ANNUAL CONFERENCE 1985

The 34th Annual Conference was held at Massey University from 20-23 August. There were 108 registrants. Mr Philip Woollaston MP, Under-secretary to the Minister for the Environment, was key speaker at the Tuesday afternoon workshop on Environmental Administration. He outlined the broad plans for the changes proposed by Government to rationalise environmental administration in New Zealand and to make it more effectively protect our dwindling natural resources without stultifying reasonable development. Mr Woollaston fielded some ecologically provocative questions at the end of his speech. The afternoon proved to be a stimulating way to start the Conference and the Society was pleased that Mr Woollaston was able to attend.

The general conference programme was as follows:

Tuesday: Workshops.
Wine and Cheese evening.

Wednesday: Contributed papers
Excursion to Aokautere Research Centre
Poster Session
AGM

Thursday: Presidential Address, Dr Mike Rudge "Science Management and Accountability"
Symposium: Managed Ecosystems
Annual Dinner.

Friday: Contributed papers

Papers presented in the contributed papers sections on Wednesday and Friday were:

D. Kelly: Strict and facultative biennials.

C. West: Populations of *Beilschmiedia tawa* in logged and virgin stands at Pureora forest.

M. McEwen: Rimu - ubiquitous podocarp of New Zealand forests.

A. Read: Habitat use by yellowheads in the Hawdon River Valley, Arthur's Pass National Park.

E. Murphy: Comparison of island and mainland populations of house mouse in the Marlborough Sounds.

R. Powlesland *et a1.,* Breeding of kakapo on Stewart Island 1985.

G. Rogers: The role of fire in New Zealand vegetation patterns.

H. Chapman: An introduction to the spread of heather *(Galluna vulgaris)* in Tongariro National Park.

H. Madgwick: Dry matter and nutrient relationships in stands of *Pinus radiata*.

P. Williams & R.P. Buxton: Hawthorn populations in mid Canterbury.

B. Wills: The Cockayne plots of Central Otago -a 1985 evaluation.

I. Payton *et a1.,* Vigour in *Chionochloa:* a question of energy or nutrition.

J. McLennan: Home range and denning behaviour of Brown Kiwi in Hawkes Bay.

D. Morgan: Behavioural responses in possums *(Trichosurus vulpecula)* to baits used in aerial control operations.

B. Reid: Kiwi and possums: traps and baits.

M. Moffat: Bird community structures in part of Tararua State Forest

J. Craig: Coevolution? or the true life story of flax and its floral violators.

Papers presented at the Thursday Symposium, 'Managed Ecosytems' were:

L. Rowan: A geomorphological analysis of New Zealand's National Parks

A. Cunningham: Mountain land management.

J. Innes: Kokako and possum control.

R. Irving: Peatlands for agriculture.

C. McKay: Peatlands for reservation.

P. Moore: Lake Wairarapa wetlands.

A. Mark & P. Johnson: Factors in the management of indigenous ecosystems.

T. Field: The pasture ecosystem.

R. East *et a1.,* Pasture pest management in the northern North Island.

G. Nugent: Changes in the distribution and density of deer in part of the wapiti area of Fiordland 1969-1984.

G. Gleason: Sustained yield beech forests.

B. Springett: Managed ecosystems - summary and overview.

Papers in both the contributed sections and the Symposium were of high standard and some, such as the paper given by Ash Cunningham, had a good measure of timely humour.

The poster session, formally held in the hour before the AGM, but available for people to peruse throughout, was a valuable addition to the Conference. Posters were prepared by:

W.M. McEwen: Ecological Regions in New Zealand.

G. Jane: Recognition of patterns in vegetation: Wilberforce Ecological Area.

C. West: *Clematis vitalba*.

A. Clayton & J. Roper-Lindsay: A preliminary methodology for ecological planning in New Zealand.

B. Bulloch: Research topics on native plants for lowland soil conservation plantings.

H. Stengs: Inventory work on ecological areas in Westland.

P. Stanton & D. Noda: Habitat use by blue duck *Hymenolaimus malacorhynchus*.

P. Greenwood & J. Skipworth: Keebles Bush.

A. Nixon: Possum fur biology.

The field trip to Aokautere Research Centre on Wednesday afternoon was informative and enjoyable and appropriate to the symposium theme "Managed Ecosystems". Research topics covered by the Centre include land stability, land resources, plant materials, remote sensing and the development of improved soil conservation techniques. We thank the staff at the Research Centre for their hospitality, their time and for sharing their knowledge with us.

The 1985 Conference was organised by John Skipworth with help from many other Palmerston North ecologists. The success of the Conference was due to the hard work put in by all these people, to the people who contributed papers and posters, to Prof Brian Springett for his summing up of the Symposium, to Mr Philip Woollaston for his contribution to the workshop and to Mike Rudge for his stimulating and topical presidential address. We thank them all.

Abstracts of papers read at the conference are presented below.

ON STRICT AND FACULTATIVE BIENNIALS, OR, WHY IS IT WORTH BEING A SHORT LIVED PLANT?

D. Kelly
Department of Botany, University of Canterbury, Christchurch.

The current view is that in the wild, so-called biennials often take longer than two years to reach flowering size, and that in most circumstances the plant would have a selective advantage if it were an annual and did not delay flowering. Using data from some short-lived plants in chalk grassland, I show that true biennials do exist, although they are not common. Four of the six species of strict biennials so far identified have annual forms at other sites, so they are quite different from the facultative "biennials". Consideration of the regeneration stretegy of these plants, and of the currency of evolutionary success, shows the biennial and annual life histories are much more closely balanced than previously thought, and data from the chalk grassland site suggests that my biennials are actually doing a better job than annual variants could.

POPULATIONS OF *BEILSCHMIEDIA TAWA* IN LOGGED AND VIRGIN STANDS AT PUREORA FOREST.

C.J. West
D.S.I.R. Botany Division, C/- NZ Soil Bureau, Private Bag, Lower Hutt.

The response of residual tawa following logging at different intensities is shown in relation to the growth of tawa within a virgin stand of forest. Factors influencing growth rates of tawa are investigated and an age-size relationship for tawa is discussed. Demography of tawa at Pureora Forest is also outlined and the "strategy" of tawa is discussed. Finally, the suitability of tawa for sustained-yield management is discussed.

RIMU - UBIQUITOUS PODOCARP OF NEW ZEALAND'S LOWLAND FOREST. ASPECTS OF ITS EVOLUTIONARY HISTORY AND CONSEQUENT PHYSIOLOGY AND ECOLOGY.

W.M. McEwen
Biological Resources Centre, D.S.I.R. Private Bag, Wellington.

Rimu or its morphologically similar ancestor has grown in what is now New Zealand for many millions of years. During that time the country has undergone many changes in size, configuration and climate. In post Pleistocene pollen assemblages abundant rimu pollen is used as an indicator of warmer climatic periods. The 15 other species of the genus which are closely related to rimu all have present day distributions in tropical or sub-tropical climates.

Rimu survived the Pleistocene ice ages in refugia, presumably in the north of the country, but has evolved some degree of cold tolerance and today is the most widespread of all indigenous tall forest trees. It occurs throughout the country in lowland areas from latitude 34ºS to 46ºS and grows in a large number of different forest types, being dominant in many of them.

In this paper some aspects of the physiology of rimu seedling growth are discussed in relation to the evolutional history and present day ecology of the species.

HABITAT USE BY YELLOWHEADS IN THE HAWDON RIVER VALLEY, ARTHUR'S PASS NATIONAL PARK.

A.F. Read
New Zealand Wildlife Service, Department of Internal Affairs, P.O. Box 19546, Christchurch, and Zoology Department, University of Otago, P.O. Box 56, Dunedin. Present Address: Zoology Department, Oxford University, South Parks Road, Oxford OXI 3PS, England.

An investigation of habitat use by yellowheads *(Mohoua ochrocephala* Gmelin 1789) was conducted in mixed red *(Nothofagus fusca)* and mountain *(N. solandri* var. *cliffortioides)* beech forest in the Hawdon River Valley, Arthur's Pass National Park. Observations were made after nesting (late December 1983 - April 1984), when the birds were ranging widely. Yellowheads spent on average 90070 of their time foraging. They were found to be entirely insectivorous, and fed predominantly in the upper understorey and shaded canopy. Yellowheads did not exploit the forest at random. They showed a significant preference for red beech trees and forest types which contain a large red beech element, and also preferred trees with large diameters, tall forests and forests on steep slopes. Mountain beech trees and standing dead trees were exploited less often than would be expected if yellowheads fed at random. These results may indicate a preference for arboreal substrates containing a larger and more diverse invertebrate fauna.

A COMPARISON OF AN ISLAND AND MAINLAND POPULATION OF MICE IN THE MARLBOROUGH SOUNDS.

E.C. Murphy
Zoology Department, Victoria University of Wellington.

House mice were live- and snap- trapped on the mainland area and an island (with fewer predators) in the Marlborough Sounds, to test two generalised rodent population models. Tamarin (1977) suggests high density island populations might be K- selected compared with lower density r- selected mainland populations. Moller and Craig (in prep.) model the influence of predators and dispersal on rodent density. Both models predict a short, intense breeding season and delayed sexual maturation for island populations. However Tamarin's model predicts a smaller litter size on islands, while Moller and Craig predict a larger

Compared with the mainland, island mice were at a higher density, were dispersed more evenly and survived longer. The pregnancy rates and litter sizes were similar for island (26%; 5.9) and mainland (28%; 6.1) females.

These results are discussed in relation to the two models and future experimental studies are outlined.

References

Moller, H. and Craig, J.L. (In prep.) The population ecology of *Rattus exulans* on Tiritiri Island.

Tamarin, R.H. 1977. Reproduction in the island beach vole, *Microtus breweri,* and the mainland meadow vole, *Microtus pennsylvanicus,* in Southeastern Massachusetts. *Journal of Mammalogy 58*: 536-548.

BREEDING OF KAKAPO OF STEWART ISLAND 1985.

R.G. Powlesland, B.D. Lloyd & A.D. Grant
Wildlife Service, Department of Internal Affairs, Private Bag, Wellington.

The kakapo, a lek species, last bred on Stewart Island in 1981. Males attract females to traditional display sites by giving' distinctive "booming" calls. Between 1981 and 1985 no nesting occurred, although some males boomed during those years. In the 1984-85 summer all males boomed, beginning in mid-December and continuing in a concerted fashion until the end of March.

The movement of three radio-tagged females were monitored during the 1985 breeding season. One female mated in mid-January; the other two probably did so between mid-January and early February. The clutches consisted of two, three and four eggs. During incubation a female usually left her nest once per night at about sunset. Each nightly absence lasted from one to two and a half hours.

Of the nine eggs laid only two hatched and both chicks disappeared before they were a week old. At least four, and probably six, of the other eggs were infertile and the seventh contained a dead embryo. In Maya nestling was found in close proximity to one of the females which had lost a chick, but 1 km away from the original nest site of that female.

AN INTRODUCTION TO THE SPREAD OF HEATHER *(CALLUNA VULGARIS)* IN TONGARIRO NATIONAL PARK.

H. Chapman

Heather was introduced into Tongariro National Park in 1913 with the intention of converting its red tussock grasslands into a grouse moor, and creating a 'sportsman's paradise'. Despite strong opposition to the plan which put an end to the planting in 1920 heather has continued to spread throughout the park. Little native tussock grassland remains in the western sector of Tongariro National Park.

Studies of the spread of heather, its age structure, performance, productivity and site preferences have provided a basis for understanding the limitations to its spread and making suggestions for its possible control.

DRY MATTER AND NUTRIENT RELATIONSHIP IN STANDS OF *PINUS RADIATA*.

H.I.A. Madgwick
Forest Research Institute, Private Bag, Rotorua.

Published and unpublished data on the weights and nutrient content of the trees and litterfall in stands of *P. radiata* will be summarized. The 102 observations of tree weight data cover a wide range of silvicultural treatments. The 42 observations of litter fall cover a wider range of stand age and most of these data sets include nutrient data.

Needle mass can attain 15 t/ha in stands 4 to 8 years old but then drops to about 10 t/ha in older stands. Total branch mass is related to stand height in unmanaged stands. Stem mass can be readily estimated from conventional stand measurements. Needle litterfall averaged 3.2 t/ha/yr and total litterfall, 4.0 t/ha/yr.

Total nutrient mass in the various ecosystem components was more variable than nutrient concentrations.

A GEOMORPHOLOGICAL ANALYSIS OF NEW ZEALAND'S NATIONAL PARKS.

L.M. Rowan
Soil Conservation Centre, Ministry of Works and Development, Private Bag, Aokautere, Palmerston North.

The National Parks comprise"....areas of New Zealand that contain scenery of such distinctive quality, ecological systems or natural features so beautiful, unique or scientifically important that their preservation is in the National interest". An understanding of the geomorphology of the land contained within National Parks is a necessary prerequisite for understanding their representativeness, and forms one basis for identifying further areas for inclusion in future National Parks. This understanding can be advanced by analysis of the New Zealand Land Resource Inventory (NZLRI). This paper provides such an analysis of existing National Parks.

MOUNTAINLAND MANAGEMENT

A. Cunningham
Mountainland Consultant, Bay View, Hawkes Bay.

Life in the mountain lands is harsh for plants and animals alike. Storms are common and plant growth rates are slow. Ecosystems in New Zealand mountains are more fragile than they at first appear, and are vulnerable to the influence of man and to introduced animals. The mountains are being used, with increasing intensity, by hunters, trampers, tourists, campers, rafters, canoeists, fishermen, and a variety of commercial interests. Our mountains are also hosts to introduced animals, birds, and fish which are in competition with the indigenous flora and fauna. Not all mountainland is owned by the State. Some is Maori land and much is leased by runholders. Each group of people tends to see only their own interest in the mountains. The mountainland manager on the other hand must have a sound knowledge of all the ecological processes occuring in his territory. While giving first priority to the protection of ecosystems he must try, unobtrusively, to accommodate the various needs of mountainland users. To offset the impact of man and of introduced animals, quite stringent measures may sometimes be necessary to ensure the preservation of indigenous mountainland flora and fauna. Public participation is an important part of such management.

AERIAL POISONING AGAINST POSSUMS - GOOD OR BAD FOR NORTH ISLAND KOKAKO?

J. Innes
Forest Research Institute, NZ Forest Service, Private Bag, Rotorua.

North Island kokako *(Callaeas cinerea)* might benefit from aerial poisoning operations against possums since

the two species may compete for food. However, if too many kokako are non-target victims of the 1080 poison, then kokako populations will be reduced by poisoning.

A study of the reactions of non-captive kokako to non-toxic pellet baits, using feeding platforms and aerial drops of non-toxic baits, suggests that the risks to kokako are low. Further data will be gathered before toxic pellets are dropped over kokako.

1. PEATLANDS FOR AGRICULTURE
2. PEATLANDS FOR RESERVATION

R. Irving, C. McLay & K. Thompson.

Department of Biological Sciences, University of Waikato, Private Bag, Hamilton.

1.Peatlands for agriculture

Huge areas of peatland are now managed for pasture or crops. Much has been poorly managed because most peatland development in the past has been *ad hoc* with little real effort going into trying to understand ecosystem dynamics. Compromising between peat conservation and minimising waterlogging (careful draining) is the most critical requirement. Establishing, and yet not over-compensating for, nutrient deficiencies is the second. New data are presented in both areas to illustrate how important good management planning is.

2. Peatlands for reservation

Very few peatlands yet enjoy reservation status and none of these have active long-term management plans. Most basic hydrological and autecological data for natural peatlands are lacking, so that ecosystem dynamics are insufficiently well understood to permit predictive modelling. Illustrative examples are taken from Moanatuatua Scientific Reserve (inadequate management) and Kopuatai Peat Dome and Whangamarino Swamps (Crown Land, but no reservation status). Some preliminary studies of fire ecology and nutrient status are discussed and autecological studies are illustrated with bryophytes, *Sporodanthus* and kahikatea.

LAKE W AIRARAP A WETLANDS

P.J. Moore

Wildlife Service, Department of Internal Affairs, Private Bag, Wellington, New Zealand.

Although Lake Wairarapa is one of the largest lakes in New Zealand, it is not well known by the public. It was once part of a vast complex of ponds and swampland in the lower Wairarapa region, 90% of which have been drained. A regime of irregular fluctuations of water levels has caused a zonation of vegetation cover on the wide expanses of the eastern shore, ranging from bare substrate to marshland of native turf (e.g. *Limosella lineata)* and jointed-leaved rush *(Juncus articulatus)*. Pond complexes lie adjacent to the eastern shore.

The lake has been managed mainly to protect farming interests, by controlling the lake outlet and diverting the Ruamahanga River past the lake, except in times of flood. The revival of the "polder scheme", a drainage scheme which would eliminate the shallows and marshland of the eastern shore, stimulated the Wildlife Service to study the birds of the area between November 1982 and October 1983.

The wetland birds were diverse and abundant, 47 species being seen during the study, and 25,000 birds being present in autumn 1983. Important species that used the lake shore include New Zealand shoveler *(Anas rhynchotis variegata),* black swan *(Cygnus atratus),* pied stilt *(Himantopus himantopus leucocephalus)* and least golden plover *(Pluvialis fulva)*. The habitat use of wetland birds was quantified, revealing that species have different requirements. The study showed that Lake Wairarapa is a wetland of international importance and the eastern shore is the most valuable part of the wetlands for wildlife. For these reasons, drainage of the area would be undesirable.

Lake Wairarapa should be managed for wildlife, but in such a way that farming interests are protected. The lake should be reserved or otherwise protected and stop-banks and stock removed from the lake shore. The lake water levels must be allowed to fluctuate as naturally as possible to favour the vegetation and wildlife. Habitat diversity could be increased by excavating some ponds or allowing controlled grazing by stock. The final desirable step is to promote public use by providing information centres, hides and walkways, thus creating an important educational and recreational resource.

FACTORS IN THE MANAGEMENT OF INDIGENOUS ECOSYSTEMS -SOME CASE STUDIES FROM THE SOUTHERN SOUTH ISLAND.

A.F. Mark and P.N. Johnson†

Botany Department, University of Otago, P.O. Box 56, Dunedin. †D.S.I.R. Botany Division, Private Bag, Dunedin.

Our combined experiences in the management of a range of natural ecosystems from the southern South Island - lakes, wetlands, low altitude tussock grasslands, coastal dune-saltmarsh complexes, adventive plants and wild herbivores has provided information that probably is more widely applicable while also revealing significant deficiencies in our knowledge which justify further research effort.

Lake shores: The ecologically-based guidelines devised for Lakes Manapouri and Te Anau will be outlined together with confirmatory evidence from the adverse effects on shorelines that have resulted from apparently minor excessions. These guidelines, while ensuring ecological stability for the vulnerable lakeshores, allow for c.93 per cent of the total lakes' water resource to be utilized for hydroelectric generation.

Wetlands: Most remaining examples of this seriously diminished natural resource have been generally accepted as justifying preservation for one or more of their many values (biological, hydrological, recreational, educational, etc) to the extent that most relevant Government departments or agencies (Lands and Survey Department - Land Settlement Board; Ministry of Works and Development - Water and Soil, and Catchment Authorities) have adopted preservation policies. However, almost without exception current wetland reservation is being planned and actioned with serious loss of ecosystem integrity through either partial (peripheral) development or exclusion of th catchment which nourishes the wetland. Some recent examples and recommended solutions will be discussed. .

Low-altitude Tussock Grasslands: Proposals to reserve low-altitude tussock grasslands are almost invariably rejected in official quarters, not only because of the agricultural potential foregone, but also the degree of modification already sustained to both vegetation and soil through previous limited development (e.g. oversowing and topdressing), the uncertainty of future management requirements and the national benefits likely to accrue from reservation. A virtual absence of scientists from the decision-making role is a further serious impediment. Greater efforts in management-oriented research and in education are urgently needed to achieve adequate reservations ahead of irreversible development. Factors in the management of tussock grassland reserves which require scientific assessment include fire, grazing and rehabilitation. Some examples will be described.

Wild Animal Impacts on Natural Ecosystem Values: We are concerned with the apparent complacency within some Government departments and even among many practising ecologists in New Zealand for accepting wild animals as being either an inevitable component or one of negligible influence in reserves. Studies in Fiordland over the last 20 years have revealed significant changes in forest structure and composition. These will be reviewed. A much greater research effort into methods of eradication as well as the monitoring of exclosures is called for.

Weeds in Indigenous Ecosystems: Within scrub, tussock grasslands, sand dunes, wetlands and submerged communities some adventive plants must be accepted. The presence of some weeds must not be considered a justifiable reason for non-reservation of such ecosystems. Potentially troublesome weeds require recognition and research aimed at management strategies. Some examples will be given.

PASTURE AS A MANAGED ECOSYSTEM

T.R.O. Field

Grasslands Division, D.S.I.R. Private Bag, Palmerston North.

There is a vast body of information about production from managed pastoral ecosystems. By contrast, there appears to be a requirement for better quantitative information about the floristic makeup of New Zealand's pastoral resource.

Some management effects on pasture diversity have been inferred from a limited survey of Manawatu pastures. Within the constraints of soil type and the influence of the major climatic and altitudinal gradients, management played a major role in determining botanical composition. As management intensity increased, diversity decreased. Along a farming intensity gradient, pastures on hill country farms were found to contain on average 24 species, in comparison with 17 and 13 on terrace and alluvial farms respectively. On both terrace and alluvial soils, rotationally-grazed dairy farm pastures had 2 less species than the less intensively-managed, set-stocked sheep pastures.

Pastures containing introduced species are not a climax vegetation and require a continuing management input to prevent a regression towards the original vegetation cover. Within any climatic zone, botanical composition and diversity are primarily a function of the past level of management input, which determined the current fertility status, and the present input which determines the direction of any tendency for change. At high management intensities, deficiencies in management are rapidly symptomised

by the ingress of weeds, with the highest management expertise required to maintain the purity of monocultures such as lucerne pasturs. Where management is completely withdrawn there is a rapid reversion of all pasture types towards native or imported shrubby species, with a long term transition to a modified form of native bush, if the pasture is not too far removed in either time or distance from sources of seed.

Intensification of pastoral agriculture, and reversion to scrub or bush associations, has taken place often cyclically, in the past. The first cycle was completed when the fertility which was released following bush clearance was rundown, pasture productivity declined, and much marginal farmland reverted to scrub. Successive development cycles have since seen a rise to the present peak extent of the New Zealand pasture ecosystem.

PASTURE PEST MANAGEMENT IN THE NORTHERN NORTH ISLAND.

R. East, R.A. Prestidge & L.N. Robertson
Ministry of Agriculture and Fisheries, Agricultural Research Division, Ruakura Agricultural Research Centre, Private Bag, Hamilton.

This paper reviews recent developments in pasture pest management in the northern North Island and analyses the current and future relative importance of chemical, biological and cultural (e.g. plant resistance, farm management practices) control methods by examining three case studies: the introduced pests Argentine stem weevil *(Listronotus bonariensis)* and Australian soldier fly *(lnopus rubriceps)* and the endemic species grass grub *(Costelytra zealandica)*. It is concluded that integrated pest management utilising mainly non-chemical controls will become increasingly important in pasture pest control in the future.

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CHANGES IN THE DISTRIBUTION AND DENSITY OF DEER IN PART

OF THE WAPITI AREA OF FIORD LAND(1969-1984).

G. Nugent.

Forest Research Institute, P.O. Box 31Oll, Christchurch.

Three pellet surveys conducted in 1969, 1975 and 1984 showed an estimated 85% decline in deer density since the advent of aerial hunting. Use of the open tops above the forest zone have declined to near zero, while within the forest deer densities have dropped by 70%. Highest deer densities remain in areas with the smallest proportion of open tops.

Within the forest the reduction has been greatest in the upper forest, and secondly, in the valley bottom. The initially least-used mid-forest zone has had the least reduction. Of the major forest types, the seral associations are most preferred by deer. As deer numbers have been reduced, deer usage appears to have become more concentrated in these forest types. A comparison of high and low deer density areas in 1984 also showed this greater concentration of use in favoured sites. The reduction in deer density has thus been least marked in the areas most critical in forest succession.

HAWTHORN POPULATIONS IN MID-CANTERBURY.

P.A. Williams & R.P. Buxton

D.S.I.R. Botany Division, Private Bag, Nelson.

Hawthorn *(Crataegus monogyna)* is a naturalised tree that is classified as a noxious plant in several counties in eastern South Island. It is locally abundant in lowland forest remnants, and with the indigenous spiny shrub matagouri *(Discaria toumatou),* on grazing land in Canterbury. Two scrub sites near Porters Pass, where the original hawthorn trees still existed, and a forest site near Lords bush, were sampled by measuring stem diameters and counting growth rings, to determine the age structure and dynamics of hawthorn. Matagouri was sampled similarly at one of the sites. There is a close positive relationship between age, stem diameter and bush height for hawthorn and the slower growing matagouri. Grazing impedes hawthorn growth, but it is spreading near Porters Pass in clumps of matagouri, and pastures that are only lightly grazed. If existing management continues, hawthorn is predicted to increase as more of the bushes begin fruiting.

In the forest site, less hawthorn is establishing now than when the forest was more disturbed, whereas seedlings and saplings of native trees are abundant. Hawthorn is predicted to decrease here. The management of hawthorn should recognise these different situations.

THE COCKAYNE PLOTS OF CENTRAL OTAGO - A 1985 EVALUATION.

B.J. Wills & J.S. Begg.

Ministry of Works and Development, P.O. Box 273, Alexandra.

The plots established by Cockayne in 1920 on Northburn Station near Cromwell, Central Otago, were last described in Douglas (1970) from observations made in 1967. In this paper, the early results are briefly reviewed and discussed in comparison with a 1984/85 assessment of the plots.

This latest assessment includes quantitative data on the composition and spread of pasture species and tree species both inside and outside each trial area, thus establishing a base for future appraisals of Cockayne's plots.

The ability of several plant species to survive and spread from the plots despite adverse conditions is noted in relation to possible low cost development in depleted tussock grasslands. The spread from the Cockayne plots of conifers, and tall oat grass which is quite unpalatable, is viewed with concern.

VIGOUR IN *CHIONOCHLOA,* A QUESTION OF ENERGY OR NUTRITION?

Ian J. Payton.

Forest Research Institute, P.O. Box 31011, Christchurch.

Spring burning of snow tussocks *(Chionochloa)* was followed by an immediate reallocation of nutrients, principally nitrogen and potassium, from root to leaf tissue. In the first 2 years after burning, nutrient concentrations in leaf tissue were significantly greater than in unburnt plants, but were equivalent by the eighth year. Concentrations in stem tissue remained relatively unchanged in the first 2 years, but had declined significantly by the eighth year. Nutrient concentrations in root tissue remained significantly depressed for the 13 years studied. These trends were paralleled by changes in the growth and flowering performance of the tussocks. Conversely, nonstructural carbohydrate reserves in burnt plants were depressed in the period of rapid post-fire growth, but were somewhat higher than in un burnt plants in subsequent years.

HOME RANGE AND DENNING BEHAVIOUR OF BROWN KIWI IN HAWKES BAY.

J.A. McLennan, M.R. Rudge & M. Potter.
*D.S.I.R. Ecology Division, Private Bag, Havelock North, † Lower Hutt, * Department of Botany and Zoology, Massey University, Private Bag, Palmerston North.*

Twelve kiwis were radio-tagged and tracked for 4-70 weeks in two sites in Hawkes Bay. Bonded pairs (n = 4) had ranges of 14.6 to 40.3 ha, which were apparently defended against other kiwis. Two unmated females had ranges of 32.6 and 36.2 ha. Another unmated female occupied a narrow, circular strip, 5.4 km long, convering 27-35 ha. The ranges of kiwis in scrubland (n = 8) were similar in size.

Kiwis sheltered on 36% of days in burrows which they excavated themselves. On other days they sheltered in natural subterranean tunnels, or hollows under fallen trees, thick vegetation, or inside hollow logs. Generally the birds sheltered in a different place each day but often returned to sites they had used previously. Members of bonded pairs roosted apart on 92% of days, in different parts of their range.

Reserves for kiwis in Hawke's Bay probably need to be at least 1500 ha, if they are to support a population of 40-50 breeding pairs. None of the existing reserves meet this requirement.

BEHA VIOURAL RESPONSES OF POSSUMS *(TRICHOSURUS VULPECULA) TO BAITS USED IN AERIAL CONTROL OPERATIONS.*

D.R. Morgan.
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Captive possums were individually observed to determine the extent of sensory aversion towards 1080 baits. Possums were used in one test only in which a single bait treatment was offered, so as to avoid the possible confounding effect of experience. Carrot baits, treated with on average 9 mg 1080 per bait, were rejected equally through smell and taste by 26% of possums tested. Non-toxic carrot baits however were eaten by all but 7%. Pellet baits, containing on average 11.2 mg 1080 were rejected by 34% of possums, mainly after first tasting baits. The palatability of a range of flavours to possums was tested revealing, surprisingly, little preference. Cinnamon and orange flavours were selected for evaluation as bait additives for masking 1080 poison. Aversion, and hence survival, was reduced to a level no different to the extent of refusal of baits carrying no poison. Application of cinnamon oil at 0.133% (vol/wt) is recommended for routine use in aerial control operations.

KIWIS, OPOSSUMS, TRAPS AND BAITS.

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A 1984 questionnaire survey completed by 82 trappers showed that the 'average trapper' obtains 2,395 opossum pelts a year, 1,090 of these from a trap-line of WI traps and 1,305 from the laying of approximately 5,800 cyanide baits (= 8.9 500g tubes). Thirty-eight (58%) of the 66 trappers who had hunted in areas known (or believed) to contain kiwis reported having injured, or killed, one or more of these birds. In 274 man-years of hunting these 66 trappers had trapped 141 and poisoned 37 Kiwis for a commercial take of 1,089,000 pelts. Although one Kiwi was trapped for every 3,940 opossums taken by this method (compared with one Kiwi for every 14,400 opossums from poison), 60% of these trapped kiwis were released in 'good to fair' condition. Many may lose toes but most are expected to survive. Trappers reported catching (or poisoning) kiwi when using cloves, aniseed, curry, eucalyptus, cinnamon, rose, wintergreen or banana flavoured lures. Other non target species taken on trap-lines include rats, cats and mustelids (mainly stoats). In the Urewera National Park 10,720 opossums, 128O rats, 40 cats and 31 mustelids are destroyed for each kiwi trapped. Fuller information may be found in Reid (1986).

References

Reid, B. 1986. Kiwis, opossums and vermin - a survey of opossum hunting; and of target and non-target tallies. *Fur Facts 7(27)*: 37-49.

BIRD COMMUNITY STRUCTURES IN PART OF TARARUA STATE FOREST.

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The abundance and niches (especially feeding niche) of birds in an area around the Herepai ridge in Tararua State Forest Park were studies from

November 1982 until February 1985. Modified five-minute bird counts were used to produce indices of relative abundance for fifteen passerine species of the study area. The bird community is graphically illustrated using Principal Component Analysis. The feeding niches of ten common species are described.

COEVOLUTION? OR THE TRUE LIFE STORY OF FLAX AND ITS FLORAL VIOLATORS.

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Flax, *Phormium tenox,* is a large monocotelydon that historically relied on honeyeaters for pollination. Selfed flowers set little or no seed and hence the plant typically requires outcrossings. Observations of movements by honeyeaters show that different classes of birds provide different levels of outcrossing. The degree of pollen masking was tested with captive birds allowing levels of out-crossing by birds to be equated with seed set. Not all seeds are equal however, and it is suggested that seed set is a balance between maternal nutrition and pollen flow.