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BIOLOGICAL CONTROL IN PROTECTED NATURAL AREAS

by

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INTRODUCTION

In December 1986, the National Parks and Reserves Authority, via its reserves committee, distributed to national parks and reserves boards a paper they had prepared entitled "Biological control in protected natural areas (including national parks)". The Authority requested the Department of Lands and Survey to prepare a paper on the general subject of biological control on receipt of reserve board comments. This paper was prepared for the National Parks and Reserves Authority in response to that request.

BIOLOGICAL CONTROL - WHAT IS IT?

Biological control is one of the suite of measures available to control plant weeds or animal pests. The essence of the method is that organisms which attack a specific problem weed or pest are brought from the regions where both are native. In the countries of origin often these natural predators or pathogens control the numbers of the host species. Successful biological control agents reduce the rate of growth and spread of their host populations so that the latter are less of a problem or more amenable to other methods of control. In most cases which are likely to confront managers of protected natural areas, the organism to be controlled is a weed and the biological control agent is likely to be an insect or pathogen. Insects usually act by feeding on the weed or parts of the weed thus reducing its reproductive potential, or its growth and vigour, or tolerance to disease. Pathogens such as fungi, bacteria or viruses may be used to cause disease in weeds which kill or debilitate them.

In the past, notable successes have been achieved: prickly pear (*Opuntia*) in Australia has been controlled by the larvae of a South American moth *Cactoblastis cactorum* and St John's wort (*Hypericum perforatum*) has been controlled in California, Australia and New Zealand by the European beetle *Chrysolina hyperici*. More recently alligator weed (*Alternanthera philoxeroides*), a pest plant in Northland lakes, has been checked very well since the release in 1982 of an Argentinian beetle *Agasicles hygrophila*.

PROCEDURES

Insects and plant diseases for biological control are imported under the Plants Act 1970 which is administered by the Ministry of Agriculture and Fisheries (MAF). The procedures used have been developed by MAF in conjunction with the Ministry for the Environment.

First, information is gathered on the host specificity of the biological control agent (will it damage a range of hosts or only one), and its effectiveness as a control agent. This may involve extensive testing in the country of origin of the agent.

Next an application is made to MAF for an import permit. MAF require this application to be accompanied by an Environmental Impact Assessment (EIA) providing information on the host specificity of the agent, the severity of the weed or pest problem and the possible impact of the agent in New Zealand. The amount of detail required in the EIA and the amount of outside comment MAF seek will vary from very little for simple cases, to detailed EIA's with wide distribution for public comment for more complex cases.

Upon importation the agent is kept in one of the three quarantine facilities in New Zealand: Entomology Division, DSIR at Auckland and Lincoln, and Entomology Section, Forest Research Institute, Rotorua. The organism is checked for other pests and diseases. Only in rare situations are further specificity tests done in New Zealand. Prior to release of the agent from quarantine, a permit for general release must be secured from MAF.

The detailed procedures for host-specificity testing have developed over the last 60 years. General principles, as set out by Commonwealth Institute of Biological control in United Kingdom, guide the testing. The following describes the procedures for testing insect control agents for plant weeds.

Before any organism is released into the environment in New Zealand, it is tested in its country of origin against a range of plants, particularly New Zealand natives and beneficial exotics eg crops and ornamentals. A current example is the testing of biological control agents for European broom (Cystisus scoparius). Potential agents have been tested against a range of species including the native brooms (Carmichaelia spp and Notospartium spp) and clover species. This is to determine whether or not the agent feeds and survives on any plants other than the species for which it is being considered for control.

The organism is exposed firstly to a sequence of plants which are most closely related to the weed species, progressing to successively more and more distantly related plants until the possible host range has been adequately represented. Cultivated plants related to the weed or those which may, because of their geographical origin, never have been exposed to the biological control agent are also tested. In addition, cultivated plants which are known to be attacked by organisms closely related to the agent under investigation are tested. This is mainly done in the laboratory where conditions are artificial. However, this is likely to lead to the acceptance by the agent of a broader range of plants than would occur naturally and so enhance the likelihood of getting positive results. Clearly this will produce errors on the side of caution rather than the reverse. Further, only relatively host-specific biological control agents are considered for testing in the first instance. In the future the new technology of genetically modified organisms may offer the possibility of engineering host specificity.

All the plants are exposed to the potential biological control agent in choice tests and in no-choice tests. The former gives an indication of the selectivity of the agent. To be accepted, the testing has to be conducted by people who have the requisite scientific expertise and access to controlled facilities.

Once approval for general release has been given the agent may be released anywhere in New Zealand and it may spread rapidly depending upon its mobility. Usually, many release sites throughout the country are chosen to enhance rapid spread and establishment. Clearly, protected natural areas will be colonised eventually by these agents.

USE IN PROTECTED NATURAL AREAS

At least 3 different uses of biological control in protected natural areas have been mooted in recent years:

1. The deliberate introduction to protected natural areas of biological control agents which have already established in New Zealand. This procedure speeds up the natural spread of the agent and thus the control it can effect on its host pest or weed.

2. Monitoring the long term effect on a target species of a newly introduced biological control agent. A protected natural area offers constant management conditions.

3. Control of a weed which is a particular menace in one or more protected natural areas by the search for, and introduction of, a suitable biological control organism.

ADVANTAGES

Using biological control in protected natural areas offers several advantages. The method, if properly applied, is target specific rather than broad spectrum like chemical methods. Permanent, self-sustaining control can be achieved with only limited labour or financial input required after the initial testing and introduction. Because of this, long term control can be cheaper than by mechanical or chemical methods. Co-ordinated, nationwide control of a widespread weed can be achieved relatively easily and cheaply.

Biological control agents which have already been established in New Zealand will effect the most control in protected natural areas if they are actually introduced to the protected areas.

DISADVANTAGES

A constraint to the use of biological control in protected natural areas is that this is not allowed for in either the National Parks Act or the Reserves Act; nor is it expressly forbidden. The present National Park statute states (section 4.2(b)):

"Except where the Authority otherwise determines, the native plants and animals of the parks shall as far as possible be preserved and the introduced plants and animals shall as far as possible be exterminated."

The Reserves Act has similar clauses in sections 18.2(e), 19.2(a), 20.2(b), 21.2(a). While taking a strong line against introductions these provisions appear to offer the Authority, or the Minister, some discretion. It may be that the discretion could be used to undertake biological control for the greater good of preserving native communities. Examples of use of this discretion are to be found in the general policy that enables, for example, grazing by domestic animals in national parks and in reserves.

The Authority however resolved (Minutes of Meeting 15-16 May 1986) "... that it is not legally possible to approve the introduction of biological vectors for exotic plant management purposes in reserves or national parks" and also "... that the Authority is not yet satisfied that there is a case for legislative amendment to provide for biological control in reserves and national parks..."

A perceived disadvantage of biological control is that the control agents will transfer their attention to other species.

Another possible disadvantage is that there is no guarantee that the agent will be effective; ie that it will damage the target species populations enough to reduce the weed or pest problem and make the costs worthwhile.

DISCUSSION

i Conflict with existing policies

The General Policies for both Reserves and National Parks have strong provisions to provide for the control of exotic plants and animals and the enhancement of natural ecological processes. These aims could be aided by the introduction of a biological control agent; however both policies prohibit the introduction of exotic animals. It is ironical that an activity such as grazing, which is very damaging to native vegetation, is allowed under the general policies but that introducing an unwanted exotic animal to control an exotic pest/weed is not allowed. Further, all weed or pest control methods are in some way unnatural and indeed often have other injurious side-effects.

It seems that while biological control is not catered for specifically in either act or policy it is in the spirit of these documents. Rather than being deliberately excluded it is more likely that biological control was just not considered as a management option when these documents were prepared.

ii Introduction risks

The risk that control organisms might transfer to non-target plants is minimised by present procedures for screening control agents before release. According to the literature, there have

been no cases where a biological control agent has transferred to a completely new host after release into the field subsequent to proper specificity testing. There have been cases where successful control of a target weed by an insect has diminished its food supply to such an extent that a large, starving population has turned to another plant. In the documented cases the larvae of the next generation did. not survive and the insect population collapsed. Nevertheless vigilance must be maintained. Just as the ecology of plants can differ in different ecosystems so too can the interaction between plant and control agent differ.

The minor risk associated with introduction of a biological control agent, for example heather beetle to control heather at Tongariro, needs to be set against often the much greater risk of loss of "Ecological systems so unique or scientifically important that its preservation is in the national interest..." (National Park policy Section 4(1)).

iii Effectiveness and cost

Irrespective of policy, successfully introduced biological control organisms will eventually invade of their own accord, protected natural areas which contain their target species. This dispersal process is both an advantage and a disadvantage. A single control programme can be effective but sometimes the target species is not a nuisance in all parts of the country.

Only release in the field can give a true test of how effective the organism will be in controlling the target species. The initial cost of biological control coupled with the lack of guarantee of effectiveness is a disincentive to embarking on a biological control programme in protected natural areas even though successful biological control could be cheaper long term than conventional methods of control.

As an example, the estimated cost for biological control of heather in Tongariro National Park was $150,000-$239,500 over 3 years compared with the chemical control programme for old man's beard in the Buller Gorge: $100,000 over 2 years. Where biological control could be very cost effective is in control of gorse however it is extremely difficult to get reliable figures. Sandrey (1985) estimated the minimum annual direct cost of gorse control in New Zealand for the early 1980's as $22 million. The future costs for biological control of gorse are estimated at $100,000 per year for 10 years (R. Hill personal comment).

This cost differential, plus the permanent, self-sustaining aspect of biological control, should make it worth 'giving it a go' in some situations. Old man's beard is a prime example; present chemical and mechanical control methods are expensive and the weed occurs commonly outside reseves where it is not always considered a major pest by the landowners.

CONCLUSION

Biological control is one of the suite of measures available to control plant weeds or animal pests. Like any control method it has some drawbacks. One of these is lack of guaranteed success. For some species in some situations it has definite advantages over other control methods. If properly conducted within the standards set down biological control carries a very low risk of damage to both target organisms and ecosystems generally.

Biological control is not presently available as a management option in protected natural areas because it conflicts with policy on introductions. The general policies, and if necessary the acts, should be amended to allow for biological control of weeds or pests in protected natural areas where appropriate.

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POSTSCRIPT

At its meeting on 25-26 February 1988 the National Parks and Reserves Authority resolved to support the use of biological control methods as an option for control of weeds or pests in protected natural areas where it deems this appropriate.

It sought from Department of Conservation a legal opinion on whether biological control can be carried out in protected natural areas after amendment to the Authority's general policy or whether amendments to the Reserves and National Parks Acts would be required.