

Potential beneficial and adverse effects to be addressed in the EPA application to introduce up to four biocontrol agents, two leaf-feeding beetles, *Galerucella pusilla* and *G. californiensis* (Coleoptera: Chrysomelidae), a root-feeding weevil, *Hylobius transversovittatus* (Coleoptera: Curculionidae), and a flower-feeding weevil, *Nanophyes marmoratus* (Coleoptera: Curculionidae) for purple loosestrife (*Lythrum salicaria*).

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The potential risks, costs and benefits of the introduction of biocontrol agents to New Zealand for invasive weeds have been identified through formal brainstorming and through consultation with the public and professionals. There is a suite of possible risks, costs and benefits that are common to most biocontrol agents proposed for release, and other effects that may be specific to each biocontrol agent. These are outlined below for the proposed introduction of biocontrol agents for purple loosestrife, *Lythrum salicaria*. The effects of the introduction of exotic biocontrol agents can result from: (1) the introduction of a new organism to the New Zealand environment; and (2) a reduction in the target pest through successful biocontrol. Those effects considered to be significant (in terms of the magnitude of the effect and the frequency of or likelihood of the effect) are discussed more extensively in the application.

Potential impacts on Māori values were addressed in a separate consultation process and will be done accordingly for the purple loosestrife application.

Please contact Angela Bownes if you have any comments about the approach used in the application, or to report additional potential effects.

Potential Beneficial Effects

On the Environment

Source of potential benefit

Reduced competition from purple loosestrife leads to increased survival and diversity of native and other desirable plants in affected habitats.

Reduced damage to other vegetation and sensitive ecosystems from spraying.

Benefits to parasitoids, predator and disease relationships in trophic webs.

Reduced contamination of air, soil and water from reduced purple loosestrife spraying.

Comments

This is the major expected benefit from the biological control programme. Purple loosestrife invades wetlands, lakesides, and riparian areas outcompeting native vegetation in these habitats. Purple loosestrife has the potential to displace all other wetland flora. Successful biological control will reduce those adverse effects wherever the weed occurs, acting far beyond the reach of existing management efforts. Significant reductions of seed production by the insects will slow the spread and increases in density of the weed. Over time, the seed bank will be reduced which will slow replacement of old plants, eventually causing a decline in purple loosestrife populations. Thinning of purple loosestrife infestations from repeated defoliation and death of plants will enable native seedlings to germinate and thrive.

Spraying purple loosestrife with herbicides can damage non-target plant species and is highly undesirable in the ecosystems it typically invades such as wetlands and the margins of lakes. Spraying with herbicides can damage valued vegetation growing in close proximity to the weed, and the use of herbicides in aquatic environments is not advised. Successful biological control will significantly reduce the need for spraying purple loosestrife with herbicides.

Increased plant diversity as purple loosestrife monocultures break up will increase the diversity and complexity of trophic webs. Effects will vary locally, spatially and temporally.

Although likely a real local benefit of successful biological control, purple

Further spread and naturalisation in other areas avoided.

Increase in food sources for many fish and bird species

Loss of endangered species is slowed.

New Zealand's biodiversity is increased.

Reduced cover by purple loosestrife improves availability of nest spaces for birds.

loosestrife is not widely distributed throughout the country. Infested sites currently occupy a small percentage of the overall estate.

Successful control will reduce seed production and the development of new, serious infestations of purple loosestrife.

Successful biocontrol will help to restore affected habitats to their natural state, supporting a greater variety of native and valued fauna.

Not a significant effect. No species are known to be at risk primarily because of purple loosestrife.

Not a significant effect. Species increases by four.

A likely effect locally but not significant nationally. The return of native wetland plant species and a reduction of purple loosestrife monocultures may attract more native birds, but purple loosestrife is unlikely to be limiting nesting sites for birds at present.

On Human Health

None identified.

On society and communities

Source of potential benefit

Successful biocontrol would benefit society and communities by restoring the amenity values and cultural and conservation significance of Lake Horowhenua

A significant benefit.

Successful biological control reduces costs of purple loosestrife management to regional and territorial authorities and private landowners.

A significant benefit. Purple loosestrife is actively managed in many regions to eradicate or contain this pest. Purple loosestrife is also a problem plant in pastures requiring regular control.

Improved look and feel of wetland habitats and riparian zones

A significant local effect. Successful control limits the development or reduces the occurrence of monocultures of purple loosestrife, making wetlands and lakes more accessible for recreational activities and improving their aesthetic value.

Reduced need for spraying in and near aquatic and wetland ecosystems.

A significant benefit. The use of herbicides in waterways and wetlands is deeply objectionable to the New Zealand public, especially Māori. Successful biocontrol of purple loosestrife will significantly reduce the demand for chemical control to manage the weed and prevent its spread.

Reduced flooding and rafting impacts.

Purple loosestrife 'rafts' reduce the surface areas of shallow lakes and cause potential flooding as the water is displaced. Blockages downstream from rafts can also lead to localised flooding.

Successful control reduces the need for purple loosestrife control operations, leading to better targeting of community resources and use of conservation volunteers

Not a significant benefit for purple loosestrife. Limited community resources currently targeted at control of this weed.

On the market economy

Source of potential benefit

Successful biological control reduces the current costs of purple loosestrife management, allowing more sustainable control options for existing infestations.

A significant benefit. Purple loosestrife is currently managed exclusively with herbicides which require repeat applications in the long-term to be effective.

Reduced seed production to eliminate future invasion risk.

A significant benefit. Purple loosestrife seeds spread predominantly by water, making invasion of new sites and reinvasion of cleared sites a major risk.

Potential Adverse Effects

On the Environment

Source of potential adverse effects

Non-target feeding by newly established control agent significantly reduces native plant populations.

Experimentation and evidence from the native range indicates no such effect is likely. Native plants are not at risk from the purple loosestrife biocontrol agents.

Adults of the biocontrol agent compete with native species for food.

Not a significant risk. Adults and immature stages of the biocontrol agents feed on purple loosestrife. No native species reliant on purple loosestrife for their survival were identified during surveys of the weed. Their feeding requirements will be miniscule, both spatially and temporally, in comparison to other insects in the environment.

Non-target feeding by introduced biocontrol agents significantly reduces the usefulness of ornamental plants

A possible effect. Laboratory experimentation and evidence from the field in the USA indicates that feeding damage by the leaf beetles to two exotic ornamental species (*crêpe myrtle*, *Lagerstroemia indica* and two varieties of *Lythrum virgatum*, Dropmore purple and rose queen) is possible. This damage will be minor and transient and the beetle can't reproduce on these plant species. *Lagerstroemia indica* does not appear to be popular as an ornamental plant in New Zealand. Effects would be highly localised, only occurring only in the vicinity of the host plant when beetle populations are high.

Reduced habitat quality for some native fauna.

Not significant. Replacement vegetation will also support invertebrate fauna. No fauna of special significance found on purple loosestrife in surveys (Bownes et al., unpublished).

Swift evolutionary change in insect leads to unexpected non-target damage to valued plants and/or alterations to food webs

Not a significant risk. There is little evidence of adaptive host range expansion to non-target species in weed biocontrol agents.

Food web interactions are adversely affected by the introduction of new prey species.

Adverse effects are conceivable but not expected. Increased plant diversity as purple loosestrife monocultures break up

The biocontrol agents hybridise with native beetles and weevil.

Indirect competition causes extinction of native insects.

will increase the diversity and complexity of trophic webs, but effects will vary locally, spatially and temporally.

Not a significant risk. No beetle or weevil species in New Zealand are closely related to enable hybridisation.

Not a significant risk. No indication that vulnerable or endangered species are associated with purple loosestrife infestations, and any measurable indirect competition would be restricted to the immediate vicinity of the host plant.

On Human Health

Source of potential adverse effect

Public phobia of the new beetles and weevils.

The beetles and weevils generate an allergic response.

Possible due to concerns the beetles and weevils will damage valued ornamental plants and/or of native and/or commercial crops.

Not a significant risk. Literature search reveals no such cases, and agents have been used as biocontrol agents in the USA and Canada for >30 years.

Beetles and weevils need spraying with adverse effects to humans.

Not a significant risk. No predicted large-scale attack on non-target plants. Mass populations of the beetles and the weevils is not possible.

On the Market economy

Source of potential adverse effect

Successful biological control reduces revenue for contractors and suppliers.

Feeding on leaves and flower buds ruins the aesthetic value of ornamental species, making sales in nurseries unprofitable.

Suppression of flowering significantly affects the bee-keeping industry.

A possible local effect. Revenues directly related to purple loosestrife management are unlikely to be a key revenue source for many or any contractors or suppliers.

Not a likely effect. An online search suggests the ornamental species at risk of attack are not widely available or very popular in New Zealand and will not be a significant source of revenue for plant growers.

Not a significant risk. Purple loosestrife is not reported to be valued by beekeepers

in New Zealand, and effects would be highly localised.

On Society and Communities

Source of potential adverse effect

Fear and distrust of exotic species and their possible non-target effects

Control reduces aesthetic values of purple loosestrife

A likely effect. Firmly held opinion in a proportion of the New Zealand population.

A possible effect. Purple loosestrife may still be valued as an ornamental or as a showy wetland plant species.