to both keep weeds out and to identify and react quickly to the early stages of spread, along with widespread public acceptance of the need to eradicate potential weeds ahead of necessity. Past history and current practice does not provide any comfort that this phase of the operation will be effective, because prevention of a problem rarely gains any notice (aside from a disquieting trend to curtail efforts too soon) and lessons do not seem to be learned from heroic but pointless attempts to control invasions. We must continue to invest in the development of tools that can contain damaging environmental weeds (such as biocontrol and improved conventional approaches for area operations) and to develop a better social awareness of the highly threatening future of today's valued garden ornamentals"[9].

Molloy and Walker (2011) suggest that increasing the amount of land in regenerating native forest should aim to increase connectivity between current forest patches, because small, isolated forest fragments suffer exaggerated losses of biodiversity through higher levels of weed invasion, and reduced genetic diversity and interchange (among other impacts) compared with large, continuous forest tracts. They suggest that doing so will also provide for more and larger populations of many native species, which will permit them to adapt and evolve in the future.

While there is some merit in this concept it does not appear to take into account the extent to which connecting forest fragments is likely to enhance weed spread[10]. To minimise the chances of weed establishment and spread, reforestation efforts (including those in areas designed to connect isolated forest fragments) should initially involve serious weed control throughout the local area, the edge-to-area ratio of all sites involved should be maximised and as wide and as possible, and should involve the establishment of a wide diversity of native plants.

An indirect consequence of climate change involves the creation of wind power stations in natural and semi-natural areas. These can fragment large areas of hitherto intact indigenous habitat and create constant vegetation disturbance, providing routes and vectors for weed establishment and spread.

"Biological controls – as necessary tool in Aotearoa for control now?"

Biological control is a method of managing pests and invasive species using natural predators, parasites, pathogens, or competitors. It involves the deliberate introduction of natural enemies that have evolved to control a target pest in its natural range and are absent from their introduced range. Biocontrol agents can include insects, mites, fungi, bacteria, viruses, nematodes, or even larger organisms like birds or fish. Biocontrol agents are generally selected when they are specific to the target pest, meaning they primarily

[9] Ibid. p.43 (emphasis added)

[10] See the Environmental Weed Workshop presentation of 16 March 2023 for more information on this topic

target that pest without harming non-target organisms. Extensive research and testing are conducted in an attempt to ensure biological control agents will not become pests themselves.

There are two main kinds of biological control:

1. Classical biological control involves the introduction of natural enemies from the pest's native range. The goal is to establish a wild population of the natural enemy, allowing it to reduce the pest population over time.
2. Augmentative biological control involves wild or commercially produced agents that are routinely released in large numbers to control pests. This method is commonly used in agricultural settings.

New Zealand has a long history of using biological control to manage pests in agriculture. Some of the early attempts, such as the release of stoats to control rabbits, did not turn out so well. According to the international Biological Control of Weeds Database[11] 88 weed biocontrol agents have been introduced to Aotearoa with human assistance and 16 are thought to have arrived naturally. In recent decades increasing emphasis has been placed on releasing biocontrol agents in an attempt to control environmental weeds. A selection of environmental weeds and their biocontrol agents in Aotearoa is appended, and includes a brief categorisation of the impact of each agent to date.

Biological control offers several advantages over traditional chemical pesticides. Biocontrol agents can more easily reach target pests throughout large areas than humans, especially areas with rugged terrain and dense vegetation. Biocontrol can be integrated with other pest management strategies, providing a sustainable and long-term solution. Success requires careful consideration of the specific pests, their natural enemies, ecosystem dynamics, and potentially susceptible species to ensure effective control without unintended consequences. Non-target impacts are difficult to predict because of the complexity of ecosystems. Laboratory experiments often fail to indicate the consequences of a release into the wild. Non-target impacts are also very difficult to detect. Some such detections have only happened by chance, e.g. by eagle-eyed scientists on holiday in natural areas.

The research and other activities associated with biological control is costly and there is no guarantee of success. Internationally many biological control agents failed to establish wild populations after multiple releases and about 80% failed to control their target pest. Biocontrol is unlikely to completely eradicate any pest for the same reason that predators rarely eradicate their prey. Biocontrol works best when the target pest has a limited distribution, which is when conventional methods may be able to achieve similar results. Biocontrol may be the best option currently available for some widespread weeds where there is reason to hope it will reduce their impacts on biodiversity. Future technologies may offer superior levels of pest control with lower risks of non-target impacts. In the meantime we need to use all the tools available to ensure the impacts of weeds on biodiversity are minimised. The more biodiversity is protected and restored today the greater the hope of it recovering in future.

[11] https://www.ibiocontrol.org/catalog/

For more information on biological control agents in Aotearoa see:
https://epa.govt.nz/industry-areas/new-organisms/biological-control-agents/
https://www.landcareresearch.co.nz/discover-our-research/biodiversity-biosecurity/weed-biocontrol/projects-agents/

End.

A Selection of Environmental Weeds and their Biological Control Agents in Aotearoa

Peter Russell
5 July 2023

Source: Biological Control of Weeds Database 5 July 2023 https://www.ibiocontrol.org/catalog/

Note: some of these plants are also agricultural weeds

Weed vernacular name	Weed scientific name	Agent vernacular name or description	Agent scientific name	Year First Released or Detected	Status	Impact	Arrival Type
Blackberry	*Rubus fruticosus* agg.	Blackberry rust	*Phragmidium violaceum*		Established	Variable	Natural
Blackberry	*Rubus fruticosus* agg.	Raspberry sawfly	*Priophorus morio*		Established	Unknown	Natural
Boneseed	*Chrysanthemoides monilifera*	Boneseed leaf roller	*Tortrix* s.l. subsp. *chrysanthemoides*	2007	Established	Slight	Assisted
Buddleia	*Buddleja davidii*	Buddleia weevil	*Cleopus japonicus*	2006	Established	Heavy	Assisted
Chinese privet	*Ligustrum sinense*	Privet lacebug	*Leptoypha hospita*	2015	Established	Too early post release	Assisted
Darwin's barberry	*Berberis darwinii*	Darwin's barberry seed weevil	*Berberidicola exaratus*	2015	Unknown	Unknown	Assisted
Gorse	*Ulex europaeus*	Black owlet	*Scythris grandipennis*	1993	Not Established	Not established	Assisted
Gorse	*Ulex europaeus*	Gorse gall mite	*Aceria davidmansoni*		Established	Slight	Natural
Gorse	*Ulex europaeus*	Gorse knot horn	*Pempelia genistella*	1996	Established	Unknown	Assisted
Gorse	*Ulex europaeus*	Gorse pod moth	*Cydia succedana*	1992	Established	Slight	Assisted
Gorse	*Ulex europaeus*	Gorse seed weevil	*Exapion ulicis*	1931	Established	Slight	Assisted
Gorse	*Ulex europaeus*	Gorse soft shoot moth	*Agonopterix umbellana*	1990	Established	Slight	Assisted
Gorse	*Ulex europaeus*	Gorse spider mite	*Tetranychus lintearius*	1989	Established	Slight	Assisted
Gorse	*Ulex europaeus*	Gorse thrip	*Sericothrips staphylinus*	1990	Established	Unknown	Assisted
Heather	*Calluna vulgaris*	Heather beetle	*Lochmaea suturalis*	1996	Established	Heavy	Assisted

Weed vernacular name	Weed scientific name	Agent vernacular name or description	Agent scientific name	Year First Released or Detected	Status	Impact	Arrival Type
Horsetail	*Equisetum arvense*	Field horsetail weevil	*Grypus equiseti*	2017	Unknown	Unknown	Assisted
Japanese honeysuckle	*Lonicera japonica*	Honshu white admiral	*Limenitis glorifica*	2014	Established	Too early post release	Assisted
Japanese honeysuckle	*Lonicera japonica*	Japanese honeysuckle stem beetle	*Oberea shirahatai*	2017	Unknown	Unknown	Assisted
Lantana	*Lantana camara*	Lantana blister rust	*Puccinia lantanae*	2015	Unknown	Unknown	Assisted
Lantana	*Lantana camara*	Lantana leaf rust	*Prospodium tuberculatum*	2015	Established	Too early post release	Assisted
Lantana	*Lantana camara*	Lantana plume moth	*Lantanophaga pusillidactyla*		Established	Slight	Natural
Moth plant	*Araujia hortorum*	Moth plant beetle	*Freudeita cupripennis*	2019	Unknown	Unknown	Assisted
Old man's beard	*Clematis vitalba*	Old man’s beard leaf miner	*Phytomyza vitalbae*	1996	Established	Slight	Assisted
Old man's beard	*Clematis vitalba*	Old man's beard leaf fungus	*Didymella clematidis*	1996	Not Established	Not established	Assisted
Old man's beard	*Clematis vitalba*	Old man's beard sawfly	*Monophadnus spinolae*	1998	Established	None	Assisted
Smilax	*Asparagus asparagoides*	A rust fungus	*Puccinia myrsiphylli*		Established	Heavy	Natural
Wandering Jew	*Tradescantia fluminensis*	Tradescantia leaf beetle	*Neolema ogloblini*	2011	Established	Variable	Assisted
Wandering Jew	*Tradescantia fluminensis*	Tradescantia stem beetle	*Lema basicostata*	2012	Established	Variable	Assisted
Wandering Jew	*Tradescantia fluminensis*	Tradescantia tip beetle	*Neolema abbreviata*	2013	Established	Too early post release	Assisted
Wandering Jew	*Tradescantia fluminensis*	Tradescantia yellow leaf spot fungus	*Kordyana brasiliensis*	2018	Established	Too early post release	Assisted
Woolly nightshade	*Solanum mauritianum*	Woolly nightshade lace bug	*Gargaphia decoris*	2010	Established	Too early post release	Assisted