THE COSTS AND BENEFITS OF GORSE

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SUMMARY

Gorse (*Ulex europaeus*) can be a very damaging weed but has useful roles which are listed. Two reports which examine the value of gorse and the likely consequences of a proposed biological control programme against gorse are summarised. They conclude that biological control is economically efficient but socially sensitive.

INTRODUCTION

Gorse is probably the most serious weed currently affecting primary producers in New Zealand. Blaschke *et al* (1981) recorded it on 3.56% of the total land area and it is ranked by South Island farmers as their second most serious weed after barley grass (Bascand and Jowett 1982). Based on a farmer survey, Reid (1985) estimated that 232,000 ha of gorse were treated in 1984-85, and in the same financial year the Noxious Plants council spent \$5.3 million on subsidies to farmers for gorse control (Sandrey 1985). Gorse is also the most serious impediment to the establishment and efficient management of exotic forest trees in New Zealand (Zabkiewicz and Balneaves 1984).

Gorse can be controlled by herbicide treatment. The advantage of this type of control is that the weed is eradicated only from the target area, causing minimum impact to other gorse in the vicinity. The disadvantages include high cost and the frequent need for repeated treatment. Biological control of gorse through the importation and release of host-specific insects and mites may provide an alternative. Biological control aims to reduce the vigour (i.e. aggressiveness and abundance) of the plant to a level where it is no longer economically significant. If successfully established here, this natural regulation of gorse would continue year after year, without further financial input. However, such control may affect use of gorse for other purposes.

Entomology Division, DSIR, has been engaged in the basic research required to assess the suitability of various species as control agents (Hill 1983). At the same time two studies have been made to find out what conflicts of interest exist between controlling gorse and using the plant. The Division commissioned a study to estimate the economic costs and benefits involved in the proposed biological control project (Sandrey 1985). A second study of the non-economic implications of the project was made with the aid of submissions from a wide range of organisations and interested groups (Hill 1986). This paper lists the values which have been ascribed to gorse and summarises the findings of the two studies.

THE BENEFITS OF GORSE

While gorse is a major weed to both farmers and foresters, others see it as a desirable species. Beekeepers regard gorse as a valuable source of pollen, especially in early spring when few other natural pollen sources are available for feeding larval bees. If there is insufficient pollen, fewer worker bees are available to undertake pollination and to forage for nectar in the summer.

Following several studies which showed that gorse can be successfully controlled by goats in many situations (Radcliffe 1983; Rolston *et al* 1983), it has been suggested that gorse could be managed as a valuable renewable resource on which to farm goats (Radcliffe in press).

In many parts of New Zealand native forest species are regenerating under gorse infestations though little is known about how successful this is. Gorse fixes nitrogen and so it has been strongly suggested that as a nurse-crop for native species it is superior to

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other plants such as manuka (Hackwell 1980).

Many hillsides presently covered with gorse are erosion-prone. Gorse may be an effective stabiliser on such slopes (Cumberland 1947).

Gorse was originally used to shelter and contain stock and there are still a significant number of gorse hedges used for shelter in Canterbury and other parts of New Zealand.

These are the major beneficial roles attributed to gorse.

A COST/BENEFIT ANALYSIS

In the Sandrey (1985) study, a questionnaire was sent to 561 beekeepers who owned more than 50 hives each to find out how valuable they thought gorse was to them, and what they thought the consequences of successful control would be for their business. The response rate was 48%. Two out of three said they were concerned about shortage of pollen in spring. Each beekeeper was asked to estimate the cost per hive which would be incurred if the number of gorse flowers was reduced by 10, 25 or 50 percent. Those who replied said there would be an average cost for each hive of \$5.24 for reducing flowers by 10 percent, \$5.10 for 25 percent reduction and \$7.93 for 50 percent reduction. Taking these replies as representative of all beekeepers, weighting them by the percentage of beekeepers who believed that they would need to feed their bees if fewer gorse flowers were available and multiplying by the total number of hives, estimates of \$417,000, \$704,000 and \$1.6 million were calculated as the potential cost to New Zealand beekeepers. A detailed explanation of how these figures were derived can be found in Sandrey (1985).

The direct savings which would accrue to farmers and foresters if the vigour of gorse was reduced by 10, 25 and 50% were estimated (see Sandrey (1985) for details) and are shown in Table 1. Assuming that repression of gorse would lead to an equivalent reduction in the number of gorse flowers, direct benefit to cost ratios were calculated and are shown in Table 1. These show that the introduction of biological agents to control gorse would be economically efficient.

TABLE 1: Direct measurable annual costs and benefits from the introduction of biological control agents against gorse (\$000's) (From Sandrey 1985).

	Percent reduction in gorse vigour		
	10	25	50
Direct Costs			
Beekeeping Industry	418	705	1560
Direct Benefits			
To farmers and farming	500	2500	10000
To foresters and forestry	—	1135	8514
Net direct benefit	82	3635	18514
Direct benefit to cost ratio	1.2:1	5:1	12:1

Indirect benefits such as increased production from gorse infested land are difficult to quantify but probably exceed the direct benefits. Other positive values of gorse as a shelter species, a potential fodder source, a soil stabilising plant and as a nursery plant are also discussed in the Sandrey study but are not quantified.

PUBLIC CONSULTATION

A second report has been prepared by Hill (1986). It contains background information on gorse and a discussion of the likely consequences of a successful biological control programme. It summarises 49 submissions solicited from a wide range of organisations and interested groups throughout the country and addresses many of the queries raised in those submissions. This report complements the cost/benefit analysis because it concentrates more on issues such as the possible impact of successful gorse control on the environment.

Submissions provided little evidence that gorse is a better nurse-crop than other scrub species such as manuka. While gorse may be a major nurse plant in some areas, it is not very significant nationwide. Analysis of the vegetation cover of New Zealand shows that gorse is a minor component of the scrub flora compared with native species (Blaschke *et al* 1981). Where gorse is the major nurse species, it is unlikely that successful biological control would severely affect regeneration. Changes in gorse density would be slow and other scrub species such as broom, manuka, or other native species would grow between remaining gorse plants and would probably fulfil a similar role.

Gorse can increase the risk of fire, and can invade more open habitats such as native grassland. These problems would be decreased by successful biological control of gorse.

Moderate degrees of control using insects and mites would complement the existing methods of control using goats but the possible impact on goat production is unknown. Where grass seed and fertiliser can be applied, productive goat management can be developed using a mixture of gorse and grass (Radcliffe in press). Heavy damage from insect attack would reduce the dry matter production of the gorse and might decrease the density of gorse plants, but a high degree of control would be required before the gorse/grass system became untenable. On unimproved land where grass seed and fertilisers are not used, invasion by other scrubweeds or low-productivity grasses might lower the value of the land for goat production.

Few submissions valued the ability of gorse to control erosion. Because successful biological control would make gorse clearance easier, it is likely that some erosion prone slopes would be inadvisably cleared and sown for pasture. In areas which were not completely cleared, however, it is likely that other scrubweeds would invade the gaps which appeared between gorse plants and any protection from erosion would not be materially affected.

The impact of successful biological control on gorse hedges is not known but some damage would be likely. This has been raised with farmers in areas where gorse hedges are still used but there has been no negative comment about possible damage.

CONCLUSIONS

Sandrey (1985) carefully outlined the limitations of the economic analysis and listed, but did not quantify several additional costs and benefits associated with the proposed project. The second study, (Hill 1986), surveyed public opinion and looked at the likely consequences of a biological control programme against gorse. These reports together suggest that a biological control programme against gorse in New Zealand is desirable.

It is not possible to predict the amount of damage which biological control agents would do to gorse in New Zealand. Beekeepers are the major group which could suffer economically, and then only if the vigour of gorse was reduced by more than 50%. At this level of control, direct economic benefits to others in the community would exceed \$18 million per annum compared with a possible loss of \$1.6 million to the beekeeping industry. There would also be indirect economic benefits arising from gorse control such as increased production.

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