

New Zealand Ecological Society Conference Programme

22nd - 24th August, 1994

Regent Theatre, Hokitika.

Monday 22nd August

- 8.30 Registrations open
- 10.30 Morning tea
- 11.00 Mihimihi, Karakia
- 11.05 Official opening (Damien O'Connor, MP Westland)

Chair: Bruce Hamilton (West Coast Conservation Board)

- 11.30 An industry view of sphagnum moss (Kees van Beek, Sphagnum Moss Industry Association)
- 12.00 Lunch
- 1.00 Removing the "stain" from sustainable. (Doug Betts, Macraes Mining)
- 1.30 Hydro electricity and the sustainable use of available resources in the West Coast region. (Ian Lees, Westpower)
- 2.00 Searching for sustainability: Environmental panaceas while Rome burns. (Kit Richards, Timberlands)
- 2.30 Use of quality information in land use decision making - an endangered species? (Henk Stengs, West Coast Regional Council)
- 3.30 An historical overview of sustainable use of natural resources of Te Tai Poutini/The West Coast (Peter Allan, Allan Associates Consultancy)
- 4.00 The East Coast forestry project: Sustainable resource use or ecological nightmare? (Paul Blaschke, Office of the Parliamentary Commissioner for the Environment)
- 4.20 Sustainability and ecology: the challenge of the "real world". (Caroline, Mason, Landcorp Property Ltd)

Chair: Dr Glen Lauder

- 5.00 Forum

Tuesday 23rd August

Chair: Dr Dave Norton

- 9.00 Impact of cattle on forest margins in South Westland.
- 9.20 Topographic roughness and the persistence of native plants in extensively modified landscapes, Central Otago.
- 9.40 The vegetation of flat top hill - a new reserve in Central Otago.
- 10.00 Ecophysiology of successional plants in South Westland.

Chair: Dr Paul Blaschke

- 10.40 Seasonal movements of female New Zealand fur seals off Cape Foulwind.
- 11.00 Maternal investment of New Zealand fur seals at Cape Foulwind.
- 11.20 Population size and breeding status of New Zealand fur seals in the Nelson-northern Marlborough region.

11.40 Results of translocations of hihi (stitchbirds) to Kapiti Island.

Chair: Dr Morgan Williams

- 1.30 Recreational thar hunters and thar in Carneys Creek: the riddle solved?
- 1.50 Options to integrate the management of mammal pests of conservation values.
- 2.10 Bait shyness in possums.
- 2.30 Possum control in forests using 1080 in bait stations.
- 2.50 Towards a better understanding of wasp population dynamics.

Chair: Caroline Mason

- 3.40 Goat diet and vegetation impacts in Isolated Hill Scenic Reserve, Marlborough.
- 4.00 What do North Island weka eat at Rakauora and when?
- 4.20 Kiwi call survey - a measure of population density, or, is this technique out of date?
- 4.40 Survival of juvenile takahe in Fiordland.

Wednesday 24th August

Chair: Dr Fran Kell

- 9.00 Host specificity in New Zealand Loranthaceae.
- 9.20 Bird-plant coadaptations in New Zealand Loranthaceae mistletoes.
- 9.40 Are we underestimating the extent of bird pollination of New Zealand forest plants?
- 10.00 Fleshy fruited weeds and native species in the diet of native and introduced birds.

Chair: Dr Neil Mitchell

- 10.40 Biological control of broom with insects.
- 11.00 Heather demography in Tongariro National Park.
- 11.20 Oviposition requirements of the heather beetle: will these be met in New Zealand?
- 11.40 Weed control on Raoul Island, Kermadecs.

Chair: Brian Patrick

- 1.30 50 years of vegetation change in the Whangamarino wetland: patterns and processes.
- 1.50 The obstacles presented by a gorse community to the establishment of mahoe and kanuka.
- 2.10 Ecology of New Zealand hoverflies in Agricultural land.
- 2.30 Invertebrate assemblage resilience of native tussock grasslands and exotic heathlands in Tongariro National Park.
- 2.50 Resistance and resilience properties of stream invertebrate communities in relation to spatiotemporal variation.

Chair: Dr Graham Hickling

- 3.30 Facets of the reproductive biology of matai.
- 3.50 Classifying ecosystems for conservation management.
- 4.10 Brown kiwi management in Westland National Park.
- 4.30 TVNZ video documentary presentation.

ABSTRACTS FOR NZ ECOLOGICAL SOCIETY CONFERENCE, HOKITIKA,
1994

Monday 22 August

An Industry View Of Sphagnum Moss

Kees van Beek
Sphagnum Moss Industry Association

The harvesting of sphagnum moss (based largely on *Sphagnum cristatum*) in New Zealand for export began in the late 1970's, with the demand to harvest the resource increasing rapidly since 1983. In 1993 export receipts were in the order of \$18 million. Of the estimated 600 people involved in the industry in New Zealand, the majority operate in the West Coast. *6-700 people*

In the West Coast the moss is generally harvested from lowland forests that have been cut-over, grazed areas, regularly burnt wetlands, abandoned mine sites, and previously harvested areas. The West Coast has a resource of some thousands of hectares.

This paper examines the sphagnum moss industry on the West Coast. Note will be given to moss ecology and the species present here. It will also look at the uses, markets, and market returns for sphagnum, and the industry structure and production cycle. The future of this bastion of private enterprise will be assessed in view of the sustainability of the resource.

Removing The "Stain" From Sustainable.

Doug Betts
Environmental Manager, Macraes Mining Company Ltd.

This paper is a general and philosophical note drawing on my past life as an environmental assessor of mining proposals and, before that, as an exploration geologist.

How should we use the word sustainable? Dictionary definitions create confusion, particularly in the context of this conference topic; the term has become a "buzzword". I will pose a couple of definitions and ask if any human activities really qualify. Examples will be drawn from farming, forestry, and tourism to see how well they fit the definition.

We mustn't allow this concept of sustainability to create notions of good and bad industries, when these industries are there to support the lifestyles we seek to maintain. All activities have the potential to be good or bad. However miners and all other industries need to embrace the principles of sustainability.

I will look at this in the context of the activities of the mining industry and compare current vs. former mining practises. The following will also be addressed:

Prescriptions for mines ought to be tailored to the specific situation surrounding each mine proposal.

Baseline monitoring is very important and can be a valuable stand-alone contribution to the ecological inventory of the area.

The expectation that land be returned as closely as possible to the state it was in prior to mining.

Softening lines of mined areas by sensitive landscaping and planting.

Ensuring that the area influenced by mining activities is minimised.

Minimising the risk of pollution from discharges.

We need to raise the level of environmental awareness of all mine employees, and seek improvements to practises from the bottom-up as well as the top-down. We must also consider what happens to the mined product, and ensure that we, the public, let manufacturers know what we want from them and what is not acceptable.

Our individual responsibility is to re-use, repair, and recycle as much as we can. Manufacturers are getting the message and changing their ways in response to consumer demands for more environmentally friendly products. We need to extend these practises and principles across the whole spectrum of human endeavour.

Hydro-Electricity And The Sustainable Use Of Available Resources In The West Coast Region.

Ian Lees
Westpower Ltd

This paper gives an overview of Westpower's past and present activities, and some future proposals regarding the production of Energy using the hydro-electric process. This section also discusses the type, size, and location of existing installations.

Current energy demand and improvements in the economy suggest demand will increase and therefore plans must be made to allow for continued growth. These are briefly outlined, as are energy conservation and efficiency promotions which Westpower has had in place for some time.

The paper outlines Westpower's perspective in terms of the sensible use of the hydro resource and discusses experiences with hydro to date, including the impact of the Resource Management Act 1991.

Finally, plans for the future are outlined and a brief overview is given of the proposed Taipo Hydro scheme.

Searching For Sustainability: Environmental Panaceas While Rome Burns.

Kit Richards
Timberlands West Coast Ltd.

As a company, Timberlands West Coast has been involved in one of the most visibly unsustainable land use activities still practised in New Zealand.

Yet, it was created specifically to attempt a fundamental reversal of one and a half centuries of Anglo-Saxon / agrarian attitudes to land use, a task which it is part way through and has to date achieved with some success.

Despite these progressions, contemplation about the direction and tenor of popular environmental debate leads one to fear that as a nation we have some way to go before we graduate from an era of environmental awareness to one of environmental understanding. In the interim Rome will continue to burn.

Use Of Quality Information In Land Use Decision Making - An Endangered Species?

Henk Stengs
West Coast Regional Council

An hypothesis explaining the cause of continuing conservation conflicts on the West Coast is advanced. It is argued that the cause is not necessarily a reaction by people to types of decisions made on land use issues, but to the process followed and the quality of ecological and economic information used. Three examples of land use decisions that were influenced by deficient information are described. Because the public are aware that such problems exist the cause of conservation on the West Coast continues to be frustrated. Whilst no review of past decisions is sought, a number of changes in the decision making process are called for to rectify this problem.

An Historical Overview Of Sustainable Use Of Natural Resources Of Te Tai Poutini/The West Coast.

Peter Allan
Allan Associates Consultancy, Recognised Forestry Consultants

The approach taken by government departments during the period from 1960 to 1986 to sustainable use of natural resources of Te Tai Poutini/The West Coast is reviewed. This overview gives particular emphasis to use of forest land.

The East Coast Forestry Project: Sustainable Resource Use Or Ecological Nightmare?

Paul M. Blaschke, Jennifer A. Boshier, Philip G. Hughes
Office of the Parliamentary Commissioner for the Environment
PO Box 10-241, Wellington.

This paper will discuss the East Coast Forestry Project and previous government schemes for afforestation in the East Coast region. It is developed within a framework of Ecologically Sustainable Development and a resulting definition and criteria for sustainable land management in the region.

The East Coast Forestry Project was announced in 1992 as a central government intervention through a tendered subsidy process to private investors and landholders (often in partnership). It aims to afforest 2000 km² over 28 years, thereby achieving soil conservation and employment goals through the creation of a large industrial forest resource. Targeting mechanisms designed to these ends have been controversial, particularly in the inclusion of some blocks of regenerating indigenous scrub in areas eligible for subsidy.

The East Coast Forestry Project is only the most recent of a number of proposed or implemented schemes of government intervention in the region aimed at land stabilisation and more sustainable land use patterns. A comparison of these schemes and their successes and failures shows some interesting similarities and differences, and may also provide some pointers to possible outcomes of the present project. What is already clear is that serious analysis of options for sustainable land management needs to go a long way beyond single issues such as scrub clearance.

Sustainability And Ecology: The Challenge Of The "Real World".

Caroline Mason
Landcorp Property Ltd
PO Box 142
Christchurch

"Sustainability" and "sustainable management" are familiar phrases which are now used in a variety of frameworks and contexts. These range from legislation (e.g., Resource Management Act) to policy (e.g., MAF Sustainable Agriculture Policy) and research (e.g., proposed National Strategy on Sustainable Land Management).

The concept of "sustainability" is of particular interest to ecologists, since this concept has the potential to embody many ecological principles. Ecologists can, and should, have a valuable contribution to make to the development of this concept of sustainability. However it is often the case that decisions made regarding the sustainability of resource use fail to adequately take account of "ecological issues".

In this paper I will explore, by way of example, some of the practical issues and dilemmas facing those of us who work as consultants in situations where ecological

issues are not well understood or acknowledged. Some suggestions as to how these issues can be resolved will be discussed.

Tuesday 23 August

Impact Of Cattle On Forest Margins In South Westland

Timmins, S.M¹., Buxton, R.P²., Wardle, P².

¹ *Science & Research, Department of Conservation, Wellington.*

² *Landcare Research, Lincoln.*

To provide information on the impact of stock on forest margins in South Westland, seven pairs of matched exclosure and control plots have been placed across forest-grassland boundaries on river flats. They were set up in late summer, the first in 1989 and the last in 1992. Full resurvey of plots on deep alluvial silt in the Waitangitona Valley was carried out after three years, and of plots on swampy ground in the lower Cook Valley after four years.

Responses so far to exclusion of grazing vary in rapidity, direction, and according to vegetation type. Some categories of native plants benefit, notably herbaceous species of the forest understorey. Others are disadvantaged by increased competition from more vigorous plants, the prime example being the almost total suppression of small native grassland species by vigorous adventives, especially *Lotus pedunculatus* and *Ranunculus repens*. For yet others, including the dominant tree species, it is too early to judge.

The project highlights three management principles. Firstly, each ecological situation should be judged and managed on its individual merits. Secondly, decisions concerning grazing should be based on clear statements of purpose; for instance, an emphasis on species diversity may require a management regime different from that needed to retain a forest canopy. Finally, monitoring projects are likely to yield new information for decades, and management strategies should be flexible enough to be modified as this information comes in.

Topographic Roughness And The Persistence Of Native Plants In Extensively Modified Landscapes, Central Otago.

Alex Wearing

Department of Geography, University of Otago.

The range and basin landscapes of Central Otago have been extensively transformed by sheep and rabbits, and fire. They are currently characterised by patchy and depleted ensembles of native and introduced plant species, with many native plants occurring at very low cover-abundance values.

The persistence of native plants considered vulnerable to grazing or which are dependent on mesic conditions was investigated in low altitude, midslope sites west of Alexandra. The vegetation cover ranged from modified short tussock grassland with scattered woody shrubs, to herbfields of introduced herbs, scabweed and bare soil. The sites investigated were characterised by rock outcrops and isolated rocky piles of varying dimensions. The role of outcrops as fine-scale refugia for woody, grass and broadleaf herb species, and the

reflection of their extent on the floristic diversity and frequency of native fern species was examined.

In a narrowly ecological sense, the current low rainfall landscapes of Central Otago represent an environment in which native plants merely survive. The conservation value of landscape elements and the pace of native plant recovery, should grazing and burning pressure cease or be reduced, are likely to bear some relation to surface roughness. The latter increases landscape 'packing' and edge habitats, and provides shelter from desiccating winds. Topographic roughness at a local scale will give rise to greater landscape potential in terms of maintaining a 'place' for native plants in the area's changing landscapes.

The Vegetation Of Flat Top Hill, A New Reserve In Central Otago, New Zealand

Susan Walker

Department of Botany, Otago University.

An account is given of the vegetation of Flat Top Hill, an elongated foothill of the Old Man Range, in Central Otago, New Zealand. The area was acquired for conservation in 1992, following almost 150 years of pastoral use. Stock (sheep, *Ovis aries*) have been removed and rabbits (*Oryctolagus cuniculus*) have been controlled. The study provides a baseline for future monitoring of the reserve.

The vegetation was sampled using a composite scheme, designed to include the majority of habitats and communities present. Permanent monitoring sites were established using a restricted randomised design in a main "belt" transect that included the complete range of altitudes and aspects, in a subsidiary transect along the crest, and in additional habitats and communities of special interest. Quantitative vegetation data were collected in autumn, spring and summer to examine seasonal variation. Twenty three environmental factors were measured in each sample.

Native species comprise 53% of the known vascular flora of the area (211 species). From multivariate analyses of the data from all three seasons, four 'formations' were recognised, and fourteen 'communities' described within them. Four 'variants' were recognised within the six most extensive communities. Although there were few constant or faithful species, strong relationships were shown with the environment, particularly with aspect, slope, soil moisture, soil depth and soil texture. Communities differed significantly in total and native species richness, dominance and diversity. Analyses also showed a gradient in vegetation from sheltered rock tor habitats to open, disturbed sites. Weak community structure was found, which may be due to year-to-year environmental variation or to lack of equilibrium.

It was concluded that the summer survey may be a poor baseline for future monitoring, due to unusually high summer rainfall. Although many species showed significant differences in abundance between sampling times, seasonal changes in the vegetation were insignificant compared to spatial variation. The vegetation had slightly weaker structure in spring than in other seasons, and was less strongly correlated then with factors related to soil moisture.

All but one site/season sample comprised both native and exotic species. Native and exotic guilds are poorly integrated and show considerable ecological differentiation. The highest proportion of exotic species is found where soil moisture, depth and fertility are greater. The distribution of native species is more determinate than that of the exotic guild, but less strongly related to the present environment. Variation in the total vegetation is better correlated with the exotic than with the native guild, suggesting that the exotic guild determines the structure of the overall vegetation.

Ecophysiology Of Successional Plants In South Westland

S.J. McCorkindale, R.A. Bungard, M.A. Andrews and G.T. Daly
Lincoln University

Eight distinct sites were selected from a previous study of plant succession and pedogenesis at Franz Josef Glacier by Stevens (1963; 1968). Plant species, diversity and abundance were recorded on the three youngest sites, aged 45 to 84 years in the study. Floristic composition was compared to composition recorded on the same sites 30 years previously. Sites in the present study were also compared to sites that were of equivalent age in the previous study. Floristic composition did not appear to occur in a predictable manner, due to a dynamically changing understorey.

Soil N levels were determined on all eight successional sites. Total soil N increased over time, with initially rapid rates of accumulation declining with progress of succession. The pattern of accumulation observed in the present study was the same as that noted by Stevens (1963), confirming that N is increasing during early succession and pedogenesis.

Total leaf N was determined for species *Griselinia littoralis*, *Pseudopanax colensoi* and *Coprosma lucida*, on each site. Leaf N (mg/g) was highly variable, exhibiting no clear trends. Leaf N per unit leaf area (mg/cm^2) declined with increasing surface age and increasing specific leaf area (SLA). Leaf N did not correlate with soil N. This may be due to soil N availability levels declining, with increasing C/N ratios, associated with succession, or the inability of these species to utilise higher N.

Chlorophyll levels and SLA were determined for the same three species, on the youngest and oldest sites of the successional sequence. An increase in SLA and total chlorophyll per weight (mg/g) and a decline in the chlorophyll a:b ratio suggests evidence of shade acclimation in these species.

Growth responses to applied NO_3 were recorded in *Carmichaelia grandiflora* and possibly in *Aristotelia serrata*, both of which had significant responses in NRA to applied NO_3 . *C. arborea* and *Olearia avicenniaefolia* dry weight was not affected by applied NO_3 , which can be related to no effect of applied NO_3 concentrations on total NRA. *C. grandiflora* was found to have high NRA up to $2.2 \text{ mMol gfw}^{-1} \text{ h}^{-1}$ of which over 50% was carried out in the leaves. *A. serrata* had NRA dominant in the leaves (>70%) which can be related to cold tolerance and growth in high PFD situations. Detectable tissue NO_3 is related to the total NRA of the plant and NRA partitioning.

These initial findings may contribute to the increasing explanatory power of measurements of indigenous plant successional strategies.

Key words

Griselinia littoralis; *Pseudopanax colensoi*; *Coprosma lucida*; *Carmichaelia grandiflora*; *Aristotelia serrata*; *Coriaria arborea*; *Olearia avicenniaefolia*; pedogenesis; succession; floristic composition; predictability; shade acclimation; nitrogen response; nitrate reductase; tissue nitrate; $\text{NO}_3\text{-N}$.

Seasonal Movements Of Female New Zealand Fur Seals (*Arctocephalus forsteri*) At Cape Foulwind

Jonathan Sinclair
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Lincoln University

Fifteen adult, presumed breeding, female fur seals were caught and radio tagged at Cape Foulwind, near Westport on the West Coast of the South Island. The Cape Foulwind colony was chosen primarily due to its proximity to the Hoki fisheries where each year a number of seals are caught. Female fur seals of breeding age which are caught in this fishery are most likely to breed in the Cape Foulwind colony. The aim of this study was to document the frequency, duration, and distance that females travel from the colony.

The seals were tagged with 2 stage VHF transmitters that had a range of at least 100km and a life of up to 10 months. Four tracking periods were chosen to coincide with important times during the year: April, following moulting; July, the Hoki fishing season; November, preparturation; and January, postparturation. Results from the first tracking session showed that the seals mostly travelled south of the colony. The furthest a seal was recorded out to sea was 62km, while the furthest location for a seal south of the colony was 35km. Fewer positions were determined in the second tracking period, however most were north of the colony. Although fewer triangulated bearings were determined in the second tracking period, signals were received from most of the transmitters. Tracking in the third and fourth tracking periods was less successful due to the limits of receiving equipment, transmitter loss, and transmitter damage.

Maternal Effort Of New Zealand Fur Seals, *Arctocephalus forsteri*, At Cape Foulwind, New Zealand.

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This study investigated maternal effort of New Zealand fur seals, *Arctocephalus forsteri*, at Cape Foulwind, New Zealand by measuring pup weights, maternal attendance patterns, and suckling behaviours.

Male pups were heavier and grew faster than female pups from 60 to 200 days old, although their relative dimorphism did not increase significantly over that period. Maternal attendance changed significantly throughout lactation. The time mothers spent ashore suckling their pup decreased significantly from 1.7 days in February to 1.2 in July per 8 days of observation. Intersexual differences in maternal attendance was significant only in February, with mothers of female pups spending 1.8 days ashore per 8 days observation, compared to those with male pups spending only 1.5 days ashore.

Pups were responsible for terminating 82% of suckling bouts, with no intersexual difference shown.

Mean suckling bout length was the only suckling behaviour which showed significant differences between pup sex over the six month study, with males having longer suckling bouts than females. Suckling bouts were significantly longer for male pups (32 mins) than female pups (23 mins) in May and there was a strong trend for males to suckle more minutes per hour (39 mins/hour) than females (35 mins/hour).

Keywords: *Arctocephalus forsteri*, New Zealand fur seal, maternal effort, maternal investment, sexual dimorphism, pup growth, Cape Foulwind.

Population Size And Breeding Status Of New Zealand Fur Seals (*Arctocephalus forsteri*) In The Nelson-Northern Marlborough Region.

Rowley Taylor, Kerry Barton, Peter Wilson, Brian Karl, and Bruce Thomas.
Landcare Research Ltd, Nelson.

New Zealand fur seal populations in the Nelson-Northern Marlborough region are expanding rapidly both in numbers and breeding range, and similar population increases have been reported from elsewhere in New Zealand and Australia.

Results show that fur seals now breed at four rookeries along the southern shores of Cook Strait; at Archway Islands and Pillar Point, near Cape Farewell; at Tonga Island in Tasman Bay; and at Stephens Island in the outer Marlborough Sounds. All are relatively new breeding rookeries - established in about 1980, 1988, 1988, and 1970 respectively.

In 1993/94, a total of about 548 pups were born at these rookeries, and the population of seals directly associated with them was assessed at 2695. There were also 15 hauling grounds, each with 25 or more seals ashore in winter, and about 30 sites where lesser numbers regularly hauled out.

A comparison with earlier estimates indicates that the summer population has increased from about 70 in 1973 to over 2500 today. The number of pups produced has increased at an annual rate of 24% since 1970.

It has been suggested that the apparent increases may be due to a redistribution of an otherwise stable New Zealand fur seal population. We have seen no evidence for this, and consider it highly unlikely. A nation-wide census of New Zealand fur seals would clarify their present status, and its initiation is supported.

Results Of The Translocations Of Hihi (Stitchbirds, *Notiomystis cincta*) To Kapiti Island In 1991 And 1992.

Isabel Castro¹, Julianne C. Alley², Edward O. Minot¹ and Raewyn A. Empson³

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2. Landcare, Massey University, Palmerston North.

3. Wellington Conservancy, Department of Conservation, Wellington.

Little Barrier Island, New Zealand, currently supports the only self-sustaining population of hihi (*Notiomystis cincta*). The New Zealand Department of Conservation is trying to establish populations of this species elsewhere to ensure its survival. In 1991 and 1992 hihi transfers to Kapiti Island were approached in an experimental way. In 1991, four release strategies were tested: immediate, delayed, paired and grouped releases. In 1992, the effect of the presence or absence of conspecifics was tested. Comparison of the different strategies based on bird sightings and movements during the first 4 weeks after release supported four main conclusions: (1) immediate-release birds survived better and travelled over a greater area than delayed-release birds; (2) there was no difference between the survival of birds released in pairs or as a group; (3) hihi released in the absence of resident conspecifics survived better than those released in their presence (not statistically significant); and (4) birds released in the absence of resident conspecifics appeared in an area with residents about three days after being released. The breeding and feeding behaviour of hihi differ between their source population on Little Barrier Island and Kapiti Island, where they have been transferred. In contrast to Little Barrier Island the hihi on Kapiti Island use artificial feeders during spring and adopt a variety of polygamous mating systems. The change in behaviour reflects both environmental differences between the islands and the ability of the species to adapt to a new environment. Although Kapiti may be a suboptimal habitat for hihi, the behavioural plasticity of the species could be used, in combination with habitat management, to establish a population on Kapiti.

Recreational Thar Hunters And Thar In Carneys Creek: The Riddle Solved?

D.M. Forsyth¹ & C. Thomson²

¹ *Department of Entomology and Animal Ecology, Lincoln University.*

² *Weeds and Pests Division, Manaaki Whenua - Landcare Research.*

Despite being very popular with recreational hunters, thar in Carneys Creek have steadily increased since annual summer counts began in 1984. However, since 1990 the proportion of male thar has increased while the total female population has declined significantly. A comprehensive survey of hunters in 1993 revealed that >100% of males counted in March 1993 were shot. Hunter success was positively correlated with the number of male thar observed in counts during March, August, and December 1993. These two independent measures confirm that thar are increasing in Carneys Creek because greater numbers of males born elsewhere are using Carneys Creek as summer habitat. During winter thar in Carneys Creek are well below the intervention density defined in the Himalayan Thar Control Plan. Interpreting summer thar counts from catchments being monitored by the Department of Conservation requires careful consideration of the male:female ratio.

Options To Integrate The Management Of Mammal Pests Of Conservation Values

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The Department of Conservation spends c. \$12 million/year controlling some of the worst of the 31 exotic mammal species living in the wild in New Zealand. Very few species and populations are actively managed to protect natural resources, partly as a result of rational choice (some species are worse pests than others), partly because it is expedient (the species is unwanted by anyone) and partly because of history (it has been controlled in the past).

There is a general belief that the conservation benefits would increase if more species were controlled and if the management of those that were controlled was better integrated. We wish to explore some options to do this, particularly on the mainland where pests cannot be easily eradicated.

Three general planning systems are discussed: the present "worst pest - priority place" model, a "priority place - critical pest" model, and the habitat island or "priority place - all pest" model. The first allows lots of places to be protected from *bette noire* pests. The second is untested but may allow better protection at fewer places. The last allows very few places to be given maximum protection, but will have large opportunity costs. We favour (on no strong evidence) a move from the present system towards the second system in a way that will not lose the substantial benefits gained to date.

The process to do this depends on identification of the relative overall pestiness of the species and of which species are critical pests in each place, i.e., the first level of integration is by comparing impacts. Data comparing the impacts of ungulates and possums in forests will be presented.

Secondary levels of integration consider strategic options (which depend on pest patchiness, likelihood of reinvasion, and so of eradication), tactical (can several pests be killed with one technique), logistic (can budgets be sustained), and social factors (who benefits especially when some species are simultaneously pests and resources).

Bait Shyness In Possums

C. E. O'Connor

*Animal Behaviour and Welfare Research Centre,
Ruakura Agricultural Centre, Private Bag 3123, Hamilton.*

A better understanding of the behavioural mechanisms involved in poison and bait rejection will lead to the development of more effective poison control strategies. In a series of experiments it has been shown that both learned and unlearned behavioural mechanisms are involved in avoidance of poisonous baits. About 20-25% of possums reject poison at first exposure and some individuals also show a neophobic response to the novel food or bait (unlearned mechanisms). The predominant learned mechanism is Conditioned Food Aversions, where baits are rejected on subsequent exposure following consumption of sublethal doses of poison. Aversions were conditioned in three experiments using i.p. or oral routes of administration with three different cyanide formulations over a range of doses. Across all experiments there was a direct relationship between dose and the proportion of animals developing aversions. When administered orally, doses greater than 5 mg/kg resulted in more than 50% of animals developing aversions.

Possums also developed learned aversions to 1080 and this shyness lasts at least as long as 12 months for both poisons. In possum management it must be remembered that although ingestion of the highest possible poison dose is more likely to ensure death, any survivors from such a poisoning operation are also increasingly likely to be bait or poison shy for some time.

Possum control in forests using 1080 in bait stations.

Malcolm Thomas

Manaaki Whenua - Landcare Research Ltd

Possum control using baits containing 1080 fed from bait stations (possum feeders) was investigated as a safer and possibly more acceptable method of using 1080 poison in an area where access was good. The results indicated that possum populations could be reduced to similar levels to those achieved with aerial application provided the possums were fed non-toxic cereal baits beforehand. If cheaper prefeeds such as maize and barley were used, less 1080 baits were eaten. Comparisons with aerial application showed that the amount of 1080 used was reduced by over 90% and costs

0/ha stations
reseed.
0.15 conc. of 1080.

commercially available.
fed on farms ~ to target possums
travelling down to feed in pasture.
forest/pasture margins
2 notes well.

0/ha (1.4/ha)
cereal pellets bait
followed by barley &
maize then
- most commercially
available pellets.
used - 0.15% 1080.
2 g/g. kill ::
little bait
aversion.

- 1080 - leaches from
bait with rain
goes (or) becomes
less palatable.

- Don't effect
non-target sp.

- Can get pop
densities.

\$34-60/ha

- charge with keeper
labour.
- 1080 - 54/ha - aerial drops
in the amount of

sodium monothiosulphate.
contain upto
2 kg food.

120 bait stations
5000 g/ha.
aerial di
force green

were similar. Costs would increase when terrain became steeper, forests more dense, and access more limited.

Towards A Better Understanding Of Wasp Population Dynamics

Dave Leathwick and Peter Godfrey,

AgResearch, Flock House Agricultural Centre, Private Bag 1900, Bulls.

The within nest population dynamics of social wasps is complex and difficult to study. The likely impact of current, or potential new, biological control agents of wasps is thus even more difficult to ascertain. A simulation model is being developed for the within nest dynamics of *Vespula* spp. in New Zealand in order to increase understanding of population changes and the likely impact of control options.

This paper outlines the basic structure and key parameters of the model. Within nest dynamics is largely controlled by four variables; the rate at which the queen lays eggs; the proportion of eggs producing workers, drones and queens; the rate at which workers build cells and the development rates of the various juvenile/caste stages. The results of field and laboratory studies aimed at defining these parameters is presented.

Factors determining the within nest dynamics of *Vespula* sp.
 relating it to control.
 continuous birth/death processes \equiv overlapping generations.
 can only do it via disruptive sampling \therefore no reps.
 using a model-based in knowledge.
 wrong answer \equiv gap in knowledge.
 egg laying - initially - small nests - empty cells limiting
 - big nests - Queen can only lay her max no. \therefore more empty cells + not limiting.

180 - mon ... combinations ... alt

Goat Diet And Vegetation Impacts In Isolated Hill Scenic Reserve, Marlborough

steep terrain
rest service - set up
plots / enclosure plots.
re-measured + looked at changes -

C. Hamish Cochrane and Dave Kelly

Plant and Microbial Sciences, University of Canterbury, Private
Bag, Christchurch 1, New Zealand.

assessed 1923
with recent
additions.

Isolated Hill Scenic Reserve in Marlborough contains a wide range of native vegetation types and a number of rare plants at threat from introduced herbivores, principally goats, pigs, red deer and possums. Goat control in this reserve has been a high priority for DOC. We measured goat diet and reassessed vegetation plots set up in 1985, including three enclosures, to determine trends in vegetation change. The results show that significant damage to vegetation is continuing at current animal densities. The implications for future vegetation composition in the reserve, and for management of this and similar reserves, are discussed in light of these findings.

goats, possums,
red deer

All seedlings counted - presence absence. Palatable sp. had seedlings throughout reserve.

What Do North Island Weka Eat At Rakauora And When?

Gary Bramley

Department of Ecology, Massey University

The number of North Island weka (*Gallirallus australis greyii*) on the mainland has declined to c. 1-3% of its pre-1980 level. There is no evidence of a recovery.

Weka productivity could be limited by food availability, lack of suitable habitat, a male biased sex ratio, and predation. Knowing what food weka eat on a seasonal basis would allow conservation managers to predict potential food shortfalls.

I measured the availability of invertebrates using pitfall traps, sweep nets and litter samples. I also collected faecal pellets (n=86) and gizzards (n=13) from which I calculated the minimum number of invertebrates eaten per sample. Fifteen invertebrate groups were recognisable from these samples. During winter and spring weka ate less invertebrate material and more plant matter. In summer and autumn this was reversed and the weka also ate more fruit. For each group the percentage of all invertebrates available in the habitat was compared with the percentage of individuals found in the faeces using a Friedman rank test. I expected that weka would be generalist feeders using all foods in proportion to their seasonal availability, but this hypothesis was rejected ($s=5.67$, $p=0.341$) with weka preferring worms, scarabaeid and carabid beetles.

If food availability is limiting the survival and breeding of weka, low weights and non-breeding should be associated with seasons of food shortage. This prediction was not supported by the data.

Kiwi Call Survey - A Measure Of Population Density, Is This Technique Out Of Date ?

J Miles

Department of Ecology, Massey University

Kiwi call surveys are a standard method for estimating kiwi population density. The aims of this study were to estimate population density of kiwi in the Tongariro National Park and in the Forest Park, to look at the biological aspects of calling behaviour, and to determine the accuracy of call surveys as a density measure. Being territorial, kiwi respond to other kiwi calls. This behaviour is exploited in call surveys by broadcasting recorded calls. Broadcasting calls combined with radio tracking of captured birds provide methods of determining the density of kiwi in an area. The density of kiwi in the Forest Park was found to be 4 birds per km², while in the National Park it was only 1 kiwi per 1 km². Call rates (calls/hour) showed a seasonal pattern with the highest calling rate occurring during the breeding season from June to November. Call rates showed a bimodal pattern within nights. The first peak occurred in the first 2-3 hours of darkness, and was predominantly made up of male calls. The second peak occurred in the last 2-3 hours of darkness. During this period males and females called about equally. The overall calling ratio in the Forest Park population was 3:1 (male:female). However this ratio changed over the breeding season to 2:1. There was a significant difference in call rates between nights. Temperature and rain were found to explain 43% of this variation. To hear most of the surveyed population call, three consecutive nights of listening were needed. Traditionally, survey teams listen for the first hour of darkness and then broadcast calls in the second hour. By alternating this, and testing responses to both broadcasted male and female calls, it was found that broadcasted female calls solicit a more even response with regard to sex ratio. There were no significant differences in call rates between nights, if broadcasting calls in the first or second hour, but there were significant differences within a night. Analysis of the biological and behavioural aspects of kiwi calling suggest ways to improve kiwi survey techniques.

Survival Of Juvenile Takahe In Fiordland.

Jane Maxwell and Ian Jamieson

Department of Zoology, University of Otago.

Captive rearing for release back into the wild is often seen as a useful wildlife management tool. Its use in endangered species management can increase recruitment by bypassing the early, high-risk, stage in an individual's life history. In evaluating the benefits of captive rearing to conservation, it is important to monitor the survival rate of animals after release, to be sure that they have the skills necessary for survival in the wild.

This three year study compared young captive -reared and released (C.R.R.) takahe with wild-reared takahe in Fiordland, using radio-tagged birds. The results indicate that C.R.R. birds survive at least as well as wild birds. Survival of wild-reared takahe prior to the release of their captive counterparts was poor over two winters marked by

particularly cold temperatures, which made the benefits of captive rearing more pronounced. There are differences in the movements and habitat selection of the two groups, but these did not have a detrimental effect on the survival rate of C.R.R. birds.

Although there was no difference in the survival rate of C.R.R. females versus males, 10/11 surviving females compared to only 3/10 males have paired since their release. This unexpected result suggests that there may be a shortage of females in the wild population.

Wednesday 24 August

Host Specificity In New Zealand Loranthaceae

David A. Norton¹ & Peter J. de Lange²

¹ School of Forestry, University of Canterbury, Christchurch

² Science & Research Division, Department of Conservation, Auckland

The New Zealand Loranthaceae comprises five extant species and one presumed extinct species (*Trilepidea adamsii*), all endemic to the New Zealand botanical region. Three of the extant species (*Alepis flavida*, *Peraxilla colensoi*, *Peraxilla tetrapetala*) show high host specificity, predominantly parasitising *Nothofagus* species. In contrast the other two extant species (*Ileostylus micranthus* and *Tupeia antarctica*) show low host specificity, with *Ileostylus* for example having been recorded parasitising 68 indigenous and 39 introduced host species. However, both these species do show higher host specificity locally. This paper quantifies the degree of host specificity in these species and discusses the evolutionary basis for host specificity in the New Zealand Loranthaceae.

Bird-Plant Coadaptations In New Zealand Loranthaceae Mistletoes

Jenny J. Ladley and Dave Kelly

Plant and Microbial Sciences, University of Canterbury, Private Bag, Christchurch 1, New Zealand.

Birds are important for both pollination and dispersal of endemic mistletoes in New Zealand. Experimental and observational data from the northern South Island show that tui and bellbirds are closely involved in the reproduction of *Peraxilla tetrapetala*, *P. colensoi* and *Alepis flavida*. The relationships are more closely evolved in *Peraxilla* than *Alepis*, and display some bizarre and fascinating details which are unlike anything previously reported in Australasia. The results show that maintenance of bird numbers may be more important for mistletoe conservation than was previously realised.

explosive flowering
bird opens bud.

Are We Underestimating The Extent Of Bird Pollination Of New Zealand Forest Plants?

Isabel Castro and Alastair Robertson

Department of Ecology, Massey University, Palmerston North

Most New Zealand flowers conform with entomophily being small in size, light in colours and scented. New Zealand flowers are often considered unspecialised. Pollination of forest flowers by birds has been described for a range of species whose flowers conform with ornithophily: large, red or yellow and unscented. On Little Barrier Island and Kapiti Island all three species of New Zealand honeyeaters have been described feeding on flowers whose pollination is currently assumed to be by insects or the pollination system is unknown (labeled here as "entomophilous"). The intensity of feeding (number of flowers visited) suggests that the birds are obtaining

large rewards in the form of nectar. Nectar is expensive to produce and the quantity is related to the type of pollinators the plant has evolved to attract. We measured the nectar production of three ornithophilous flowers and three "entomophilous" flowers. We suggest that because (a) the nectar produced by "entomophilous" flowers provides sufficient calories to sustain the energetic requirements of birds, and (b) these plants flower in the cooler months when insect activity is reduced, birds might be playing an important pollination role not previously considered. If this is the case, forest regeneration in the North Island mainland could be hampered by the loss of one of the species of honeyeater and the drastic reduction in the abundance of the other two species.

7.5, 12+
0.5 ha. Fleshy Fruited Weeds And Native Species In The Diet Of Native And Introduced
birds patches studies - near Nelson - all have Birds
high human use.

regular fruiting observation
mist netted birds

P.A. Williams and B.J. Karl

Manaaki Whenua Landcare Research New Zealand Ltd,
Nelson, New Zealand

Exotic sp.
have their favourite
dispensers here
ie holly, hawthorne,
privet, roran, holly
elder.

birds/m².
100 hrs
collected
faeces.

determined
y weights of
fruit

waxeyes,
blackbirds,
ellabirds.
mainly.

fruit mpt
part of diet.

seasonal pattern
fruiting.

closeness to
town = inc in
amount of
fruit avail
from intro
plants.

himalayan

barberry

elderberry

Eaten: main

-kawakawa, mahoe, totara,

Woody weeds with bird dispersed fruit comprise the single largest group of weeds in New Zealand forest and scrub reserves. The process and impact of weed invasion in three forest remnants at various distances from towns was studied near Nelson. The diets of native and introduced birds was examined from droppings collected from 600 mist netted birds. A high proportion of the native bell birds, and tui, and the introduced black birds, thrushes, and wax eyes had eaten fruit.

Bird diets varied greatly depending on fruit availability as determined by the sites and seasons. The diet of bell birds was the least variable and they were heavily reliant on Halls totara (*Podocarpus hallii*) and *Coprosma robusta* at all sites and ate very little weed fruit. The few tui caught also relied on native fruit, although no birds feeding high in masting kahikatea trees were caught. Black birds, thrushes, and wax eyes all ate many of the same native fruits as the native birds, but their diet included a much higher proportion of weed fruits, especially himalayan honeysuckle (*Leycesteria formosa*), barberry (*Berberis glaucocarpa*), hawthorn (*Crataegus monogyna*), Chinese privet (*Ligustrum sinense*) and the herbaceous black nightshade (*Solanum nigra*). Starlings were caught only when they fed on elderberry (*Sambucus nigra*) but they also regularly ate kahikatea.

The weed species tended to extend the seasonal availability of fruit into early winter, an affect that was most marked in the remnant closest to a town. This phenomena may exacerbate the weed seed rain into remnants, for the few seeds recorded of species not present in the remnants were mostly weeds from adjacent gardens.

The bird dispersed weeds included in this study are mostly species of early secondary vegetation and forest margins. Despite their sometimes large fruit crops, they appears to offer little overall benefit to native birds. Where they pre-empt sites that have the possibility of being occupied by native species, these weeds create an inferior habitat for native birds.

Patch size/
diversity
amount of
fruit

Native birds
= mainly eat
only natives
some weeds.

Black birds / Thrush = lots of weed
sp.

also natives
depending on
availability
size of area.

more widely
available
tutunui/winter
- extends seasonal
availability.

honey suckle. Privet hawthorne.
knightshade.

elderberry honey suckle.

-blackbird

kaikoma

tutunui

starling.

Biological Control Of Broom With Insects

Pauline Syrett
Landcare Research Ltd

The process of introduction of specialised broom-feeding insects from Europe for biological control is described. Identification of increased costs associated with importing new species is leading to increased emphasis on assessing potential impact of introductions. At the same time, the severe limitations in our ability to successfully predict the likelihood of establishment and effective control by introduced species are recognised. The roles of three specialised broom-feeding insects already present in New Zealand are described, as well as those of three currently being studied in the UK, and of one that has proved unsuitable for introduction. The twigmining moth *Leucoptera spartifoliella* is widely established in New Zealand and significantly damages broom here. A stem-mining weevil, *Pirapion immune*, is unsuitable for release because tests showed it could utilise *Sophora microphylla* (kowhai) as an alternative host. The compatibility of biological control with other weed control methods is discussed.

Heather Demography In Tongariro National Park

Catherine Foster, Jill Rapson and Alastair Robertson
Department of Ecology, Massey University.

Heather was introduced into Tongariro National Park in the early 1920s by the honorary Park warden, who wanted to "beautify the tussock" by transforming the area into a moorland suitable for grouse. Although opposition arose to the introduction, which was eventually halted, no real effort was made to eradicate heather, which gradually spread from its initial planted area. It was not until the 1980s that the threat it posed to the native plant communities was realised. Since then, research has been carried out by a number of organisations into possible ways of containing the spread of this weed dubbed "the purple plague".

I set up an experiment to examine the growth rate of heather plants in 5 sites around the Park over the course of a year. Preliminary results indicate that there is a significant difference in productivity between the sites, with the most productive site being one that was burnt 5 years ago. This seems to indicate that fire is not an appropriate management tool as has been suggested in the past.

An analysis of impacts of heather and its removal on plant communities is also underway.

Oviposition Requirements Of The Heather Beetle: Will These Be Met In New Zealand?

Bourner, T.C. and Rapson, G.L.
Department of Ecology, Massey University

The European heather beetle (*Lochmaea suturalis*) is being considered as a biocontrol agent for heather (*Calluna vulgaris*) in Tongariro National Park (TNP). This heather was deliberately introduced approximately eighty years ago in a failed attempt to create a grouse moor. It has since become a serious weed, displacing a number of native plant species. In European heaths, the *Sphagnum* mosses found under the heather canopy play an important role in the life-cycle of the heather beetle, providing oviposition, pupation and overwintering sites. Two native mosses (*Racomitrium lanuginosum* and *Dicranoloma billardieri*) which are found associated with heather in TNP, plus heather litter, were tested for their acceptability as oviposition substrates for the beetle. *Sphagnum cristatum* was used as a control. The total number of eggs laid and larvae hatched on each substrate was similar ($P > 0.05$), indicating that native mosses and heather litter should provide acceptable oviposition sites for the heather beetle if it is introduced to TNP.

Weed Control On Raoul Island, Kermadecs

Carol West
Department of Conservation, Invercargill

Mycore them - light
locus in gaps. demanding

Introduced species comprise more than half of the vascular plant flora of Raoul Island. Of the c. 160 taxa known to be adventive, only 13 species have been targeted for eradication. Most of these species are being eradicated because of their potential to permanently alter natural processes on the island. Three of these species are listed for eradication because they were recent introductions to the island with a potential to spread rapidly, although they would not interfere greatly with successional processes.

Weed control operations on Raoul Island commenced in 1972, and since that time four of the 13 species have probably been eradicated, a further four have been greatly reduced in extent, and the remaining five species require a consistent effort to reduce the current extent of infestation. Methods of control vary between species and have also changed within species, as the level of infestation has reduced. Changes in methodology will be described.

One of the major principles of eradication programmes is that the risk of reinfestation from external sources must be zero or minimal. Fortunately, on a remote island such as Raoul, this is achievable, and eradication of these invasive species will result in self-sustaining, native communities with an insignificant component of adventive species. The same situation is far less achievable on the mainland, and eradication is best attempted only for species of very limited distribution, i.e., the lag phase after a species' introduction.

50 Years Of Vegetation Change In The Whangamarino Wetland: Patterns And Processes.

Paula Reeves¹ and Keith Thompson²

Environmental Science, University of Auckland. ²*Biological Sciences, University of Waikato.*

The recent designation of the Whangamarino Wetland as a World Heritage Site clearly carries a major conservation management commitment. However since very little quantitative data exists on the vegetation ecology of the wetland the present study aims to establish a reliable scientific baseline for future management activities. Although stratigraphical studies reveal pre-historical vegetation changes related to changing hydrology, recent spectacular vegetation changes have been driven entirely from human activity. In order to establish how the Whangamarino swamps have responded to recent changes in land use, hydrology and introduced plant species, four vegetation maps were prepared from aerial photographs taken in 1942, 1963, 1977 and 1993. These maps were overlaid using a GIS program to detect and quantify pathways of vegetation change. In order to characterise the major swamp communities and their sequencing in relation to hydrology, four transects were established. These will also provide the basis for future monitoring of the changes expected from the recently installed weir at the Whangamarino Wetland. Initial analyses show that changes during the last 50 years are largely associated with the rapid spread of grey willow and manuka, and with the near disappearance of the *Carex* sedgeland. Management implications and prospects for enhancement of botanical values such as selective willow control will be discussed.

The Obstacles Presented By A Gorse Community To The Establishment Of Mahoe And Kanuka

Megan Ogle-Mannering

Department of Botany, Otago University.

The idea of gorse as a nurse crop for native tree seedlings is starting to be incorporated into minimum impact management strategies for gorse in some areas. However, in the Dunedin Ecological District the occurrence of native woody seedlings in gorse stands younger than 25 years old has been found to be rare. A seedbank study showed that mahoe and kanuka seed is uncommon in a gorse community adjacent to an area of kanuka/ mahoe forest. Suitable microsites for germination of the seed present can be restricted by dense gorse litter and very low light levels. Replacement of gorse by a kanuka/ mahoe forest may require active management for many communities in the Dunedin Ecological District.

Invertebrate Assemblage Resilience Of Native Tussock Grasslands And Exotic Heathlands In Tongariro National Park.

Vaughan Keesing, Jill Rapson, & Ian Henderson.

*Department of Ecology
Massey University*

The invasion of *Calluna vulgaris* (Hull) into tussock grasslands in Tongariro National Park has resulted in a less taxonomically diverse, but more complex architectural plant community, and a novel food resource for herbivores. The invasion has caused changes to the invertebrate community. Whether this new community is still forming, or is stable with resilience, or "static" but prone to re-structuring after disturbance, is unknown. I propose that the invertebrate assemblage associated with, and co-evolved with, tussock grasslands would re-establish more readily after perturbation than that associated with *Calluna*, due to its greater resilience.

In an attempt to answer these questions the invertebrates were removed with insecticide from areas of *Calluna* and tussock. The re-invasion was monitored using pit fall traps and 'D-vac' sampling over a period of four weeks. Initial work showed differences between the two communities to be substantial, and most obvious in the plant feeding guilds and web building predators. Insect diversity indices were higher in tussock than *Calluna* initially, due to evenness rather than species number, but the reverse was true after re-establishment. After 4 weeks the invertebrate assemblage reconstituted itself in the tussock, while in the *Calluna* the assemblage reformed to a new state.

Resistance And Resilience Properties Of Stream Invertebrate Communities In Relation To Spatiotemporal Variation

Mike R. Scarsbrook, Colin R. Townsend & Luc M. Corstens¹

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¹ *Department of Water Quality & Aquatic Ecology, Wageningen Agricultural University, Wageningen, The Netherlands*

Stream communities are generally considered to be resilient rather than resistant to disturbances. However, most studies of these properties fail to take into account the levels of temporal and spatial variation inherent in natural habitats. These variables control the intensity of disturbances and may influence the ability of a community to resist change (resistance), and its ability to recover quickly to its former state (resilience). The aim of this study was to assess the influence of spatiotemporal variation on the resistance and resilience properties of aquatic macroinvertebrates at 12 sites within the Taieri River catchment.

Several measures of disturbance frequency and spatial heterogeneity were used to describe the sites in terms of their spatiotemporal variability. At each site, resistance was defined as the change in invertebrate densities pre- and post-flood. A 10-day colonisation experiment was conducted at the 12 sites to estimate resilience. Analyses

of differences in resistance and resilience between sites were carried out at the level of individual species, functional feeding groups, taxonomic groupings and groupings related to life history traits conferring resistance/resilience.

Community resistance to the flood event varied between sites, with greatest resistance found at sites having a high degree of spatial heterogeneity. Large-bodied predators were least resistant to the disturbance, while smaller taxa with behavioural and morphological adaptations for clinging to substrata were generally resistant. The flood event had little effect on highly mobile species.

Invertebrate colonisation rates varied between species and between sites. A prediction that communities at more frequently disturbed sites would be more resilient was not supported. Larval Chironomidae and Simuliidae were the most resilient taxa. Highly mobile species were generally more resilient than sedentary taxa, although this relationship varied between sites.

Ecology Of New Zealand Hoverflies In Agricultural Land

Steve Wratten

Department of Entomology and Animal Ecology
Lincoln University

Of the thirty or so hoverfly species in New Zealand, two dominate agricultural habitats. These are *Melanostoma fasciatum* and *Melangyna novaezelandiae*. They can be very abundant and prey as larvae on aphids and Lepidoptera larvae. However, ecological information of such aspects as phenology, abundance, flower 'preferences', oviposition rates etc is needed to underpin attempts to manipulate their populations in habitat manipulation schemes.

This paper outlines information gathered at Lincoln since January 1993. It reviews differences in the phenology, foraging behaviour and dispersal of the two fly species and points to those aspects which are most important in attempts at enhancement of biocontrol by this group.

Common - Lowland forest - m + f trees.

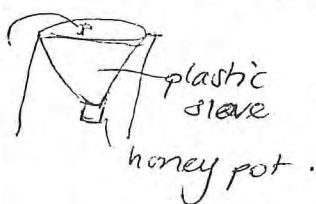
seed trapping - Banks Peninsula. ²⁶ >50 adult trees.
- saplings in moist sites. 5-700 yrs old.

- 20 traps

Facets Of The Reproductive Biology Of Matai (*Prumnopitys taxifolia*)

0.1 m² area

- beneath mt
F trees



Colin J. Burrows
Plant and Microbial Sciences
University of Canterbury

1986-1994
data.

a } <3mmØ
b } size
c } categories

>5mmØ

5mmØ

aborted
small seeds -
no damage.
eaten - insect
damage.

mature - eaten by
ship rats.

mature - with flesh intact -
those passed through a
bird's flesh cleaned off.

biennial -
seed set

of seeds/
season-variable

n non-feed
eats - aborted

+ eaten seeds
mostly.

HY SO MUCH
VARIABILITY?

ny are there
ad years -

drought-accounts
for some.

Also - no correlation appears between
pollen peaks + following yrs seed
production.

Abundant pollen - produced at the end of a
good seed fall period (pollen peak). NOV-DEC -
time of pollination: 14-16 wks for seeds to mature.

A 9 year seed-trapping study on Banks Peninsula, Canterbury shows that female matai trees bear seeds at 2 year intervals. Seeding is not synchronised in all trees. Pollination is in early summer and seeds are ripe 14-16 months later. Abundant pollen production precedes seeding but climatic conditions can interfere with seed set.

Matai seeds on the trees are attacked by the larvae of the moth *Heterocrossa iophaea* (Carposinidae) which begin to eat very small seeds and continue to eat immature seeds up to about a month before they fully ripen. Damaged seeds are shed. At the study site more ripe seeds are produced than can be processed by the resident birds (kereru and bellbirds). Large numbers of fallen or defaecated mature seeds are eaten where they fall by ship rats, or are gathered into hoards and eaten. Seedlings occur only at low densities after a seed year and almost all succumb in their first year apparently by being eaten by invertebrate herbivores or through drought.

- Armit enough birds
on sight 2 Pigeons +
bellbirds.

Classifying Ecosystems For Conservation Management

Peter Lawless
Department of Conservation
Nelson

(300 seeds/m²) to disperse the
seeds.

- ship rats - eat off
ground - hoard
seeds

Ecosystems are conceptual entities bounded in neither space nor time.

Under various legal instruments conservation managers are charged with conserving ecosystems and their processes. This has been emphasised by the terms of the Rio Convention on Biodiversity ratified by New Zealand late in 1993.

To make decisions, store information and manage ecosystems conservation managers need entities that can be identified on maps and described precisely in data bases. Where decision making is in a national context, consistency is required in terminology. To develop a consistent approach to the classification of geographically defined portions of ecosystems the Department of Conservation assembled a team with expertise in terrestrial, marine and freshwater systems.

This paper sets out a proposed approach to typology for marine, freshwater and terrestrial ecological units at two levels of geographic scale. It explains how this fits with the geographic subdivision of the country into ecological regions and districts

Insect +
RATS +
lack of
birds
= v. little
viable
seed.

Seedlings
eaten
by
sects.

• Pollen release / ovule readiness = may be
the problem

- some seeds aborted / some attacked by
insects.

- moth - eats seed contents of
immature seeds (LOTS) - before
inner seed wall hardens.

Brown Kiwi (*Apteryx australis*) Management In Westland National Park.

John Reid¹ & John Lyall²

¹Department of Conservation, PO Box 14, Franz Josef

²Department of Conservation, Private Bag 701, Hokitika

Westland National Park supports the only population of the brown kiwi that is referred to as Okarito brown kiwi. These kiwi are found in South Okarito Forest between the Okarito and Waiho rivers. The Department of Conservation surveyed the forest between 1990 and 1992 and the results indicate a population of 60-100 birds. During the surveying birds were caught and blood samples collected for allozyme and mitochondrial DNA analysis. This genetic work was part of a natural programme looking at the taxonomy of the kiwi. Results indicate that the Okarito brown kiwi are more closely related to brown kiwi in the North Island, yet they are behaviourally a South Island bird.

Limited monitoring of a breeding pair was started in 1990 after they were found incubating one egg. This incubation was not successful. As the survey programme finished, a monitoring programme began with three pairs of kiwi during 1992. This number was increased to seven pairs in 1993.

One of these pairs was monitored with a remote video camera set up outside a nesting burrow, with the recording equipment located 500 metres away. The use of remote video recording equipment has increased our knowledge of breeding behaviour and gave a valuable insight into the problems kiwi face when trying to incubate eggs. Possums were recorded regularly visiting the kiwi nest; these were sometimes chased away by the adult kiwi. A possum was recorded entering the burrow when the nest was left unattended for a short period. Soon after this time the egg was found broken.

A stoat has also been recorded attacking a kiwi in the burrow.

Kiwi in Okarito breed between June and February; nesting pairs lay one egg and both male and female share incubation. Double clutching is possible with a second egg being laid soon after, or just before, the hatching of the first egg. The evidence suggests that kiwi eggs are vulnerable to predation by possums. The chicks are also vulnerable to stoat predation.

Currently we are monitoring ten pairs of kiwi and are trialling possum and stoat control around kiwi nests. Possum numbers are being reduced throughout South Okarito Forest, and intensive control is occurring in the immediate vicinity of nesting burrows. Stoat trapping grids are also being used around nests. Trapping grids cover approximately 50 hectares, with trapping tunnels placed every 100 metres. A stoat index line has been operating for three years and is providing valuable information on stoat ecology within a podocarp forest.

Student Session

The Effect Of 1080 On Ground-Dwelling Invertebrates

Penny Aspin

Department of Ecology, Massey University

The effect of 1080 on non-target birds and mammals is well documented, but so far its effect on invertebrates has been largely ignored. Several invertebrate taxa are known to be sensitive to 1080, particularly insects.

Ground-dwelling invertebrate fauna in the Waihaha block (Pureora State Forest) was sampled before and after a major 1080 poisoning operation, using pitfall traps, litter samples, leaf fall traps and light traps. A control site outside the drop zone (Waipapa block) is being sampled with the same intensity and at the same time as the treatment site. The drop was on the 20th July 1994. Samples were taken weekly for six weeks prior to, and will continue to be taken weekly for four weeks after the drop. Toxic bait was hand-laid at 2, 3, and 5 times the existing density in some areas the day after the drop.

Invertebrates will be sorted to taxonomic order, then possibly to species for key taxa. Invertebrate community structure will then be assessed before and after the drop, in the treatment and control sites.

The Dynamics Of Ephemeral Wetlands And Wetland Vegetation In Dune Slacks At Tangimoana, Manawatu.

Nicholas Singers

Department of Ecology, Massey University.

The native flora of ephemeral wetlands in dune slacks is highly specialised for surviving both seasonal flooding and drought, as well as the combined effects of salt spray and sand drift. These ephemeral wetlands are one of the most threatened ecosystems in New Zealand.

The dynamics of ephemeral wetlands and wetland vegetation in dune slacks at Tangimoana in the Manawatu are being investigated. A description of the vegetation patterns in association with the physical parameters are being conducted.

The status and habitat requirements of the endangered sedge *Eleocharis neozelandica* is being identified. It is hoped that this species can also be a useful indicator of the health of the dune slacks.

The area was recently planted in marram and top-dressed with fertiliser and *Lotus* seed. The marram is now stabilising these dunes and modifying the natural dune processes. The stabilisation process as well as the impact of increased nutrient status on the dune slack vegetation, and the impact of rabbit grazing are being assessed.

Kamahi (*Weinmannia racemosa*) Decline In Tongariro National Park.

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Kamahi is an important component of many forest areas in New Zealand, and over much of its range is dying in dramatically large numbers. The main factors so far implicated are natural stand dynamics, drought, possum browse, and infection from *Sporothrix* spp. fungus. This study aims to investigate the extent and isolate the causes of this decline in Tongariro National Park, in order to identify possible management options.

Effects of sustained control on the morphological, physiological and demographic condition of a brushtail possum population

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Necropsy data were collected from a brushtail possum (*Trichosurus vulpecula*) population trapped between 1988 and 1993 at Hohotaka, in the central North Island of New Zealand. A major control operation reduced this possum population by 89% in 1988, and low population numbers were maintained thereafter by smaller annual operations. We made pre- and post-poisoning comparisons of morphological and physiological condition indices, breeding rates, mortality rates and intrinsic rates of increase. After poisoning, morphological condition increased, and physiological condition declined. Age specific mortality rates declined, male and female age structures became younger, and age specific sex ratios became increasingly male biased. However, there was no significant change in intrinsic rate of increase after poisoning. The utility of the condition indices, and implications for management, will be discussed.