

Potential beneficial and adverse effects to be addressed in the EPA application to introduce a weevil, *Grypus equiseti*, as a biological control agent for field horsetail.

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The potential beneficial and adverse effects of new control agents for a range of weeds have been identified systematically over a range of projects in the last ten years through formal brainstorming and through consultation with the public and professionals. This process has shown there is a suite of possible risks, costs and benefits that are common to all weed biocontrol proposals. Other effects are specific to particular agents. Effects can result from:

- The introduction of a new element into the New Zealand environment
- The reduction in density and abundance of the weed through biological control

Here is the list of effects identified. Those potential risks or benefits considered to be significant (the product of the magnitude of the effect times the frequency or likelihood of the effect) have been highlighted, and will be addressed fully in the application. Those not considered to be significant (because they are speculative, or because the magnitude and/or likelihood of the effect is low or cannot be clearly demonstrated) will probably not be addressed.

Please contact Richard Hill, preferably before 15 September 2015 if you have any comments about the approach to be used in the application, or to report additional potential effects.

Potential impacts on Māori values are addressed in a separate consultation process

Potential Beneficial Effects

On the Environment

- **Stem damage reduces the density of stems and the biomass of rhizomes, reducing the ability of plants to displace or exclude valued plants in vulnerable habitats**
- **Leaf damage causes death of stems, reversing plant diversity loss in vulnerable habitats**
- **Dense growth of fronds binds river bed gravels, and changes hydrology, worsening flooding**
- Reduced incidence of horsetail partially restores natural vegetation, trophic webs and ecosystems
- Increased nutrient turnover in the litter beneficially affects natural nutrient cycles
- Increased/decreased nutrient flows in weed patches beneficially affects regeneration
- Introduction of new insect species increases biodiversity
- Reduced collateral damage to native plant species from spraying
- Benefits to parasitoid, predator and disease relationships in trophic webs
- Reduced contamination of air, soil and water from reduced spraying
- Improved look and feel of native habitats for visitors
- Loss of endangered species slowed.
- Successful control leads to improved invertebrate biodiversity in bush margins

On Human Health

- Reduction in muscular strains to gardeners, conservation staff and volunteers caused by physical removal of horsetail
- Improved health from reduced occupational exposure of gardeners, conservation staff and volunteers to herbicides

On the Market economy

- **Successful biological control leads to reduction in the cost of control for occupiers, regional councils, DOC, and others**
- **Successful biological control leads to reduced control costs/increased production in pastures**
- Costs of controlling replacement weeds is lower than horsetail

- Management of control agents creates business opportunities for Landcare Research

On Society and Communities

- **Replacement of horsetail with other vegetation following successful biological control leads to improved public conservation values**
- **Successful biological control leads to better use of conservation volunteers and community resources**
- Landscape values improved by decline in horsetail density
- Reduction in stress in conservation workers

Potential Adverse Effects

On the Environment

- **Leaf damage by weevils reduces native plant populations**
- **Decline in horsetail abundance leads to invasion by worse weeds**
- **Introduction of the weevils to native habitats adversely affects native parasitoid, predator and disease relationships**
- **Food web interactions are adversely affected by the introduction of a new prey species. Indirect competition causes extinction of native insects**
- Control agents hybridise with related resident insects
- Swift evolutionary change in insect leads to unexpected non-target damage to valued plants and/or alterations to food webs
- Selecting agent populations other than those tested leads to unpredicted non-target effects
- Adult feeding on leaves reduces susceptibility of horsetail to herbicides, and application rates increase
- Successful control reduces habitat quality for native fauna
- Insect feeding changes nutrient flows in weed patches adversely affecting regeneration
- Massive stem death over a short time reduces quality of bordering streams
- Successful control leads to reduced invertebrate biodiversity in bush margins

On Human Health

- Insects cause a nuisance indoors
- Public fearful of insects
- Control causes loss of future phytomedicines
- Weevils bite or sting
- Weevils generate allergic response
- Weevils need spraying with adverse effects to humans

On the Market economy

- **Weevil damage on leaves significantly reduces the usefulness of valued ornamental species, making sale in nurseries unprofitable**
- Successful biological control leads to reduced herbicide sales significantly affecting vendors' businesses
- Adverse effects require costly agent eradication campaign
- Successful biological control reduces revenue for contractors and suppliers

On Society and Communities

- **Damage reduces the ornamental value of ornamental horsetails currently growing**
- Significantly increased incidence of wasp stings by wasp populations increased by eating weevils
- Fear and distrust of exotic species and their possible non-target effects.