

# SOCIAL, ETHICAL, ECONOMIC & ENVIRONMENTAL IMPLICATIONS OF BIOCONTROL

## Human perspectives

Successful biological control programmes for weeds can provide enormous benefits to communities by preventing the loss of ecosystem functions that contribute to human well being. Grateful communities in Australia and the United States have erected monuments in honour of the agents that saved their livelihoods from prickly pear (*Opuntia* spp.) and St John's wort (*Hypericum perforatum*) infestations, respectively.

Most New Zealanders value our unique New Zealand environment and do not want it to be spoiled. Maori, in particular, commonly share a view that it is their duty to take care of the environment and ensure that it is passed on to future generations in good shape – a concept referred to as kaitiakitanga. Many New Zealanders do not like using chemicals to control pests and prefer more natural methods of pest control. The fact that biological control involves introducing exotic organisms is of some concern, but overall, biocontrol is seen as an important tool to have at our disposal.

Since European colonisation the number of plant species established in the wild in New Zealand has doubled and we now have more introduced plants than indigenous species. A significant number of these are already weeds, in the process of becoming weeds, or will be weeds in the future (of particular concern are the 25,000 or so species in cultivation that could become naturalised at any time). In many situations biological control is still currently the best, and least damaging, way of protecting our environment.

At the outset we must be sure that a weed warrants this kind of action, so evidence that it poses a serious threat is needed. Since biological control is unlikely to be reversible, all the possible implications of using this technique also need to be carefully weighed up before a programme begins. There are often groups who value weedy plants as highly useful resources. For example, beekeepers benefit from pollen provided by



harmful weeds like broom (*Cytisus scoparius*) and gorse (*Ulex europaeus*). Any potential conflicts of interest like this must be identified early on, when the feasibility of a biological control programme is being evaluated, and resolved satisfactorily before a programme can begin.

See *Conflicts of interest*.

## Economic considerations

If a weed can be successfully and feasibly controlled with another method then biological control may not be warranted. Often it is not economically possible to control weeds using other methods. Recent estimates suggest that weeds in New Zealand result in losses to agriculture and forestry production of \$60 million a year, and \$40 million is spent each year preventing the introduction and spread of new weeds. It is more difficult to put a figure on the cost of weeds to the natural environment.

Cost-benefit studies of biological control programmes generally indicate positive returns on investment and the contribution of biocontrol to preventing substantial economic losses due to weeds can be significant. A review of nine studies undertaken between 1939 and 2000



**Table 1: Some economic biocontrol scenarios**

<b>Broom</b> <i>Cytisus scoparius</i>	A cost-benefit study in New Zealand found that it would be economically beneficial to introduce a new control agent against broom even if it attacked tree lucerne ( <i>Chamaecytisus palmensis</i> ) and beekeepers were negatively affected. A net annual benefit of \$3.761 million was predicted and a 49% return on investment.
<b>Golden wattle</b> <i>Acacia pycnantha</i>	In South Africa the economic benefit of preventing the spread of golden wattle using biocontrol was calculated at ZAR3602 (about NZ\$880) per hectare per year, a benefit-cost ratio of 4333:1.
<b>Paterson's curse</b> <i>Echium plantagineum</i>	In Australia a AUS\$5.9 million dollar biocontrol project is expected to deliver AUS\$253 million in benefits over the next 50 years – a 45% return on investment.
<b>Ragwort</b> <i>Senecio jacobaea</i>	In Oregon, USA, a study has shown that biocontrol of ragwort benefits the region by US\$5 million per annum. Every \$1 invested in biocontrol has produced \$13 in benefits.

found on average \$18 worth of benefits could be expected for every \$1 invested in developing a biocontrol programme.

Once successful agents are in place the ongoing costs are very low or nil as they continue to work free of charge year after year, unlike other control measures which must be repeated regularly in perpetuity.

**Weighing up the risks**

As well as being cheaper in the long run, one of the big advantages that biological control has over other techniques is that it is also safer. Chemical and mechanical forms of weed control can be harmful to the environment not to mention the people undertaking the control. Biocontrol agents rarely pose any risk to humans – an assessment of any likely human health issues is made before agents are released. For example, evidence had to be produced that mist flower fungus (*Entyloma ageratina*) spores would not aggravate asthma and hay fever sufferers.

Biocontrol agents are carefully tested to ensure that they will not attack desirable plants and will have a good safety record. Of the nearly 400 agents released worldwide in the last 100 years only around 14 have been recorded attacking non-target plants (including four in New Zealand). Only eight of these attacks (2%) were not predicted beforehand by host-range testing, which was often inadequate by modern

standards, with later testing showing that the non-target attack was actually predictable.

See *How safe are biocontrol agents for weeds?*

In New Zealand any new biocontrol agents must be approved for release by the Environmental Risk Management Authority (ERMA).

Applications must address all the possible pros and cons of releasing the agent. It usually takes at least a year to gain permission as the investigative process is rigorous. The general public are invited to participate in this process by making submissions and attending hearings.

Concerns have been raised about deliberately flooding New Zealand with alien species that might displace endemic species. So are biocontrol agents really posing a threat to our endemic flora and fauna? It has been estimated we have about 20,000 insect species in New Zealand but this figure could actually be much higher. About 2,600 of these are not native species, which have mostly established since European colonisation. Insect weed biocontrol agents represent only a tiny 1.1% of all our introduced species, and little more than 0.1% of all the insects in New Zealand – hardly a significant contribution to dilution of endemic insect biodiversity. The greatest threats to our indigenous plant and animal communities are in reality the thousands of potentially invasive introduced plant species and the continuous stream of accidental insect introductions which, unlike biocontrol agents, are often generalist species with a wide host range.

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