

provides for fernbirds and bitterns is undergoing change to forest. These pakihi have formed after fire and logging and without further fire will lose many of their present values as they revert back to forest. We can draw parallels with other countries: for example, scots pine and birch invasion of East Anglian heathlands.

In North America and particularly Europe, active intervention is commonly used to conserve semi-natural areas. Chalk grassland and acid heathlands are grazed and deciduous woodlands are coppiced. Although many of the pressures affecting New Zealand reserves are different, active intervention is still likely to play an important role in conservation management here.

Of course, ecological management is not new in New Zealand. In the 1890s Richard Henry was transferring kakapo and kiwi to Resolution Island. Other rare birds such as the black robin and takahe have long been managed, as have plants such as the Castle Hill buttercup and *Hebe armstrongii*. On islands such as Tiritiri Matangi and Mana, revegetation programmes are taking place. Urban reserves such as Riccarton Bush in Christchurch have been intensively managed. However, in many reserves, management has been minimal and largely passive. Where it has been active, it has been related to saving single species rather than whole communities of plants or animals. However, if we are to retain the full range of ecological values in reserves, we will have to manage communities too.

How do we manage?

First, we must have a good knowledge of the ecology of the species or communities concerned. That means monitoring, with an initial census of what is present and a longer term study of the losses and gains of both vulnerable species and of potentially aggressive invaders.

Prior to management, it is necessary to clearly identify the important ecological values and the threats that face them. In some cases this may be difficult. For example, shrubs readily invade induced grassland when fire or grazing ceases, but often the grassland is felt to have the greater ecological value. However, it can also be argued that management should aim to re-establish the "natural" vegetation at the site. Clearly issues of this type need to be resolved before any management is undertaken.

Active intervention management can include a large number of options: transplanting to increase plant numbers or lost plants, removal or modification of other plants (eg. introduced plants or vigorously regenerating native plants like mahoe or wineberry), and environmental manipulation through deliberate disturbance (eg. fire and grazing), to list but a few.

In some instances there may be no change from the kind of management that existed before the area was reserved. For example, in the South Island high country, continued grazing may be the most appropriate management strategy.

We also need to consider management of areas adjacent to reserves (buffer zones), for example, to prevent fertiliser or seed drift, introduced plant invasion or altered



Large natural areas such as this sand dune sequence south of Haast require little in the way of active management.

water tables.

There are always pluses and minuses when intervening in nature. Fire may help maintain grassland vegetation but reduce insect numbers. There are risks when transplanting through mixing genetically different populations. So, for example, it has been recommended that plant material used for revegetating Mana Island comes only from the Sounds-Wellington ecological region, and preferably from Mana Island itself.

Finally, when establishing reserves, we should think about how easily they can be managed as well as biological diversity and representativeness. It may be simpler to have one large reserve rather than two smaller ones, even if this means that certain plant and animal communities are not represented in reserves in each ecological district.

Conclusions

Many people have fought long and hard for the reserves we now have in New Zealand. If the values that these reserves were established for are not to be lost, it is essential that we do not view reservation as the end of the conservation effort, but rather as the beginning. We must work together, conservationists, land manager and scientists, and continue the work already started to achieve effective ecological management of all our reserved areas in order to ensure their long-term survival.

¹ - Reserve is used in a colloquial sense in this article to refer to national parks, scenic reserves, ecological areas and other protected natural areas.

² - Although natural disturbance is a normal feature of native plant communities

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Further Information

Kelly, G C and Park, G N (eds). 1986. *The New Zealand Protected Natural Areas programme. A Scientific Focus*. D.S.I.R Wellington

Mark, A F 1985. The botanical component of conservation in New Zealand. *New Zealand Journal of Botany* 23, 789-810.

Meurk, D C 1987. Conservation objectives in pastoralism. *Proceedings of the New Zealand Grassland Association* 48, 71-74.

Molloy, B P J 1971. Possibilities and problems for nature conservation in a closely settled area. *Proceedings of the New Zealand Ecological Society* 18, 25-37.

O'Connor, K F. 1982. The implications of past exploitation and current developments to the conservation of South Island tussock grasslands. *New Zealand Journal of Ecology* 5, 97-107.

Ogle, C C 1987. The incidence and conservation of animal and plant species in remnants of native vegetation in New Zealand. In D A Saunders, G W. Arnold, A A. Burbidge and A J M Hopkins (eds), *Nature Conservation: The Role of Remnants of Native Vegetation*. Surrey Betty and Sons Ltd, Chipping-Norton, NSW pp 79-87.

Scott, D. 1979. Use and conservation of New Zealand native grasslands in 2079. *New Zealand Journal of Ecology* 2, 71-75.

Timmins, S M, Atkinson, I A E and Ogle, C C. 1987. Conservation opportunities on a highly modified island. Mana Island, Wellington, New Zealand. *New Zealand Journal of Ecology* 10, 57-65.

The New Zealand Ecological Society is running a three-day symposium on "Management of New Zealand's Natural Estate" in Dunedin on August 22-26. Managers and scientists will speak on a number of issues related to this theme. Anyone may attend. Further information: The Secretary, NZ Ecological Society, PO Box 12-019, Wellington.