

REVIEW OF CURRENT BIOSECURITY RESEARCH IN NEW ZEALAND

**Prepared for the Biosecurity Strategy Development
Team**

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ACRONYMS

AGCARM	(previously) Agricultural Chemicals and Animals Remedies Association
AGMARDT	Agricultural and Marketing Research and Development Trust
AHB	Animal Health Board
CRIs	Crown Research Institutes
DOC	Department of Conservation
ESR	Environmental Science and Research
FAO	Food and Agricultural Organisation
FRST	Foundation for Research, Science and Technology
MAF	Ministry of Agriculture and Forestry
MFAT	Ministry of Foreign Affairs and Trade
MfE	Ministry for the Environment
MFish	Ministry of Fisheries
MORST	Ministry of Research, Science & Technology
NCDI	National Centre for Disease Investigation (MAF)
NIWA	National Institute of Water & Atmospheric Research
NPPRL	National Plant Pest Reference Laboratory (MAF)
SPO	Strategic Portfolio Outline (of FRST)
TechNZ	Technology New Zealand (FRST)

EXECUTIVE SUMMARY

Biosecurity research is a vital element in building New Zealand's capacity to successfully exclude, eradicate and control unwanted organisms that threaten the economy, environment and people's health. This review reports on the national research effort related to biosecurity that has been completed, or has been contracted for, since 1999/2000.

In all, 406 research projects were identified and account for over \$64.5 million in expenditure. Seventy-five percent of this expenditure was for projects in the years 2000-01 and 2000-02. Each project was classified into one of four categories – General, Pre-border, Border, or Post-Border. Within each of these main categories, sub-categories were used to define more specific areas of research activity.

The greatest research effort was in the Post-Border category, which accounted for \$57 million, or 88% of the expenditure. Border-related research was \$3.3 million (5%), followed by General (\$2.6 million – 4%) and Pre-Border (\$1.7 million – 3%).

The majority of funds, \$41.4 million or 64%, came from FRST, including Technology NZ input. Other significant funders were the Department of Conservation (DOC) (\$6.6 million – 10%), the Ministry of Agriculture and Forestry (MAF) (\$3.5 million – 9%) and Animal Health Board (AHB) (\$4.7 million – 7%). Landcare led five Crown Research Institutes (CRIs) and DOC as the main providers of biosecurity research. These five CRIs accounted for 72% of the total expenditure. Universities, Forest Research (another CRI) and the Cawthron Institute are other important providers.

Details are given of the 17 sub-categories of Post-Border research for which expenditure exceeded \$1 million. These sub-categories fell into two distinct groupings. The first group of sub-categories had few projects but large individual expenditures. These were in the production-centred sectors (horticulture, crops and pastoral), based around large multi-component projects with an emphasis on integrated pest management approaches to pest and disease control.

The second group of sub-categories had multiple funders and a larger number of projects, but with smaller individual budgets. These projects were focused mostly on the operational needs of management agencies - DOC, MAF, AHB and councils. The operational focus was reflected in the main areas of research involved – biocontrol, possums, poisons/baits, invertebrate pests, mustelids, weeds, mammalian pests and marine. These are the areas of research where overlap of research effort is most likely, although there was insufficient detail to show if significant overlaps actually occurred.

The distribution of research across all four categories needs to be considered when identifying gaps or unnecessary overlaps. In some cases it is possible to identify a coherent and wide-ranging group of projects. For example, there are projects relating to marine biosecurity in the Pre-Border, Border and Post-Border categories that reflect the decision by Government in 2000 to spend \$9.8 million over five years on marine biosecurity. These form a coherent and cohesive package of research projects that start to address a neglected area of biosecurity concerns.

Most sub-categories of high expenditure in the Post-Border category continue earlier efforts to improve control and management techniques of known pests, such as possums. This is not to downplay the importance of such research. What does appear to be missing, however, is 'anticipatory biosecurity research'. This could include, for example, a consideration of cost-effective techniques to improve detection and eradication around known high-risk entry points such as major ports and airports. It would also suggest more research is warranted into a wider range of risk pathways and consideration of how global change, including global movements of major invasive species, is likely to affect risks to New Zealand.

This review also identified significant gaps in research relating to the human dimensions of improving biosecurity management. These needs apply to border as well as post-border situations. These needs have been specified in earlier reports, but funding has not yet followed. There was very little research identified that related to human health considerations of biosecurity, the main exception being a cluster of projects relating to mosquitoes.

New Zealand's centres of research collectively represent a wide range of scientific expertise and information (collections and databases) relating to biosecurity research. These skills appear to be complementary, rather than overlapping, although the competitive funding system may not be conducive to developing the optimal synergies that are needed with respect to problems that require a multi-disciplinary approach.

1. INTRODUCTION

In November 2000 the Cabinet approved terms of reference, a structure and process for the development of a comprehensive Biosecurity Strategy for New Zealand. The purpose of the Strategy is to obtain agreement on the goals, objectives and measurable targets for New Zealand's biosecurity programmes. Subsequently, a Biosecurity Strategy Development Team was established in mid-December 2000 with responsibilities for managing the strategy development process.

One of the outcomes that Government expects from the Strategy is "*Identification of biosecurity research requirements*" since research is needed to provide the information necessary to make decisions about the management of biosecurity risks. The Biosecurity Strategy will make provision for the development of a research strategy by identifying research needs and establishing research priorities.

Accordingly, the Biosecurity Strategy Development Team commissioned EcoLogic Conservation Consultants "**to review and report on recent, current and approved biosecurity research.**" The objective was to give the "big picture" of biosecurity research, identify the major players, where the focus is and identify gaps or unnecessary overlaps.

The working definition of 'biosecurity' used in the review, as used by the Biosecurity Council was as follows: "*Biosecurity*" means the protection from the risks posed by organisms to the economy, environment and people's health, through exclusion, eradication and control.

The terms of reference for this review defined the following scope:

- Biosecurity research completed in New Zealand since January 2000;
- Current biosecurity research in New Zealand;
- Biosecurity research that has been approved, but not yet commenced; and
- Recent or current overseas biosecurity research that contributes directly to New Zealand's biosecurity, for example, collaborative research involving New Zealand researchers.

Since the major funding agencies have financial years running from July to June, research that was funded for the 1999-2000 financial year was included in the review.

Providing an overview of biosecurity research capabilities and expertise in New Zealand and/or particular technical skills, specialised equipment, collections or databases was also in the terms of reference.

2. METHOD

All the main funders and providers of biosecurity research projects were contacted. This included public and private sector organisations, as well as government ministries with a peripheral interest in biosecurity such as Defence, Economic Development, and Foreign Affairs & Trade. The purpose of the review was explained in a flyer and each organisation was asked to provide details of all projects based on a standard reporting format (below). Follow-up calls were made when required. Responses from biosecurity staff in regional and district councils were kindly co-ordinated through Environment Waikato. I acknowledge the excellent cooperation from organisations and individuals, which helped considerably in completing this survey.

Respondents were asked to provide the following information on each research project (subsequently referred to as 'projects'):

- Research Category (General, Pre-Border, Border, or Post-Border)
- Title
- Brief description of the research
- Funding agency(s)
- Dollars allocated
- Researcher(s) and provider organisation
- Time period for the research (e.g. 2000-2002)

In a few cases funders or providers did not provide financial details of projects. Most of the major funders, however, provided full financial information. For some current projects decisions on dollar allocations were still pending, although the project topic had been decided.

Overall, I am confident that this review gives a broadly accurate account of the major patterns of research and expenditures although it is important to acknowledge the shortcomings in the financial analysis in some sub-categories. The lack of financial data is mentioned in the results where appropriate. For eighteen projects there were two, or occasionally more, funders or providers identified. When the financial split between them was unknown the allocation was arbitrarily split evenly between each funder or provider to avoid 'double-counting'.

2.1 Definitions and criteria

An explanation is required about what projects were included under the definitions of 'biosecurity' and 'research', given the broad working definition used for the former and occasional debates over defining the latter.

Projects were included when the primary focus for the research was to assist with the exclusion, eradication or control of organisms that pose a risk to the New Zealand economy, environment and people's health. This definition is

consistent with the definition of 'biosecurity', but requires further clarification. For example, efforts to eradicate hitchhiker mosquito species which can act as vectors for human diseases are included, whereas research on new strains of influenza virus (which would be impossible to exclude at the border) would not be included.

A related issue, which is open to debate and interpretation, is for how long a particular area of research should continue to be regarded as 'biosecurity' if the species in question has been in New Zealand for a very long time. A case in point is work related to the role of possums as vectors for bovine Tb, or for that matter, control work on possums which were first released in New Zealand almost 150 years ago. The rationale for continuing to include possum-related research within the category of biosecurity is that the 'possum problem' is clearly part of a wider 'pest problem' which has a lot of aspects in common, regardless of how long the species have been here. There are therefore benefits, with regard to funding, management and public perception, of continuing to define these species as 'biosecurity issues'. Not the least of these benefits of keeping them under the biosecurity label is the value of being able to identify the overall ongoing economic costs and efforts to the country of the control, management and related research associated with invasive alien species.

Projects in this review were classified using categories of 'general', 'pre-border', 'border' and 'post-border' that indicate their operational usefulness. Within these categories there still remains a gradation in the degree of relevance of the research to biosecurity. One could, for example, distinguish three further criteria as follows:

- *'Core biosecurity research'* – undertaken specifically for biosecurity purposes. For example, risk pathway analysis or developing new poisons for stoats.
- *'Biosecurity-relevant research'* – undertaken principally for other purposes, but with results of direct relevance to biosecurity issues. For example, marine surveys of coastal waters that may discover new alien species.
- *'Underpinning research'* – research undertaken for other purposes, but provides basic information of potential value to biosecurity issues. For example, ecological studies of Hieracium species that assist in predicting the likelihood of its spread into new areas or taxonomic research that helps to distinguish indigenous from alien species.

The difficulty obviously comes with deciding whether to include projects that fall into the second two criteria. This is especially the case with 'post-border' research where there is a lot of research done on pest and weed species. Projects dealing with aspects of pest or weed science were only included in this review when there was a specific intent to link the findings to improved management or control methods. It therefore excluded studies, such as university theses, which looked at aspects of, for example, weed or pest ecology without addressing biosecurity issues. This remains a subjective

judgement call, since some of this research may turn out to have future value to management objectives for biosecurity.

Its primary focus on fundamental research meant that research under the Marsden Science Fund was also largely excluded from the review. Likewise, the Health Research Council rarely funds research that fits the criteria.

Research to develop or improve monitoring methodologies was included, but not activities related to ongoing monitoring programmes of plant or animal pests *per se*. A considerable effort goes into monitoring by government agencies, councils and the private sector. It is not usually classified as 'research' as it can be done as part of operational activities by non-scientific staff.

2.2 Data Analysis

A total of 406 research projects were included in the analysis. This represented total funding of over \$64.5 million dollars.¹ This is not annual expenditure, but represents the amount spent, or is currently budgeted to be spent, over the life of the projects. It is not possible from the data to calculate annual expenditures since projects ran for 1, 2, 3, or more years and project expenditure varied between years. However, the 89 projects funded for 2000-2002 accounted for 56% of the total expenditure, while the 110 projects for 2000-2001 accounted for a further 19% of expenditure. Thus 75% of expenditure (\$48,762,000) was allocated to these two periods, 2000-01 and 2000-02.

Each project was classified into one of the four meta-categories (Pre-Border, Border, Post-Border, or General) then into a further sub-category. Ninety-five sub-categories were identified for coding purposes. These were drawn in part from the descriptors of areas for biosecurity research identified in 2000 by the agencies involved in biosecurity management in New Zealand. These descriptors are listed in Section 2.3.

Technology New Zealand is part of the Foundation for Research, Science and Technology (FRST), but is listed as a separate funder given the distinctive way it operates in partnership with other investors.

Details for each project were entered in an Access database which facilitated the analysis of the data, particularly the analysis of relationships between the research categories, funders, providers and expenditures. This database could be used for tracking future changes in expenditure patterns by adding additional project information in subsequent years.

¹ Funding was unknown for 68 projects. These probably represent additional expenditure of \$2 to \$4 million, based on the average cost of non-FRST projects

2.3 Areas for biosecurity research by category

The agencies involved in biosecurity management in New Zealand identified the following areas of biosecurity research “*to assist those deciding to fund or undertake biosecurity research*” as the areas in which biosecurity research should be focussed². These were intended to provide guidance, but not identify priorities, pending the development of the national biosecurity strategy. The agencies suggested that research in these four areas could either be generic biosecurity research or more sector-specific research.

General

- Analysis of economic and political models for the management of biosecurity threats.
- Development of rapid-access information systems, collections and environmental databases on unwanted organisms.
- Improve export opportunities for ‘clean’ products.

Pre-Border

- Identifying threats to ecosystems.
- Profiling and modelling the characteristics of damaging or potentially damaging organisms.
- Identifying controls (in the country of origin) for selected organisms that pose a threat to New Zealand.
- Analysing and predicting risk pathways for unwanted organisms.
- Identifying and collating databases and expertise on unwanted organisms.
- Developing systems for rapid access to appropriate data.
- Developing compliance validation methodologies.
- Identifying and locating biosecurity-related risks to animal, plant and human health.

Border

- Developing improved technologies for intercepting unwanted organisms and sampling methodologies.
- Developing border containment and eradication methodologies.
- Developing profiles of non-compliance behaviour to biosecurity requirements.

Post-Border (includes pest management)

- Developing rapid identification techniques for unwanted organisms.
- Designing and developing methodologies for undertaking delimiting surveys for new incursions.
- Developing rapid response options for potential incursions of unwanted organisms.
- Analysis of public attitudes and perceptions of biosecurity risks and barriers to biosecurity responses.
- Developing long-term containment and control strategies.

² Biosecurity Council paper “Biosecurity research areas for New Zealand”, 12 July 2000.

3. RESULTS

3.1 Overview of Expenditure and Research Activities

This section identifies the major patterns of expenditure by research category, lists the top funders and providers, and the main areas of research activity. More detailed analyses and comments follow it on the research projects under the various sub-categories.

Table 1. Distribution of projects by research category

Category	General	Pre-Border	Border	Post-Border	TOTAL
\$ Allocated	2,587,000 (4%)	1,658,300 (3%)	3,278,300 (5%)	57,010,000 (88%)	64,533,600
Number of Projects	14 (3%)	16 (4%)	27 (6%)	349 (87%)	406

Clearly the overwhelming focus for both expenditure and research effort is in the Post-Border category, which accounts for 88% and 87% of the expenditure and project activity respectively.

Table 2. Major funders by research category

Category	General	Pre-Border	Border	Post-Border	TOTAL
Funder	\$ allocated (# projects)	\$ allocated (# projects)	\$ allocated (# projects)	\$ allocated (# projects)	\$ allocated (# projects)
FRST	2,293,400 (6)	997,000 (4)	686,000 (4)	36,119,100 (65)	40,095,500 (79)
DOC	21,300 (2)	0	25,000 (2)	6,562,200 (96)	6,608,500 (100)
MAF	155,600 (3)	35,000 (2)	2,094,800 (17)	3,521,100 (43)	5,806,500 (64)
Animal Health Bd.	0	0	0	4,712,200 (39)	4,712,200 (39)
Tech. NZ (FRST)	0	0	84,700 (1)	1,214,700 (11)	1,299,400 (12)
M.Fish.	? (2)	512,800 (5)	303,100 (3)	396,300 (10)	1,212,200 (20)
Reg./Dist. Councils	0	0	0	765,400 (38)	765,400 (38)
M.Health	0	? (1)	0	251,000 (10)	251,000 (11)
Other Funders	116,700 (1)	113,500 (4)	84,700 (1)	3,468,000 (49)	3,782,900 (55)

Provision of financial support to biosecurity research is dominated by allocations made by the Foundation for Research Science & Technology (FRST). The eight funders listed in Table 2 contributed 96% of the total funds. The importance of the FRST contribution is evident when these totals are expressed as percentages:

FRST	62%	M. Fisheries	2%
DOC	10%	Councils	1.5%
MAF	9%	M. Health	0.5%
AHB	7%	Other funders	6%
TechNZ (FRST)	2%		

Table 3. Major providers by research category

Category	General	Pre-Border	Border	Post-Border	TOTAL
Provider	\$ allocated (# projects)	\$ allocated (# projects)	\$ allocated (# projects)	\$ allocated (# projects)	\$ allocated (# projects)
Landcare	1,742,400 (4)	0	19,800 (2)	19,541,500 (109)	21,303,700 (115)
Hort Research	0	0	0	10,240,200 (32)	10,240,200 (32)
Ag Research	0	549,500 (2)	401,100 (2)	8,929,000 (34)	9,879,600 (38)
Crop and Food Res.	0	0	0	3,621,800 (5)	3,621,800 (5)
DOC	20,000 (1)	0	0	1,930,100 (26)	1,950,100 (27)
NIWA	0	0	18,800 (2)	1,868,900? (18)	1,887,700? (20)
MAF	45,000 (1)	0	938,000 (2)	170,000 (1)	1,153,000 (4)
Consultants	0	0	49,800 (1)	1,115,100 (17)	1,164,900 (18)
Otago University	0	0	0	1,091,100 (3)	1,091,100 (3)
Cawthron Institute	0	0	0	1,084,000 (8)	1,084,000 (8)
Forest Institute	0	0	0	751,400 (8)	751,400 (8)
Lincoln University	0	0	0	598,000 (5)	598,000 (5)
Auckland University	0	0	0	588,600 (6)	588,600 (6)
ESR	0	0	0	538,000 (5)	538,000 (5)

Although the number of providers exceeded 40 in total, the 15 listed above (all those with more than \$500,000 identified as allocated over the period) account for 87% of the money allocated to providers.

Crown Research Institutes (CRIs) are the main organisations doing biosecurity research. When the totals for the above 15 organisations are converted to percentages the allocation of funding is as follows:

Landcare	32%	Consultants	2%
HortResearch	16%	Otago Univ.	2%
AgResearch	15%	Cawthron Inst.	2%
Crop&Food	6%	Forest Research	1%
Dept. of Conservation	3%	Lincoln Univ.	1%
NIWA	3%	Auckland Univ.	1%
MAF	2%	ESR	1%
		Other providers	13%

Table 4. Leading categories of biosecurity research

Sub-category	\$\$ Allocated	Number of Projects
Horticulture	6,662,000	2
Biocontrol	5,367,100	38
Crops	4,598,200	8
Possums	4,296,800	30
Poisons/baits	4,180,000	36
Pastoral	3,780,000	3
Invertebrate pests	3,450,100	23
Risk assessment	2,848,500	10
Mustelids	2,673,700	26
Freshwater species	2,511,400	5
Weeds*	2,312,700	37
Mammalian pests	2,150,200	10
Bovine Tb	1,581,500	5
Marine	1,495,000	19
Risk management	1,414,000	3
General biodiv. impacts	1,288,000	3
Forestry	1,149,000	14
TOTALS	46,312,400	272

This table lists the 17 sub-categories within 'Post-Border' for which expenditure in the 2-3 year period exceeded \$1 million. They are ranked according to expenditure, not the number of projects within each sub-category. **The total expenditure of these 17 sub-categories represents 81% of the known expenditure within the Post-Border category and 72% of total expenditure across all categories.**

3.2 “General” Research

The summary of the projects coded as “General” is as follows:

		% of total
Number of projects	14	3
\$\$ Allocated	2,587,000	4

The largest sub-category represented was ‘collections’, with five projects and a total expenditure of \$1,827,400 over all years. These are FRST-funded projects for Landcare Research and Cawthron Institute to manage national collections of fungi, plants, micro-organisms, arthropods and algae.

No other sub-category exceeded three projects (information systems, exports), and none appear to be particularly large in expenditure. Two projects are new M.Fish initiatives with few details available at this stage, one of which addresses the need for ongoing baseline information to support border control while the other is looking at managing vector threats.

Of the three export projects the largest (457) is to manage the risk of toxins in shellfish harvesting. One of very few projects dealing with human behaviour is included here – a small DOC project (326) dealing with public attitudes to pest control and pesticide use.

3.2.1 Research gaps and overlaps

This research category, by its very nature, does not show much cohesion in the scope and focus of the projects, with the exception of the funding for national collections which are more accurately regarded as ‘underpinning research’ for biosecurity concerns. Other research agencies (see Section 4) and councils also hold collections relevant to biosecurity, but their funding sources were not captured in this review. With so few projects it is not surprising that there is little evidence of overlap between projects.

No projects were identified that dealt with economic or political models for the management of biosecurity threats or with the development of rapid-access information systems. There was little emphasis on research aimed at improving the ‘safe goods’ status of exports or other aspects of trade needs. This conclusion does not imply that such work is not being done and some may be sub-components of larger FRST projects as under the ‘horticulture’ sub-category in Section 3.5.1. Also, it may not have been considered as ‘research’ by agencies that were approached and therefore not notified for this review.

In the overall context of expenditure on biosecurity, however, there is little research effort that is looking at the broad issues relating to political and economic aspects of biosecurity issues. Comments on Pre-border and Border research should also be considered in this context.

3.3 “Pre-Border” Research

The summary of the projects coded as “Pre-Border” is as follows:

		% of total
Number of projects	16	4
\$\$ Allocated	1,658,500	3

This is the category with probably the lowest level of expenditure, although it is important to note that expenditure for six projects is unknown. The largest general subject area being addressed is the marine environment, with seven projects in different sub-categories. Five projects on ‘risk analysis’ account for over \$1,027,000 (62%) of known expenditure. The largest risk analysis project (465) focuses on risk as it affects productive sector ecosystems, while the others are spread between marine risk assessment (407, 423), timber and packaging (421), and a broad one examining the links between trade and travel to risks from disease vectors (376).

Two of four ‘alien profile’ projects relate to marine hull-fouling and potential risk marine species (401,415). Three ‘offshore control’ projects relate to ballast water exchange and related compliance issues (399,409). Four trade-related projects relate to specific fruit-fly or fruit import issues and Salmonella.

There are other Pre-Border activities that do not qualify for inclusion in this review, but are worth noting. The Ministry of Foreign Affairs and Trade (MFAT) is providing \$1.8 million over four years as New Zealand’s contribution to a broad pest management project in the Pacific. While the emphasis is on management, rather than research, it is a regional initiative with relevance to biosecurity. The component parts of the project include: fruit fly management (22 countries and territories); taro beetle management (6 countries); plant protection services; quarantine-related activities and information and extension services relating to pest management. The MFAT have also funded a position in the South Pacific Regional Environment Programme (SPREP) for some years responsible for invasive species issues in the Pacific. This has led to the development and adoption of a regional invasive species strategy which now needs to be implemented in the region.

3.3.1 Research gaps and overlaps

Recent Government allocations to address marine biosecurity concerns have flowed through into seven projects addressing broad issues in the marine environment. It is clear, however, that there are significant pre-border areas that are listed in Section 2.3 that are not the subject of research projects. The need for more research on pathways and risk assessment, and the links to exports, have been discussed in previous publications³ but are under-represented in current research projects. Some risk pathway projects are

³ Managing a leaky border. Towards a biosecurity research strategy. 1998. D.R. Penman. MORST, Wellington.

listed under Border Research. It is worth noting that research by DOC on weed databases, recorded under Post-Border, may also be relevant to Pre-Border and Border needs, assuming there will be the opportunity for other agencies to access the information.

3.4 “Border” Research

The summary of the projects coded as “Border” is as follows:

		% of total
Number of projects	27	6
\$\$ Allocated	3,278,300	5

The Ministry of Agriculture and Forestry (MAF) is the main funder in this category, contributing over \$2,094,700 (64%) of the total. The largest allocation of \$1,320,500 (65%) is to six projects in the sub-category of ‘risk pathways’. Pathways under investigation are: soils (especially via containers), threats to forests and threats from shipping containers. Five MAF-funded projects (over \$480,000) are concerned with ‘interception techniques’; two relate to container contamination (12, 29) while a third examines wood pathogens that could have relevance to wood exports as well as to imports.

FRST and Ministry of Fisheries are funding five marine-related projects covering a range of topics including hull cleaning, ballast water, detection techniques and a generic project relating to Port Shakespeare (425) that should also assist with work on pathway questions relating to vessels. The last marine project (406 – under ‘surveillance’) focuses on information needs at ports for border control. All of these projects address quite distinct and non-overlapping research needs.

Three MAF projects involved identification methods in relation to the detection and identification of egg masses of invasive moth species.

3.4.1 Research gaps and overlaps

No research was identified aimed at better understanding why people do not comply with biosecurity requirements and linkages to effective public education, or into how containment, detection and eradication at specific, high risk entry points (ports and airports) could be improved. There may be a case for additional research into risk pathways for other sectors, particularly those linked to new trading initiatives, and in the context of global change, linked to Pre-Border considerations. Sectors that appeared to have limited research into border-related issues included pastoral, horticultural and crops, as well as work related to freshwater ecosystems.

3.5 “Post-Border” Research

The summary of the projects coded as “Post-Border” is as follows:

		% of total
Number of projects	350	87
\$\$ Allocated	57,069,700	88

Post-Border projects were the largest category and will necessarily be given greater coverage in this summary.

First, it is important to explain why some sub-categories should be considered along with other categories when examining research effort. For example, projects with a primary focus on possums were classified under the ‘possum’ sub-category. However, some projects listed under the ‘poisons/baits’ sub-category also relate to possum control. A similar linkage applies to projects under ‘mustelids’ and ‘poisons/baits’. Likewise, a number of projects grouped under ‘biocontrol’ deal with biocontrol of weeds so this sub-category plus ‘weeds’ both need to be examined to gain a full picture of weed-related research.

The following tables detail the number of projects, dollar allocations, major funders and providers for all 17 sub-categories where total expenditure exceeded \$1 million. They are ordered by expenditures, not by the number of projects. The latter gives a better indication of the range of involvement of agencies in the research areas, but the number of projects does not always correspond to expenditure levels.

The numbers in brackets after the listing of major funders and providers are the number of projects that were classified in that sub-category. The headings below are the same as those used in the project table in Section 5 to make cross-referencing easier. Brief comments on potential gaps or overlaps will be made, where appropriate, within each sub-category.

3.5.1 Horticulture

Summary information on projects on horticulture biosecurity is as follows:

Number of projects	2
\$\$ allocated	6,662,000
Major funders	FRST (2) - \$6,662,000
Major providers	HortResearch (2) - \$6,662,000

Although this is the largest funding package, it consists of only two large projects (208, 221). Both focus on export crops and aim to improve pest, disease and weed management systems. Whether this addresses research on pathways and risk assessment, both for imports and exports, is not known.

3.5.2 Biocontrol

Summary information on research projects on biocontrol is as follows:

Number of projects	38
\$\$ allocated	5,367,100
Major funders	FRST (8) - \$2,350,500, MAF (7) - \$1,854,500, DOC (4) - \$360,400, AHB (2) - \$161,500, Councils (7) - \$41,500
Major providers	Landcare (17) - \$1,728,200, AgRes (7) - \$1,281,000, HortRes (3) - \$1,474,500

Four universities were also involved as providers along with international providers. The large number of projects and wide spread of funders reflects the split of activities between 12 projects related to biocontrol of possums, two relating to stoats and 18 projects that examined biocontrol for several weed species. There were few projects identified that related to biological control of insect pests. (Some such projects are identified under 'forestry'.) Regional councils funded a number of low-cost projects, which are linked to their related funding of 'weed' projects.

3.5.3 Crops

Summary information on projects on crop biosecurity is as follows:

Number of projects	8
\$\$ allocated	4,598,200
Major funders	FRST (7) - \$4,172,800
Major providers	Crop & Food (4) - \$3,601,800, University projects (3)- \$774,400

There were several large FRST grants for generic projects into disease and pest control. These included looking at new biological control agents to reduce pesticide use on a range of crops and increase disease and pest control. These projects did not overlap with the 'biocontrol' group.

3.5.4 Possum

Summary information on research projects on possums is as follows:

Number of projects	30
\$\$ allocated	4,296,800
Major funders	DOC (11 projects) - \$2,140,700, AHB (10) - \$973,400, FRST (5) - \$662,800
Major providers	Landcare (18) - \$3,441,700, DOC (3) - \$503,300

Additional projects related to possum research are also listed under 'bovine Tb', 'biocontrol' and 'poison/baits'. About half the 'possum' projects are concerned with trapping and related techniques of measuring the success of control operations, estimating population levels and poison-related projects. Funding for these projects came from several agencies (FRST, DOC, Animal Health Board (AHB) and councils) and Landcare carried out most of them. Estimating the degree of overlap between these projects, if any, would require a more detailed examination of the aims and results of the projects.

Five projects examined aspects of possum impacts on native forests or bird species or links to benefits of control operations for native species. A similar number examined management topics, including efforts to link different levels of control to measurements of recovery of native forests.

3.5.5 Poisons/Baits

Summary information on research projects on poisons and baits is as follows:

Number of projects	36
\$\$ allocated	4,180,000
Major funders	AHB (12) - \$1,182,200, FRST (3) - \$1,112,000, TechNZ (3) - \$1,065,000* DOC (17) - \$782,900
Major providers	Landcare (23) - \$2,476,500

*TechNZ funding includes the contribution of other funders - approx. 50%.

DOC initiated the largest number of poison/bait projects, but larger funding levels came from AHB and FRST. Two major themes in research on poisons are an examination of impacts on non-target species, especially invertebrates, and to look for alternatives to the widespread use of 1080 and brodifacoum. Other projects seek to develop better baits, such as for stoat control.

3.5.6 Pastoral

Summary information on projects on pastoral biosecurity is as follows:

Number of projects	3
\$\$ allocated	3,780,000
Major funders	FRST (2) - \$3,706,000
Major providers	AgResearch (3) - \$3,780,000

One major project by AgResearch is examining integrated pest management against pasture pests. A second project focuses on exploiting bioactive compounds to assist with, among other objectives, the control of insect, fungus and nematode pests.

3.5.7 Invertebrate pests

Summary information on research projects on invertebrate pests is as follows:

Number of projects	23
\$\$ allocated	3,450,100
Major funders*	FRST (4) - \$2,673,000, MAF (7) - \$502,500?, DOC (3) - \$83,300,
Major providers	Landcare (6) - \$2,700,300 AgResearch (5) - \$25,000?

*Funding levels for 10 projects is not known. These areas are indicated by a question mark.

These projects cover research into the control of a wide range of invertebrate pests from pasture and horticulture species to wasps in native forests. A large FRST allocation to Landcare is for biosystematic studies of terrestrial invertebrates, including introduced species. Four projects look at aspects of wasp control, while three projects focus on the Argentine ant. One project relevant to border security and exports is a project to develop electronic detection of biohazards in containers (specifically arachnids and reptiles).

3.5.8 Risk Assessment

Summary information on research projects on risk assessment is as follows:

Number of projects	10
\$\$ allocated	2,848,500
Major funders	FRST (2) - \$2,486,000, MAF (2) - \$275,000, DOC (3) - \$27,500
Major providers	AgResearch (2) - \$2,486,000

The largest FRST allocation is for a study into the effects of global change and unwanted organisms on productive sectors. Another generic FRST study examines the environmental impacts of biotechnologies and has been listed here since it may have implications for future biosecurity research. Other projects cover risk assessment of new plant taxa, the vulnerability of native grasslands to exotics and risks from Lymantriid species for native forests. One project looks at social impacts of disease outbreaks and unwanted organisms.

3.5.9 Mustelids

Summary information on research projects on mustelids is as follows:

Number of projects	26
\$\$ allocated	2,673,700
Major funders	AHB (8) - \$1,487,500, DOC (18) - \$1,186,200
Major providers	Landcare (9) - \$1,580,800 DOC (6) - \$364,000

The relatively high number of mustelid projects follows a decision of Government to boost research into the ecology and management of this major group of predators of native wildlife. The AHB have a specific interest in determining the extent to which ferrets are a vector and reservoir of bovine Tb and have therefore funded several projects. The DOC is investigating mustelid baits, traps, biocontrol options and management strategies.

3.5.10 Freshwater species

Summary information on projects on freshwater species is as follows:

Number of projects	5
\$\$ allocated	2,511,400
Major funders	FRST (3) - \$1,657,000, Royal Soc. (1) - \$618,000
Major providers	NIWA (3) - \$1,657,000

This includes the only project funded by the Marsden Fund that relates to biosecurity issues. It is a science-focused study (rather than biosecurity-focused) into the impacts of brown trout on energy flows through ecosystems. Three FRST projects target management strategies for restoring degraded freshwater habitats, part of which relates to aquatic weed control. One of these projects specifically seeks to increase public education and participation in restoration and protection initiatives. The DOC project most directly addresses biosecurity needs with respect to the control of pest fish in freshwater habitats.

3.5.11 Weeds

Summary information on research projects on weeds is as follows:

Number of projects	37
\$\$ allocated	2,312,700 (+ unknown \$ for 16 projects)
Major funders*	FRST (1) - \$1,456,000 DOC (14) - \$627,700 Councils (16) - \$229,000 +?
Major providers*	Landcare (6) - \$1,579,000?, DOC (10) - \$441,700, NIWA (12) - \$36,000?, AgResearch (3) - \$64,000

*Funding levels are not known for 16 weed projects.. Details were not supplied for a number of weed projects undertaken by Landcare, including several involving regional councils.

The large number of weed projects reported reflects the wide interest from management agencies in improving weed control. The FRST project takes a broad look at characteristics of woody and lowland weeds and how ecosystem

properties affect the success of weeds. Regional councils are funding projects which examine management of specific weeds (10 projects), develop monitoring methodologies (2), or are assessing new potential weeds in Auckland. The DOC has several broad projects looking at risk assessment, surveillance and monitoring, development of a national weed database, along with operational research for weed management.

Given the wide range of projects on related topics, such as monitoring and weed assessments, there may be some overlaps in weed research.

3.5.12 Mammalian pests

Summary information on projects on mammalian pests is as follows:

Number of projects	10
\$\$ allocated	2,150,200
Major funders	FRST (4) - \$1,869,000, DOC (4) - \$221,200
Major providers	Landcare (5) - \$1,885,000, University projects (3) - \$117,200

There is little current research into mammalian pests apart from possum research. There are three projects covering hedgehogs, wallabies, and development of long distance lures for deer and goats. A FRST project is examining the economic and social sustainability of pest management which includes raising public awareness of these issues. Two other FRST projects look at protecting native animals from predation, and at interactions between introduced mammals in forests including how forests respond to the removal of pests. Some of these objectives appear similar to possum projects looking at impacts on forests.

3.5.13 Bovine Tb

Summary information on projects on bovine Tb is as follows:

Number of projects	5
\$\$ allocated	1,581,500
Major funders	FRST (2) - \$1,210,000 AHB (2) - \$81,000
Major providers	Landcare (2) - \$1,210,000

The Animal Health Board also funds research relevant to bovine Tb under the sub-category 'possums' as well as under 'mustelids'. The FRST projects are looking at the epidemiology of Tb and how movements of wildlife contribute to the spread of Tb.

3.5.14 Marine

Summary information on research projects on marine biosecurity is as follows:

Number of projects	19
\$\$ allocated	1,495,000
Major funders	FRST (5) - \$533,000, M.Fish (9) - \$317,000, TNZ (3) - \$300,000
Major providers	Cawthron Inst. (9) - \$1,162,500, NIWA (3) - \$200,200

The emergence of toxic dinoflagellates as a major economic threat to aquaculture has led to several projects investigating their ecology, distribution, identification and toxins. Incurion response tools for marine invasives and new surveillance regimes are being developed through four other projects. More specific projects are examining Asian kelp management, control of *Spartina* and control of biofouling pests on marine farms.

3.5.15 Risk management

Summary information on projects on risk management is as follows:

Number of projects	3
\$\$ allocated	1,414,000
Major funders	FRST (2) - \$1,400,000
Major providers	HortResearch (1) - \$1,400,000

The research effort is almost exclusively directed at the productive sector for risk management of unwanted plants and diseases, with an emphasis on horticultural interests.

3.5.16 General biodiversity impacts

Summary information on projects on general biodiversity impacts is as follows:

Number of projects	3
\$\$ allocated	1,288,000
Major funders	FRST (1) - \$1,048,000
Major providers	Landcare (2) - \$1,138,000

One project will model ecosystem processes to try and improve understanding of how ecosystems recover following pest management. Another aims to predict vulnerable native species based on life history and ecological traits and should have value as a risk assessment tool. A third will develop techniques to examine impacts of pesticides in the environment.

3.5.17 Forestry

Summary information on projects on forestry biosecurity is as follows:

Number of projects	14
\$\$ allocated	1,149,000
Major funders	FRST (5) - \$1,002,000, Forest Health Collaborative (8) - \$114,000
Major providers	Forest Research (8) - \$751,400, Waikato Univ. (3) - \$316,000

There are a number of relatively small projects looking at specific pests (ranging from possums in pine plantations to cypress canker). Two larger projects focus on *Pinus radiata* pests, investigating their biology so as to improve control options. Another project was to minimise pesticide dosages by optimising delivery to target organisms.

3.5.18 Other Sub-category projects

There were a few other sub-categories with total expenditure of less than \$1 million that had a well defined cluster of projects. These were sometimes based on recent incursions. One such example is about \$500,000 allocated to various projects related to the varroa bee mite. The MAF have funded 16 varroa projects so far, mostly to HortResearch. The funding allocations are given for seven of these, totalling \$275,400. Another incursion-related group was the eight projects funded by the Ministry of Health into mosquito research.

Other sub-categories with projects included 'monitoring' (seven projects - mostly of weeds), 'traps' (six projects designing new animal traps), and 'rodents'. The latter had six projects totalling over \$900,000, that were focused on baiting questions, how to detect recent rodent invasions on islands and three projects monitoring or investigating the epidemiology of rabbit haemorrhagic disease (RHD).

3.5.19 Research gaps and overlaps

It is easier to identify gaps than overlaps. While areas receiving considerable research focus have been clearly identified in this report it was not immediately obvious where overlapping research was occurring. Accurately identifying overlaps would require more in-depth information on projects and their outputs than was available for this overview. The information gathered does suggest areas where such analysis may be useful, however, namely those sub-categories with a large number of projects, diverse funding agencies and with related projects in other sub-categories. On these criteria overlaps may be identified in research on biocontrol, poisons/baits, possums and weeds.

What of the gaps in biosecurity research? This review indicates that \$57 million of post-border biosecurity research is being spent with limited reference to the social context of biosecurity management. There are only three projects that touch on public attitudes, and another on rehabilitating freshwater ecosystems that has a clear component of public involvement. Yet a 1998 MRST report⁴ called for multidisciplinary research (in biosecurity) that involved “*significant components of social and economic research to ensure cost effective solutions are developed that meet economic and social expectations.*” That report also identified the special interests of Maori in minimising the impacts of exotic organisms on food and other resources. No projects specifically involving Maori were identified in this review. The MRST report also posed a question that still awaits wider investigation: “*What are institutional and societal boundaries [and barriers] to cross-sectoral responses?*”

The Parliamentary Commissioner for the Environment made a similar point with specific reference to possum control in his 2000 report⁵ on public attitudes towards different control options for possums. The second recommendation in his report was “*That there be a substantive increase in research into the interface between biocontrol technology, including genetic engineering and New Zealand society.*”

At the international level a recent publication⁶ by IUCN, the World Conservation Union, elaborates the central role played by people in creating the invasive species problem. Various authors point out the need to understand people’s belief systems and values that often resist the ‘solutions’ proposed by scientists and policy makers.

When all the research categories are considered there is limited multidisciplinary research being undertaken and even less that links economic factors, societal considerations and pest management into a coherent research programme. Risks to public health and to native ecosystems from global change factors, trade expansion, and increased tourism are receiving little research funding. Research on risk pathways and risk assessment is directed at the productive sector, with less emphasis on indigenous terrestrial systems. In those cases the focus is largely on specific pest or disease issues, their environmental impacts, and related efforts to improve control or move to more environmentally benign control techniques.

⁴ Managing a leaky border. Towards a biosecurity research strategy. 1998. D.R. Penman. Report No. 81. Ministry of Research, Science and Technology, Wellington.

⁵ Caught in the headlights: New Zealander’s reflections on possums, control options and genetic engineering. 2000. Parliamentary Commissioner for the Environment, Wellington.

⁶ The great reshuffling. Human dimensions of invasive alien species. 2001. J.A. McNeely (ed) IUCN, Gland, Switzerland.

4. RESEARCH CAPABILITIES AND COLLABORATION

4.1 *Research Capabilities of Institutions*

Expertise in biosecurity research lies predominantly with six CRIs (Landcare, HortResearch, AgResearch, Crop & Food, Forest Research and NIWA), the Department of Conservation and the Cawthron Institute in Nelson. Each tends to have specific areas of expertise. Between them, they also hold most of the national collections as well as a number of relevant databases. There are other researchers in universities and consulting firms who have personal expertise in biosecurity subjects, some of whom are engaged internationally in research and management related to biosecurity issues.

Not all agencies provided information on their biosecurity research capabilities. The information gathered from various sources on collections, databases and areas of expertise relevant to biosecurity is summarised as follows for the six CRIs mentioned above, the Cawthron Institute and DOC.

CAWTHRON INSTITUTE

Collections:

- New Zealand national microalgae collection, including toxic strains;
- Ballast water plankton and sediment-dwelling organisms.

Databases:

- Ballast water plankton and sediment-dwelling organisms databases;
- Species lists for high risk marine pests;
- Ecological baseline databases for the new port development at Shakespeare, Marlborough, and for Asian kelp in Lyttelton Harbour;
- Freshwater invertebrate database including native and introduced species;
- Database on fouling organisms on merchant ships in NZ waters;
- Toxic phytoplankton spatial and temporal databases, including national surveys of toxic cyst distributions.

Expertise:

Risk assessment; ballast water management practices and treatment; marine biosecurity issues; invasion processes and pest establishment; molecular probes for identification of target marine pests; sampling ballast water and dry-dock vessels; micro- and macro-algae taxonomy; aquaculture parasites and diseases.

NIWA

Collections:

- Marine collection of native and introduced species (Wellington);
- Reference collection of toxic algae (Wellington);
- Freshwater fish collection (Christchurch);
- Secure collection of freshwater plants, including noxious and high-risk weed species (Hamilton).

Databases:

- Freshwater plant database from over 100 NZ lakes, with over 1000 reference sites. Identifications via the NIWA Aquatic Plants web site;
- Marine biodiversity databases;
- Freshwater fish and invertebrate databases;
- Ministry of Fisheries databases.

In addition, 1-2 new marine biosecurity databases are to be built for M.Fish.

Expertise:

Marine and freshwater survey design; field sampling techniques; freshwater and marine species taxonomy; quantitative analysis, risk assessment including weed risk evaluation (pre and post-border); marine and freshwater biosecurity issues; weed identification, weed control and management.

DEPARTMENT OF CONSERVATION

Databases:

- National weeds database, including ecological and management information (part of Bioweb on DOC intra-net).

Expertise:

Ecological studies and management of mammalian pests and weeds; ecology and restoration techniques for endangered birds, reptiles and invertebrates; field testing for bait acceptance by a range of pest species; development of control methodologies for specific pest species; pest monitoring methodology; ecosystem restoration techniques.

LANDCARE RESEARCH

Collections:

- New Zealand arthropod collection;
- National nematode collection;
- International collection of microorganisms from plants;
- New Zealand fungal herbarium;
- Research herbarium
- New Zealand terrestrial invertebrates;
- Collection of biological control agents.

Landcare accepts material from other CRIs without their own collections.

Databases:

- New Zealand plant diseases database;
- New Zealand plant names database.

Expertise:

Ecology and management of mammalian and invertebrate pests and weeds; modelling of pest populations; immunocontraception; biological control of mammalian pests and weeds; monitoring the response of ecosystems following pest control; bait development and testing; trialling and monitoring of toxins for pest control; assessment of non-target impacts of toxins; risk assessment; testing traps.

FOREST RESEARCH**Collections:**

- Forest insects including insects affecting timber in use and insects from quarantine interceptions;
- Mycological herbarium;
- Forest forage herbarium.

Databases:

- Forest health database;
- Quarantine database.

Expertise:

Forest entomology; ecology of insects and diseases; management and control of pests and diseases; assessment of quarantine risks; pest detection survey and forest monitoring techniques; risk identification and evaluation; biological control of weeds and pests; pest risk analysis; high level quarantine containment facilities; diagnostic services; forest surveillance advisory services.

CROP & FOOD RESEARCH**Collections:**

Stored product insect colonies;
Arable and vegetable viruses;
Cereal rusts.

Expertise:

Characterisation of pests and diseases; epidemiology (predicting pest and disease problems); crop loss assessment; pest and disease control; biological and chemical control; ecology and management of weeds.

AGRESEARCH

Collections:

Native and introduced insects collection;
Insect pathogen cultures.

Expertise:

Pasture and grassland ecology; weed management; ecological restoration; biological control for animal parasites, pasture pests and diseases; development of biopesticides; weed and pest management strategies.

HORTRESEARCH

Collections:

Insect pathogen cultures;
Germplasm for resistant crops;
Horticultural insect colonies.

Expertise:

Integrated pest management; disease control for horticultural crops; development of disease and possum-resistant tree species for agro-forestry; pest monitoring systems; disease control for horticultural crops; biological control; development of biopesticides; risk assessment.

4.2 Institutional Collaboration

This review suggests there is relatively limited multidisciplinary research being undertaken and little in disciplines outside the traditional sciences of the productive and conservation sectors. This is not to diminish the importance of existing collaborative projects, but to suggest, in line with earlier reports, that there are biosecurity areas where more collaboration is warranted.

This section reports on institutional collaboration and some of the factors that influence it.

The major funder of biosecurity research is FRST and therefore the FRST approach to the directions, objectives and priorities for its Strategic Portfolios Outlines (SPOs) is a major influence in determining the shape and extent of present and future institutional collaboration.

The three FRST portfolios under SPOs of direct relevance are:

- *Biosecurity across productive sectors*. This portfolio is aligned with the Biosecurity strategic objective of the “Sustainable Management of Productive Sector Environments SPO”.

- *Biosecurity (land, freshwater and estuaries)*. This portfolio addresses the threats to indigenous ecosystems objective in the 'Protection and Restoration of Land, Freshwater and Estuarine Ecosystems and Environments SPO'.
- *Biosecurity (marine)*. This portfolio will be guided by the 'Protection and Restoration of Marine Ecosystems and Environments SPO'. It will also be considered in relation to the Seafood and Aquatic Environment-based Industries SPO, including the Quality, Safety and Market Access portfolio which includes work on toxic algal blooms.

All three portfolios are down for scheduling in 2003/2004. The rationale given for this scheduling timetable is that FRST is waiting for the completion of the national biosecurity strategy. At that time analysis using the Biosecurity cross-portfolio theme will take place and "...will ensure [that] the whole spectrum of biosecurity research investments is considered together. It will also ensure the Foundation's investments are not considered in isolation from those of industry and operational agencies."⁷

This suggests that, depending on the directions signalled in the Biosecurity Strategy, there could be significant developments in the approach taken by FRST to biosecurity funding and the extent to which future institutional collaboration is encouraged. The current FRST descriptor of its 'Protection and Restoration of Land, Freshwater and Estuarine Ecosystems and Environments SPO' spells out the 'higher level behaviours' that will direct the Foundation's research investments. These behaviours include integration (encouraging multidisciplinary approaches), collaboration (among different research providers to marshal the best available research teams), long-term research, collections and databases and wider participation (of communities and stakeholders).

As a leading management agency with broad responsibilities that exceed its in-house research expertise, the DOC is obliged to work with a variety of research providers, through its research contracts, to improve its management expertise and effectiveness. As this review indicates, DOC is the second major funder of biosecurity research and has a wide-ranging research portfolio both with CRIs and universities. In addition, its scientific staff maintains formal and informal links with the New Zealand research community as well as internationally. Its scientists, like those in CRIs and universities, benefit from the frequent informal exchanges that occur through New Zealand scientific societies that address biosecurity research in their journals and annual conferences, such as the NZ Ecological Society.

An example of a current initiative is the collaboration between NIWA and DOC concerning introduced plant species. The second objective under NIWA's 'Aquatic Plant Management' programme is "Identifying and Predicting Threats from Invasive Weed Species". This objective aims, in conjunction with the DOC, to improve ways of evaluating the risks to New Zealand waterbodies

⁷ Taken from the FRST description of portfolios, dated June 2001.

from introduced plant species. The goal is to assist with deciding on priority weeds for border control, trade legislation, surveillance and management strategies.

CRIIs form collaborative arrangements with other research organisations to respond to specific needs. For example, AgResearch has developed working relationships with the United States Department of Agriculture Biological Control Station in Montpellier, France, the Pennsylvania State University and UK Institute of Grassland Environmental Research in its efforts to develop biological controls of the clover root weevil pest. AgResearch interacts with HortResearch for work related to pheromones and maintains formal and informal linkages with MAF scientists.

Landcare Research is one of five core members of the Marsupial CRC (Cooperative Research Centre) that is focused on researching the biological control of possums. It is also an associate member of the Weed CRC that addresses weed management systems. Both of these CRCs are Australian-based. Landcare also collaborates with government agencies in Hawaii (Dept. of Agriculture and US Geological Survey) to assist it with animal and weed control research.

Collaboration with respect to biosecurity research in the forestry sector is managed through the NZ Forest Health Research Collaborative. This is a grouping of about 27 organisations, the majority being forestry companies, but also including Landcare Research, AgResearch, HortResearch and DOC. The Forest Health Research Collaborative commissions research as well as sharing information, but does not make bids to FRST or have international linkages in its own name.

In summary, there are various collaborative arrangements that have been developed by management and research agencies, based on specific needs. They appear to play a minor, but important role in the overall activity of biosecurity research at present. The research priorities that emerge from the Biodiversity Strategy may influence the current level of institutional collaboration.

5. LISTING OF RESEARCH PROJECTS

On the following pages the reader will find a complete listing of the 406 projects that were identified during this investigation.

Projects in particular categories or sub-categories can be easily located as follows. Projects are first grouped into the four 'meta-categories' which are in the following order:

1. General
2. Pre-Border
3. Border
4. Post-Border.

Within each 'meta-category' each 'sub-category' is listed in alphabetical order. All the 'funders' are also listed in alphabetical order within each sub-category.

For example, under 'Post-Border' and 'Possum' the first group of 10 projects lists all those funded by Animal Health Board, the next group of 11 projects are those funded by Department of Conservation, then FRST, etc.

Projects were classified by financial years where these were known, although the duration of some projects was shorter than a full year. Start and finish dates of projects do not always correspond to the months marking the financial years.

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
203	Nationally Significant Biological Collection	Enhance the scope and integrity of the collections for arthropods and nematodes, fungi and bacteria, and NZ plant specimens and associated databases of importance to conservation, preservation of biodiversity, and primary industry	General	Collections	FRST	322,000	Landcare	1999-2000
207	CHR plant herbarium	Enhance the scope and integrity of the foremost collections of NZ plant specimens and associated databases of importance to conservation, preservation of biodiversity and primary industry.	General	Collections	FRST	882,400	Landcare	2000-2002
439	Fungal herbarium (PDD) and Microbiological collection (ICMP)	Enhance the scope and integrity of the fungal and bacterial collections, and the associated databases of importance to conservation, preservation of biodiversity, and primary industry.	General	Collections	FRST	334,000	Landcare	2000-2002
440	Database integration for fungal and bacterial collections	Enhance the quality, integration, user-access and information value of the databases associated with biosystematic research based on the fungal and bacterial collections.	General	Collections	FRST	204,000	Landcare	2000-2002
441	Micro-algae Culture Collection	Provide a national collection of marine and freshwater micro-algae species with toxic and noxious properties and other attributes of economic significance, as a reference and resource for researchers, industrial users, the aquaculture industry and the public health sector.	General	Collections	FRST	85,000	Cawthron Institute	2000-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
457	Marine Algal Toxins: Improved management tools and potential new bioactive compounds.	This objective will contribute to the sustainable harvesting of shellfish through the development of strategies for managing risks posed by known and uncharacterised biotoxins, by consolidating and validating key methodologies that enable the seafood industry to market safe products while responding to increasing consumer demands for removal of animal testing.	General	Improving 'safe' goods	FRST	466,000	ESR	2000-2002
301	Review of biosecurity-related information on blue-tongued lizards (Tiliqua)		General	Information systems	Department of Conservation	1,300	Uni of Sydney	1999-2000
22	Validation of pest-host associations	Make publicly available a comprehensive record of validated pest-host associations in economically important New Zealand crops.	General	Information systems	Ministry of Agriculture and Forestry	90,600	NPPRL	1999-2000
416	Baseline information to support border control.	Ongoing research. The nature and extent of specific projects in this area have yet to be determined.	General	Information systems	Ministry of Fisheries	Unknown	To be confirmed	2001-2004
381	Population health impacts of global environmental change	Post-doctoral fellowship which includes the following: modelling the potential distribution of arboviral disease in New Zealand; assessing vulnerability and adaptation to climate change in Pacific Islands.	General	Post-doc research	Health Research	116,686	Otago Uni	2001-2003
326	Attitudes to pest control and pesticides use		General	Public attitudes	Department of Conservation	20,000	Department of Conservation	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
3	Sensitivity and reliability of methyl bromide sachets used to monitor and verify fumigation parameters	Test methyl bromide indicator sachets under a variety of fumigation configurations, and compare the data from the sachets with that from gas detection tubes to develop a sound overview of the reliability of the sachet technology.	General	Trade issues	Ministry of Agriculture and Forestry	20,000	To be confirmed	2001-2002
1	Studies on the distribution and taxonomy of <i>Arhopalus</i> spp. in Australia and NZ	Providing an exact identification of, and an illustrated key to <i>Arhopalus</i> spp. occurring in NZ and to define their current geographic distribution in NZ and Australia.	General	Trade needs	Ministry of Agriculture and Forestry	45,000	Ministry of Agriculture and Forestry	2001-2002
417	Alternative management tools for vector threats	Ongoing research. The nature and extent of specific projects in this area have yet to be determined.	General	Vector threats	Ministry of Fisheries	Unknown	To be confirmed	2001-2004
9	Cattle and deer tick literature review	None available as yet.	Pre-Border	Alien profiles	Ministry of Agriculture and Forestry	10,000	To be confirmed	2001-2002
401	The potential for the introduction of exotic species by vessel hull fouling: a preliminary study.	Description of the extent and distribution of fouling biotic assemblages on the hulls of cargo vessels and yachts; and the type and frequency of occurrence of exotic species on the vessels. Provision of a basis for the design of a more comprehensive study of the risks of species introductions by hull fouling.	Pre-Border	Alien profiles	Ministry of Fisheries	Unknown	NIWA	1999-2000
415	Risk profile for marine species that may arrive in New Zealand	Ongoing research. The nature and extent of specific projects in this area have yet to be determined.	Pre-Border	Alien profiles	Ministry of Fisheries	Unknown	To be confirmed	2001-2004

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
467	Avocado sunblotch viroid variant analysis	To determine the population and distribution of avocado sunblotch viroid ASBV variants and to assure that the virulent variant ABSV1 is not present in New Zealand.	Pre-Border	Alien profiles	NZ Avocado Growers' Association	20,000	Qld Univ. Technology	2001-2003
414	Compliance monitoring of ballast water exchange for vessels entering New Zealand.	Ongoing research of specific projects in this area have yet to be determined.	Pre-Border	Compliance issues	Ministry of Fisheries	Unknown	To be confirmed	2001-2004
399	Examination of efficiency of ballast water exchange practices and degree of ship compliance with NZ ballast water mandatory controls and voluntary guidelines.	Review of the availability of methods to measure and record volumes of ballast water movement during exchange, determine the volumetric efficiency of mid-ocean ballast exchange, and verify ship compliance with mid-ocean ballast water exchange controls and guidelines. Development and testing of a practical compliance of verification methodology.	Pre-Border	Offshore controls	Ministry of Fisheries	332,500	Cawthron Institute	1998-2000
409	Ballast water exchange areas	Identification of mid-ocean areas in which ballast water can be exchanged so as to minimise the quantity of exotic coastal marine organisms in ballast tanks, and development of educational material to inform ship's masters of recommended exchange sites when en-route to NZ	Pre-Border	Offshore controls	Ministry of Fisheries	78,800	Cawthron Institute	2001-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
421	Biosecurity Import and Export Risk Analysis for timber, logs and packaging.	Determining those pathogens posing a potential severe threat to New Zealand forestry and developing methods for monitoring and by detection of fungi and bacteria that are not present in NZ, and/or maybe questioned regarding trade to export markets.	Pre-Border	Risk analysis	FRST	89,000	Waikato Uni	2000-2002
423	Marine bioinvasions risk assessment management	Establish and verify the risks posed by foreign marine species via international and coastal transport pathways and develop effective management protocols, thereby reducing the risk of unwanted invasions.	Pre-Border	Risk analysis	FRST	216,000	Cawthron Institute	2000-2002
465	Biosecurity of productive sector environments.	Better targeted biological control and improved science/policy linkages in biosecurity including: <ul style="list-style-type: none"> • Assessment of pre-border biosecurity risk from accidental introductions. • Development of a risk profile for "passenger pests" of productive ecosystems that are not currently covered by import health standards. • Improve border and post-border biosecurity by developing diagnostic databases and guides backed by molecular identification of morphologically similar species. 	Pre-Border	Risk analysis	FRST	542,000	AgResearch	2000-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
407	Development of a risk profile for marine species that may arrive in NZ	Assessment of the risk of species likely to be present in ballast water and on fouled hulls establishing in NZ, the potential impacts of these species on NZ's marine biodiversity, and recommendations on future research to improve understanding of possible impacts.	Pre-Border	Risk analysis	Ministry of Fisheries	180,000	Consultants	2001-2002
376	New Zealand's Global Connectedness	A Biosecurity Risk Assessment of trade and travel links and their relationship to the potential dispersal of disease vectors.	Pre-Border	Risk analysis	Ministry of Health	Unknown	To be confirmed	2001-2002
59	Consultancy on Indian fruit exports	Fruit fly disinfestation of tropical flits and vegetables	Pre-Border	Trade issues	FAO	Confidential	HortResearch	2000-2001
60	Determine the efficacy of one new post-harvest technology for controlling fruit flies	Mathematical monitoring of fruit fly thermo-tolerance	Pre-Border	Trade issues	FORST	150,000	HortResearch	2000-2002
58	Protocols to overcome quarantine barriers for Vietnamese exports	Fruit fly disinfestation of tropical fruits and vegetables	Pre-Border	Trade issues	MFaT	Confidential	HortResearch	2000-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
4	Comparison of NZ and overseas isolates of Salmonella typhimurium DT160	Identify the relationships between NZ and overseas strains of Salmonella typhimurium DT160 using pulsed field gel electrophoresis (PFGE). Determine whether overseas isolates belong to the same clone and attempt to identify the origin of the NZ strain. This will aid in the development of import health standards for animals and animal products.	Pre-Border	Trade issues	Ministry of Agriculture and Forestry	25,000	To be confirmed	2001-2002
26	Development and validation of a serological assay for the detection of Echinococcus granulosus (hydatid) cysts in animals.	Further validate the ProtELISA and to establish immunoblotting as a confirmatory method.	Border	Animal health	Ministry of Agriculture and Forestry	56,000	NCDI	1999-2000
14	Detection of Animal Infected Echinococcus granulosus - using cell mediated immune response	All live animals imported to the country have the potential to re-establish Hydatid disease and need to be monitored. The project was to develop and evaluate an antigen-dependent gamma interferon test for detection hydatid disease in sheep imports.	Border	Animal health	Ministry of Agriculture and Forestry	59,681	NCDI	2000-2001
15	Passage time for weed seeds in Digestive Tract of Herbivorous Livestock	Review the literature and produce a report to provide a basis for making decisions on the length of time animals need to be maintained in quarantine for them to pass all potential weed seeds.	Border	Border containment	Ministry of Agriculture and Forestry	7,313	Landcare	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
473	Heat disinfection of quarantine risk vehicles	Not given	Border	Border containment	Technology NZ and Biosecurity Services	169,300	Forest Research Institute	2001-2002
10	Diagnostic procedures for the identification of selected species and populations of Lymantria and Orgyia moths from intercepted egg masses	Continuation of a 1999-2000 project, this part focussed on finding a method to assign origins of intercepted egg masses for <i>Lymantria dispar</i> , <i>L.mathura</i> , <i>L.monacha</i> and <i>Orgyia antiqua</i>	Border	Identification methods	Ministry of Agriculture and Forestry	91,263	Lincoln Uni	2001-2002
18	DNA diagnostic procedures for the identification of selected species and populations of Lymantria and Orgyia moths from intercepted egg masses	Develop DNA diagnostic procedures for the identification of selected species and populations of Lymantria and Orgyia moths from intercepted egg masses	Border	Identification methods	Ministry of Agriculture and Forestry	83,260	Lincoln Uni	1999-2000
23	Development of diagnostic keys for Tortricidae	Develop and integrate a series of morphological and molecular diagnostic keys to economically important larvae and adult New Zealand Tortricidae, as well as to the exotic Tortricidae species most likely to be introduced.	Border	Identification methods	Ministry of Agriculture and Forestry	88,745	NPPRL	1999-2000

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
12	Identifying signature chemical compounds in wood packaging in shipping containers - Electronic detection of biohazards	Determine the effectiveness of adapted electronic volatile detection systems for the interception of unwanted wood packaging material at New Zealand's borders.	Border	Interception techniques	Ministry of Agriculture and Forestry	235,852	AgResearch	2000-2001
13	Rapid identification of target pathogens in imported wood	Address biosecurity by targeting specific fungal pathogens not known to be present in New Zealand but considered to be of potentially high risk to the Agroforestry sector or a threat to trade with export marketers	Border	Interception techniques	Ministry of Agriculture and Forestry	78,498	Waikato Uni	2001-2002
29	Investigation of new methods of detecting container contamination	Investigation of 'electronic sniffer' technology which may have application to biosecurity inspections.	Border	Interception techniques	Ministry of Agriculture and Forestry	165,232	AgResearch	2000-2002
45	Pheromone identification for Painted Apple Moth	Identify an attractive blend for PAM	Border	Interception techniques	Ministry of Agriculture and Forestry	Confidential	HortResearch	2000-2001
46	Trapping for distribution of Painted Apple Moth	Identify an attractive blend for PAM	Border	Interception techniques	Ministry of Agriculture and Forestry	Confidential	HortResearch	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
424	RNA gene based probes to reduce the risk of invasions by marine pests.	Initiate development of molecular based probes as a compliance tool for improved detection of species posing a risk to our marine environment, leading to effective monitoring by border control authorities.	Border	Marine	FRST	78,000	Cawthron Institute	2000-2002
425	Port Shakespeare marine biosecurity project.	Further develop the Port Shakespeare Marine Biosecurity Project to determine the relationship between the transport of foreign marine species, success of establishment and risks to key biosecurity sectors, leading to effective surveillance and response protocols.	Border	Marine	FRST	166,000	Cawthron Institute	2000-2002
408	Ballast water contingency discharge areas	Characaterisation of the oceanographic feature within NZ's territorial sea to identify areas, and their relative efficacy, in which ballast water can be discharged so as to minimise the risk of marine organisms present in ballast water impacting on the NZ marine environment.	Border	Marine	Ministry of Fisheries	22,350	NIWA	2001-2002
410	Guidelines for acceptable hull cleaning facilities	Development of guidelines for the collection and disposal of the solid matter from vessel hull cleaning. Production of a checklist of requirements to be used by regulatory authorities when assessing hull cleaning facilities and processes.	Border	Marine	Ministry of Fisheries	49,800	Consultants	2001-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
321	Border control for potential ecological weeds: development of an ecosystem-based risk model for new terrestrial plants	The aim of this research is to develop an ecosystem-based risk assessment model for new aquatic plant taxa.	Border	Plant species	Department of Conservation	12,500	Landcare	1999-2001
320	Border control for potential ecological weeds: priority species, priority pathways, and proposed risk assessment model	The aim of this research is to assess the likelihood of entry and to assess the potential impact of exotic species of aquatic plants in order to better manage the risks posed by exotic aquatic plants to natural ecosystems. A list of priority exotic species which could pose a threat to New Zealand will be developed from overseas information sources.	Border	Plant species	Department of Conservation	12,500	NIWA	1999-2000
435	Identifying and Predicting Threats from Invasive Weed Species.	Develop tools for measuring environmental health and biosecurity threats from invasive weed species. To include further work on an aquatic weed risk assessment model.	Border	Risk management	FRST	93,000	NIWA	2000-2002
28	Decontamination of contaminated sea containers	Investigate where improvements can be made to current methods of decontaminating containers; to research new and novel methods of decontaminating containers; to develop a business case (if appropriate) for improving or implementing new methods of decontamination.	Border	Risk management	Ministry of Agriculture and Forestry	200,000	Ministry of Agriculture and Forestry	2000-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
19	Assessment of contamination soil as a risk pathway	Identify pathways, and determine relative risks to New Zealand, of pest and disease entry as a result of soil introductions into New Zealand with particular reference to the container trade.	Border	Risk pathway	Ministry of Agriculture and Forestry	88,250	Crop and Food	1999-2000
431	Biosecurity, monitoring and surveillance	The biosecurity threats to New Zealand's forests and their associated risk pathways will be identified. New and innovative response strategies to pests and disease, including improvements in forest health surveillance technologies, within and outside New Zealand will be identified and evaluated.	Border	Risk pathways	FRST	349,000	Forest Research Institute	2000-2001
11	Assessment of soil as a risk pathway	Continued a project begun in 1999-2000. Completed the analysis on select microbial groups and extended the study to examine the degree of genetic variability between selected fungal and bacterial groups and potential pathogenicity, and compare degree of variability between NZ derived and overseas derived isolates.	Border	Risk pathways	Ministry of Agriculture and Forestry	87,734	Crop and Food	2000-2001
21	Identification of fungal infections in imported timber	Isolate fungi on imported timber, focussing on wood packaging. The outcome will be to compare the fungi found on wood to known New Zealand organisms in order to establish potential biosecurity risk	Border	Risk pathways	Ministry of Agriculture and Forestry	45,000	Waikato Uni	1999-2000

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
27	Biosecurity risks posed by shipping containers	To determine as far as possible the biosecurity risks posed by the shipping container pathway into New Zealand; to review current methods and assess new and novel methods of detecting and managing the biosecurity risks to an acceptable level; and to produce a new import health standard for shipping containers.	Border	Risk pathways	Ministry of Agriculture and Forestry	738,000	Ministry of Agriculture and Forestry	2000-2002
7	Lophodermium identification tools	Enhance New Zealand's border biosecurity by providing a simple molecular based diagnostic tool to aid the rapid identification of Lophodermium seditiosum, a serious pathogen of pines that is not present in New Zealand	Border	Surveillance methods	Ministry of Agriculture and Forestry	70,000	To be confirmed	2001-2002
406	Baseline information to support border control.	Development of selection criteria and recommendations for sites to be included in an ongoing surveillance regime for ports and other points of entry with the highest marine biosecurity risk in NZ. Design and implementation of baseline surveys and ongoing surveillance in the selected sites.	Border	Surveillance methods	Ministry of Fisheries	230,980	NIWA	2001-2004
113	Patchiness as a determinant of RTC's for Tb eradication		Post-Border	Animal Health	Animal Health Board	238,170	Landcare	2000-2001
114	Are deer an important long term reservoir host		Post-Border	Animal Health	Animal Health Board	74,100	Landcare	2001-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
219	The epidemiology of tuberculosis control in possums and cattle	The goal is to determine a set of strategies for more effective and efficient control of tuberculosis in possums and a reduced risk of tuberculosis transmission to cattle.	Post-Border	Animal Health	FRST	260,000	AgResearch	2000-2002
16	Use of veterinary Practices to define baseline patterns of Animal Diseases for National Animal Health Surveillance	Evaluate the feasibility and reliability of collecting detailed animal disease data directly from clinical veterinarians and compare the resulting data with other sources	Post-Border	Animal Health	Ministry of Agriculture and Forestry	34,650	Massey Uni	2000-2001
17	Spread of Salmonella organisms in sheep yards - extension contract 00/01 for October sampling	To compare the prevalence of S. Brandenburg in the dust of sheep yards where S. Brandenburg and those where no S. Brandenburg abortions are thought to have occurred	Post-Border	Animal Health	Ministry of Agriculture and Forestry	15,636	Consultants	2000-2001
8	Molecular and animal-based studies on the New Zealand Salmonella typhimurium DT160 clone to examine spidemiology, pathogenicity and immunogenicity.	None available as yet.	Post-Border	Bacteria	Ministry of Agriculture and Forestry	100,000	To be confirmed	2001-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
25	Determining the relationship of amplicons of European foulbrood (EFB) PCR to the bacterial fauna of New Zealand bees	Clarify the relationship of the non-specific amplicons with the bacterial fauna of the honey bee using molecular techniques such as PCR assay, cycle sequencing and phylogenetic analysis, to confirm that New Zealand is free of <i>Melissococcus pluton</i> , the causative organism of EFB.	Post-Border	Bees	Ministry of Agriculture and Forestry	31,375	NCDI	1999-2000
481	Treatment thresholds for varroa bee mite	This project will determine thresholds for treating varroa mite for two different climate/colony development zones in the north half of the North Island.	Post-Border	Bees	Ministry of Agriculture and Forestry	60,000	Regional/local govt.	2001-2002
482	Analysis of sampling methods for varroa bee mite	There are various sampling methods reported in the literature designed to estimate the number of varroa present in beehives. A number need research to check their reliability. This project will make recommendations on a range of sampling methods.	Post-Border	Bees	Ministry of Agriculture and Forestry	21,000	HortResearch	2001-2003
483	Testing alternative treatments for varroa bee mite.	Currently only Apistan (fluvalinate) and Bayvarol (flumethrin) have been registered for varroa control in New Zealand. Given the overseas development of resistance by varroa to this class of chemicals there is a need to register further varroa control products. This project will test formic acid, oxalic acid and thymol under NZ conditions.	Post-Border	Bees	Ministry of Agriculture and Forestry	50,000	HortResearch	2001-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
484	Testing for tolerance to varroa bee mite	Overseas, selection for suppression of varroa reproduction can produce honey bee stocks that have enhanced tolerance to varroa. It is necessary to establish the variability that currently exists to suppress varroa reproduction in NZ honeybees to see if NZ stock could be used for this purpose.	Post-Border	Bees	Ministry of Agriculture and Forestry	20,000	HortResearch	2001-2002
485	Optimal usage of bee mite control products	A significant concern for NZ beekeepers is the cost of the two varroa control substances (Apistan and Bayvarol). Apistan contains over 200 times the amount of active ingredient found in Bayvarol. This project will recommend on the optimum use of these two products such as for the amount of compound applied, the application time period and strip placement in the hive.	Post-Border	Bees	Ministry of Agriculture and Forestry	16,000	HortResearch	2001-2002
486	Testing a model for an integrated pest management (IPM) programme for varroa	Previous varroa projects should provide enough material to develop model IPM programmes for varroa control. This project will develop three varroa IPM programmes using different control substances (synthetic only, organic only, combination), then implement them in a controlled manner.	Post-Border	Bees	Ministry of Agriculture and Forestry	77,000	HortResearch	2001-2003

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
487	Relative effectiveness of Apistan and Bayvarol at killing varroa after use for ten 24-hour periods.	The purpose of this investigation was to determine whether used Bayvarol strips were as effective as used Apistan strips at killing varroa when placed in a honey bee hive for 24 hours.	Post-Border	Bees	Ministry of Agriculture and Forestry	Unspecified	HortResearch	2000-2001
488	Resistance of the bee mite Varroa jacobsoni to fluvalinate	The purpose of this investigation was to determine the level of resistance to fluvalinate exhibited by the varroa mites introduced into NZ.	Post-Border	Bees	Ministry of Agriculture and Forestry	Unspecified	HortResearch	1999-2000
489	Sensitivity trial of Apistan as a diagnostic test	The diagnostic test consists of placing a sticky board on the base board of the hive being tested. The strips and sticky boards are removed after 24 hours and the boards analysed for the presence of varroa.	Post-Border	Bees	Ministry of Agriculture and Forestry	Unspecified	HortResearch	2000-2001
490	Effectiveness of old, new and used Apistan strips at killing varroa mites	The purpose of this investigation was to determine the continuing efficacy of old Apistan strips.	Post-Border	Bees	Ministry of Agriculture and Forestry	Unspecified	HortResearch	1999-2000
491	Infectivity of Apistan strips that have been placed in AFB hives	With the use of Apistan as a diagnostic tool for varroa, strips placed in hives with AFB (American foulbrood disease) are subsequently being used in uninfected hives. This investigation will: 1. Determine the fluvalinate effects on the growth of AFB spores; 2. Determine whether Apistan strips are likely to spread AFB spores.	Post-Border	Bees	Ministry of Agriculture and Forestry	Unspecified	HortResearch	1999-2000

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492	Irradiation as a means of sterilising used Apistan strips	Objectives: assess the efficacy of irradiation as a means of killing American Foulbrood spores on used Apistan strips; comment of the risk of AFB transmission via Apistan strips with and without irradiation.	Post-Border	Bees	Ministry of Agriculture and Forestry	Unspecified	HortResearch	2000-2001
493	Destruction of managed and feral honey bee colonies	The perceived difficulty in eradicating varroa is the removal feral honey bee colonies. Trials were conducted on eight poisons to determine their attractiveness and toxicity to honey bees at different concentrations and to determine the speed of each poison's effect on honey bee foraging.	Post-Border	Bees	Ministry of Agriculture and Forestry	Unspecified	Lincoln Ventures	2000-2001
494	Risk assessment of varroa movement to the South Island	Objective: analyse the risk of varroa being introduced into the South Island by: assessing the means by which varroa could spread to the South Island including pathways involving the movement of bees and other possible means of varroa dispersal; comparing pathways in terms of relative risk; suggesting mitigation methods that could reduce the risk of spread.	Post-Border	Bees	Ministry of Agriculture and Forestry	Unspecified	HortResearch	2000-2001
495	Population dynamics trial of the bee mite varroa	This trial will investigate the population dynamics of varroa in honey bee colonies in New Zealand.	Post-Border	Bees	Ministry of Agriculture and Forestry	Unspecified	HortResearch	2001-2003
63	Biology, ecology and safety of Bacillus thuringiensis	Review of all information on the biopesticide B. thuringiensis	Post-Border	Biocontrol	Abbott Laboratories	50,000	AgResearch	1999-2000

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
395	A model system for biological control of possums using DNA expressed by parasites		Post-Border	Biocontrol	AGMARDT	Unknown	Victoria Uni	2000-2002
387	Advance biocontrol of Scotch Broom in North Canterbury		Post-Border	Biocontrol	AGMARDT	Unknown	Amuri Broom Group	2000-2002
390	Improved control of Californian thistle with natural enemies		Post-Border	Biocontrol	AGMARDT	Unknown	Californian Thistle Action Group	2001-2002
391	the biological control of giant buttercup in dairy pastures		Post-Border	Biocontrol	AGMARDT	Unknown	Golden Bay Sustainable Ag Group	2000-2001
392	Fungal Biocontrol of Californian thistle		Post-Border	Biocontrol	AGMARDT	Unknown	Ohinewai Dairy Farmer Group	2001-2002
99	Longer life bait markers for bio-control	To develop methods of safely presenting baits over prolonged periods (l.e. up to one year) as a follow-up to, and for sustaining the effectiveness of maintenance control operations.	Post-Border	Biocontrol	Animal Health Board	45,200	Landcare	1999-2002
115	Plant-derived contraceptive antigens for possum biological control		Post-Border	Biocontrol	Animal Health Board	116,327	Landcare	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
160	Possum fertility control #2	To investigate the biology of possum sperm, eggs and fertilisation and methods of interfering with possum reproduction as a means to development of methods of biological control for possums.	Post-Border	Biocontrol	Co-operative Research	385,000	Landcare	2000-2001
319	Review of plant biological control for conservation purposes	This project will document the successes and failures of biological control programmes for weeds around the world with respect to conservation values, both target and non target values.	Post-Border	Biocontrol	Department of Conservation	35,000	Consultants	1999-2000
322	Co-investment in biocontrol	For many weed species of conservation concern, no effective control method is available, or control is not cost effective, practical or environmentally acceptable. This project provides for an initial feasibility assessment of the top priority species for biological control.	Post-Border	Biocontrol	Department of Conservation	50,000	Landcare	1999-2002
345	Biological control of stoats using a vaccine strain of canine distemper virus	This project is to investigate whether the vaccine strains of CDV (canine distemper virus) can be used as a lethal agent for the biocontrol of stoats.	Post-Border	Biocontrol	Department of Conservation	234,000	AgResearch	2000-2003
352	Incidence and diversity of Bartonella in stoats and other wildlife	Biocontrol using the bacterium Bartonella. This project examines the suitability of Bartonella as a vector for biological control.	Post-Border	Biocontrol	Department of Conservation	41,350	Waikato Uni	2000-2002
122	Biological control of blackberry		Post-Border	Biocontrol	Forest Health Collaboration	14,000	Landcare	2001-2004

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52	Developing sustainable management systems	this objective will increase the range of environmentally benign plant protection measures available	Post-Border	Biocontrol	FRST	1,200,000	HortResearch	2000-2002
54	Willow Sawfly	Identify key factors that affect natality and mortality of willow sawfly and determine how these can be used to manage this pest.	Post-Border	Biocontrol	FRST	124,500	HortResearch	2000-2002
56	Invertebrate pest control: New technologies to advance new biological based enterprises	The development of new/alternative methods to control vertebrate pest species.	Post-Border	Biocontrol	FRST	150,000	HortResearch	2000-2002
69	Biocontrol of gorse	Test a potential mycoherbicide against gorse	Post-Border	Biocontrol	FRST	66,000	AgResearch	2000-2002
70	Risk analysis of fungi used in weed biocontrol	Develop models for the analysis and management of disease risk associated with wide-host range fungi used as mycoherbicides	Post-Border	Biocontrol	FRST	200,000	AgResearch	2000-2002
159	Possum fertility control #1	To identify and characterise egg antigens to assess their potential for biological control of possums	Post-Border	Biocontrol	FRST	10,000	Landcare	2000-2001
454	Possum biocontrol development	Develop a socially acceptable and environmentally safe biological control that interferes with possum fertility.	Post-Border	Biocontrol	FRST	600,000	Landcare	2000-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
378	Rearing and release of the gall wasp <i>Aulacidea subterminalis</i> for biocontrol of <i>Hieracium</i>	Populations of the gall wasp were reared at Delmont, Switzerland and shipped to New Zealand in November 1999. Imported wasps were tested for the presence of pathogens before being either released into the field in New Zealand or used to establish a rearing colony.	Post-Border	Biocontrol	Heiracium Trust	25,315	Cabi Bio Science	2000-2003
379	Complete host testing and prepare application for release into New Zealand of the hover flies <i>Cheilosia praecox</i> and <i>C. psilophthalma</i> and the gall wasp, <i>Macrolabis pilosellae</i> for biocontrol of <i>Hieracium</i> .	Complete host testing of selected plants both at CABI BioScience, Switzerland and in quarantine in New Zealand. Importation of puparia and gravid females into quarantine at Lincoln. Testing for presence of pathogens. Development of rearing techniques for hover flies. Preparation of data for application to ERMA to release into the field.	Post-Border	Biocontrol	Heiracium Trust	95,263	Landcare	2001-2002
380	Importation and rearing of plume moth, <i>Oxyptilus pilosellae</i> for biocontrol of <i>Hieracium</i>	Field collection in Switzerland of first instar larvae, importation in May 2001, testing for pathogens and parasitoids, confirm identification, rear to adulthood with a view to establishing a rearing colony and field releases.	Post-Border	Biocontrol	Heiracium Trust	29,084	Cabi Bio Science	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
31	Gametes and embryos in the female possum reproductive tract	Develop cost-effective in vivo and in vitro models of sperm and egg maturation, fertilisation and embryogenesis in the possum to identify, test and develop promising reproduction-based biocontrols.	Post-Border	Biocontrol	Ministry of Agriculture and Forestry	337,500	Marsupial CRC	2000-2001
32	Blocking embryonic development in brushtail possum	Characterise cloned genes, prepare and evaluate proteins that are essential for embryonic development by in vitro assay systems and examination of gene expressions and protein secretion	Post-Border	Biocontrol	Ministry of Agriculture and Forestry	389,250	Melbourne Uni	2000-2001
33	Immune responses in pouch young and adult possums	Study aspects of immune responses in both pouch young and adult possums which could be important for implementing biocontrol	Post-Border	Biocontrol	Ministry of Agriculture and Forestry	80,297	Macquarie Uni	2000-2001
34	Synchronised oestrus and controlled mating in possums	Develop hormonal methods of controlling the time of oestrus, ovulation and fertile mating in captive possums and to establish formulation strategies to deliver effective doses of peptides and proteins across the possum gastrointestinal tract.	Post-Border	Biocontrol	Ministry of Agriculture and Forestry	215,000	AgResearch	2000-2001
35	Immunoglobulin transfer in the mammary gland of the brushtail possum	Determine the classes and quantities of immunoglobins in milk, and to characterise the mechanism required to transport them into the milk for development of methods for the biological control of possums	Post-Border	Biocontrol	Ministry of Agriculture and Forestry	200,000	AgResearch	2000-2001
41	Possum viruses	Isolate, characterise and genetically manipulate possum viruses for the biological control of possums	Post-Border	Biocontrol	Ministry of Agriculture and Forestry	316,000	AgResearch	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
158	Possum biocontrol-field validation	To validate reproductive inhibition as method of biological control for possums by assessing population and behavioural consequences in wild populations	Post-Border	Biocontrol	Ministry of Agriculture and Forestry	316,500	Landcare	2000-2001
173	Biological control of weeds	To undertake feasibility studies, host range testing and efficacy testing on different agents for range of plant species	Post-Border	Biocontrol	Regional/local govt.	Unknown	Unknown	1985 - ongoing
175	Biological Control of Plant Pests	Feasibility studies for new biological control agents for plant pests and better methods of spreading and monitoring existing agents.	Post-Border	Biocontrol	Regional/local govt.	15,000	Landcare	2001-2004
187	Bio Control - Feasibility Studies	Investigate the possibility of agents for a range of plants	Post-Border	Biocontrol	Regional/local govt.	2,000	Landcare	2001-2002
188	Bio Control of weeds	Test agents for the control of Boneseed	Post-Border	Biocontrol	Regional/local govt.	8,500	Landcare	2001-2002
469	Bio-control of weeds - feasibility studies	Investigate the possibility of agents for a range of plants	Post-Border	Biocontrol	Regional/local govt.	2,000	Landcare	2001-2002
470	Bio-control of the weed Boneseed	Test agents for the control of Boneseed	Post-Border	Biocontrol	Regional/local govt.	8,500	Landcare	2001-2002
471	Biological control of the weed Banana Passionfruit	Identify agents for the control of Banana Passionfruit	Post-Border	Biocontrol	Regional/local govt.	5,500	Landcare	2000-2001
164	Impacts of Magpies on other bird species	To determine the impacts of magpies on other bird species. Collaborative national project with six other regional councils.	Post-Border	Birds	Regional/local govt.	30,000	Landcare	2000-2003

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
86	Specific ancillary serial test for bovine Tb		Post-Border	Bovine TB	Animal Health Board	65,500	AgResearch	2001-2002
88	Investigating the sources of M bovis infection in humans		Post-Border	Bovine Tb	Animal Health Board	15,960	ESR	2000-2001
450	Improved local Tb management	Improve understanding of Bovine Tb epidemiology, transmission between species, the relative risks posed to Tb management by the different wildlife hosts, and develop enhanced models of wildlife management for Tb control.	Post-Border	Bovine TB	FRST	567,000	Landcare	2000-2002
451	Improved containment of geographic Tb spread	Improve understanding of the contribution of wildlife movement behaviours to the spread of Bovine Tb and how wildlife can be best used to detect and monitor Tb.	Post-Border	Bovine TB	FRST	643,000	Landcare	2000-2002
40	Immunology of Bovine Tuberculosis	Improve diagnostic tests and vaccines for control of bovine tuberculosis	Post-Border	Bovine TB	Ministry of Agriculture and Forestry	290,000	Consultants	2000-2001
287	Feral cat habitat use and effectiveness of control operations - Stewart Island	Cats are a serious threat to several bird populations, most notably dotterel, in Stewart Island. The primary aim of this investigation is to identify habitat areas that cats use preferentially. Improvements in poisoning efficiency and cost effectiveness are likely.	Post-Border	Cats	Department of Conservation	30,000	Otago Uni	1999-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
291	Peer review of cat-specific toxin studies	A novel cat-specific and humane toxicant is being developed as a multi-agency project in Australia. This toxicant could be extremely valuable for cat control in New Zealand	Post-Border	Cats	Department of Conservation	59,450	Landcare	1999-2001
458	Soilborne pathogens and pests of arable and vegetable crops.	Enhance control of soilborne pathogens and pests of arable and vegetable crops to improve the sustainability and quality of production, and enhance economic and personal wellbeing of producers and consumers of food products.	Post-Border	Crops	FRST	1,267,400	Crop and Food	2000-2002
459	Durable disease and pest resistance of crop plants.	Ensure that disease and pest control based on host plant resistance is sustainable by improving the durability of the limited resource of genetic resistance for crop plants.	Post-Border	Crops	FRST	903,200	Crop and Food	2000-2002
460	Improved biological control for vegetable and cereal crops.	Develop sustainable crop protection for vegetable and cereal crops through the introduction of new biological control agents for key pests, so that pesticide use is reduced and pest control is improved. To include: <ul style="list-style-type: none"> • Risk assessment for new biological control agents • Selection criteria for new biological control agents • Assessment of post-introduction impacts of biological control agents. 	Post-Border	Crops	FRST	540,000	Crop and Food	2000-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
461	Integrated systems for disease and pest management of vegetable and cereal crops.	Develop sustainable crop protection for vegetable and cereal crops through the integration of disease and pest management methods so that pesticide use is reduced and disease and pest control is improved. To include: <ul style="list-style-type: none"> • Modelling epidemiology and population dynamics • Non-pesticide control strategies and pesticide durability • Integrating crop protection systems for end users. 	Post-Border	Crops	FRST	891,200	Crop and Food	2000-2002
462	Soil borne pathogens and pests of arable and vegetable crops.	Enhance control of soilborne pathogens and pests of arable and vegetable crops by detection, quantification and characterisation of plant pathogens and biological control agents.	Post-Border	Crops	FRST	300,000	Lincoln Uni	2000-2001
463	Biology and control of grapevine trunk diseases	Enhance the control of woody trunk diseases of grapevine to improve the sustainability and quality of production.	Post-Border	Crops	FRST	160,000	Lincoln Uni	2000-2002
71	Crop weed competition	Develop models for the influence of crops on weed growth and development in order to develop improved weed management decision support in arable crops	Post-Border	Crops	FRST and Technology NZ	222,000	AgResearch	2000-2002
480	Systems-based management of pests of avocado	Not given	Post-Border	Crops	Technology NZ and Avocado Industry Council	314,400	Auckland Uni	2001-2004

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
105	Assessing the effect of aerial possum control on deer numbers in part of the Blue Mountains RHA		Post-Border	Deer	Animal Health Board	51,700	Landcare	2000-2001
106	Epidemiology of Tb in wild deer	To determine the role that wild deer have as hosts and/or vectors of bovine tuberculosis	Post-Border	Deer	Animal Health Board	508,200	Landcare	1997-2001
285	Impact of Sika Deer on beech forest vegetation	This study will determine the impacts of sika deer on mountain beech forest vegetation.	Post-Border	Deer	Department of Conservation	75,000	Department of Conservation	1999-2002
273	Effectiveness of pest control in Kaka management, South Island	The reproductive biology and general ecology of south Island kaka are being investigated to evaluate the effectiveness of pest control with respect to conserving kaka.	Post-Border	Endangered birds	Department of Conservation	223,000	Department of Conservation	1999-2002
365	Indigenous forest biosecurity protection: annual survey	Not given	Post-Border	Forestry	Department of Conservation	33,000	Department of Conservation	2001-2002
116	Handbook on the pathology of New Zealand trees		Post-Border	Forestry	Forest Health Collaboration	17,000	Forest Research Institute	1999-2001
117	Electronic guide to forest pests and diseases in New Zealand - Year 2		Post-Border	Forestry	Forest Health Collaboration	7,500	Forest Research Institute	2000-2001
118	Pine pitch canker - seed treatments and seed testing Year 2		Post-Border	Forestry	Forest Health Collaboration	10,000	Forest Research Institute	1999-2000

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
119	Quantifying Possum Damage in Radiata Pine Plantations - Year 1		Post-Border	Forestry	Forest Health Collaboration	28,700	Landcare	1999-2001
120	Evaluation of Risk and Impact of Possum Damage to Radiata Pine Plantations - Year 2		Post-Border	Forestry	Forest Health Collaboration	8,000	Forest Research Institute	1999-2000
121	The economic impact of the Monterey pine aphid		Post-Border	Forestry	Forest Health Collaboration	20,000	CRIs	2000-2001
123	Cattle grazing and Diplodia staining in Pinus radiata		Post-Border	Forestry	Forest Health Collaboration	12,850	Forest Research Institute	2000-2002
124	Testing cypress canker resistance: Initial screening methodology		Post-Border	Forestry	Forest Health Collaboration	10,000	Forest Research Institute	2000-2003
419	Endophytes and potential Biocontrol of Pitch Canker and minor pathogens.	Identify the major endophytes from Pinus radiata, and determine their biology, interactions and virulence in order to develop solutions and to prevent their establishment and loss of New Zealand productivity and loss of value to wood fibre products.	Post-Border	Forestry	FRST	182,000	Waikato Uni	2000-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
420	Vectoring of Fungi in NZ Radiata pine by Hylastes	Understanding the life cycle of the bark beetle, Hylastes ater and the taxonomy of associated fungi in order to develop methods and systems to reduce value loss effects in monocultural/plantation forests.	Post-Border	Forestry	FRST	72,000	Waikato Uni	2000-2002
422	Antibodies Created by Proteomics for detection of detrimental fungi for solid wood and international Biosecurity.,	Employment of technology for the detection of detrimental fungi on solid wood.	Post-Border	Forestry	FRST	62,000	Waikato Uni	2000-2002
432	Management of pest and disease impacts.	Fundamental knowledge of pests and pathogens will be used to develop management systems that will minimise their impact. Management systems will utilise selection for host resistance, silviculture, and the introduction of chemical or biological control agents.	Post-Border	Forestry	FRST	341,000	Forest Research Institute	2000-2001
433	Plant protection chemistries for weed, pest and disease control.	Reduce adverse environmental and economic impacts of weeds, pests and diseases in New Zealand by providing methods to minimise pesticide dosages, optimise delivery to the target organism and increase the biological and cost effectiveness of spray formulations.	Post-Border	Forestry	FRST	345,000	Forest Research Institute	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
327	Methods of eradicating and monitoring pest freshwater fish species	Department needs to develop technical capabilities to control or manage populations of pest fish. A suite of control and management techniques (including monitoring) are required. There is a need for a long-term, focussed programme to progress development of methods to control and manage pest freshwater fish in New Zealand.	Post-Border	Freshwater species	Department of Conservation	230,000	Department of Conservation	2000-2005
434	Aquatic Plant Biodiversity and Ecology	Improve knowledge and understanding of the biodiversity, composition, structure and function of aquatic plant communities in freshwater ecosystems, including the habitat effects of weeds.	Post-Border	Freshwater species	FRST	497,000	NIWA	2000-2002
436	Restoration of Freshwater Ecosystems	Develop improved technology and management strategies for restoring degraded and devegetated habitats and for minimizing the impacts of aquatic weeds on natural ecosystems. To include: Restoring native vegetation Using weed control methods to restore aquatic environments Effective herbicide use Hydrilla control and vegetation recovery	Post-Border	Freshwater species	FRST	777,000	NIWA	2000-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
437	Development of Protection, Mitigation and Restoration Strategies for aquatic ecosystems.	Integrate end-user and community interests and increase public education and participation in restoration and protection initiatives aimed at enhancing aquatic vegetation values. To include a weed identification service and related management information.	Post-Border	Freshwater species	FRST	383,000	NIWA	2000-2002
385	Ecosystem consequences of an invader: brown trout in New Zealand streams	The proposed research will assess the impact of brown trout on the flux of matter and energy through the whole ecosystem.	Post-Border	Freshwater species	Royal Society	618,000	Otago Uni	1999-2002
438	Fungi as plant pathogens	Provide descriptions, illustrations, and identification keys for selected groups on New Zealand plant pathogenic fungi of importance in quarantine, primary production, and conservation and in understanding ecosystem processes.	Post-Border	Fungi	FRST	290,000	Landcare	2000-2002
356	An integrated framework for examining pest impacts on ecosystem processes	This work will integrate ecosystem processes within a simulation model, to conceptualise how herbivore impacts and ecosystem processes change with time, and along environmental gradients thus improving our capacity to predict the extent of ecosystem recovery following pest management.	Post-Border	General biodiversity impacts	Department of Conservation	90,000	Landcare	2000-2003

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
206	Biodiversity and threatened species. Resilience, rarity and abundance	Improve the maintenance of indigenous biodiversity by predicting vulnerable indigenous species on the basis of life history and ecological traits, and determine the factors that limit population growth amongst endangered species in common habitats.	Post-Border	General biodiversity impacts	FRST	1,048,000	Landcare	2000-2002
479	Development of techniques to assess the impact of application of biological pesticides in the environment	Not given	Post-Border	General biodiversity impacts	Technology NZ and Biodiscovery Ltd	150,000	PhD student	2001-2004
37	Riboflavin Carrier protein (RCP): Identification purification	Identify the RCP gene in a mammalian species, and eventually to immunise possums with RCP.	Post-Border	GM control	Ministry of Agriculture and Forestry	155,000	AgResearch	2000-2001
38	Transgenic worms for the control of possums	Develop the technology to enable the possum parasite <i>Parastrongyloides trichosuri</i> to be used as a vector for genes expressing proteins which could interfere with reproductive success, growth or longevity of its host	Post-Border	GM control	Ministry of Agriculture and Forestry	125,000	AgResearch	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
208	Pipfruit steps to the future: Competitive advantage from science and technology	The objective is to develop underpinning knowledge and technologies that will lead the New Zealand pipfruit industry into a future as pre-eminent producers and marketers of pipfruit from systems with demonstrably high environmental and health integrity. This objective will develop new and cost effective integrated pest, disease and weed management systems that minimise environmental impacts.	Post-Border	Horticulture	FRST	4,992,000	HortResearch	2000-2002
221	Sustainable systems for pest and disease management for horticulture export crops	To enhance premiums and add value throughout the fruit supply chain by developing innovative and sustainable pest and disease control systems. A key outcome of this objective is to derive integrated fruit production (IFP) blueprints for emerging horticultural export crops.	Post-Border	Horticulture	FRST	1,670,000	HortResearch	2000-2002
456	Tracking viruses in the food chain especially in the shellfish sector.	Provide information and methodologies needed to address the increasing rates of viral food-borne illness in New Zealand by using molecular and culture methods to determine the transmission and persistence of human enteric viruses in the food chain to assist the shellfish and other food sectors.	Post-Border	Human health	FRST	340,000	ESR	2000-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
6	Incidence of stained growth rings in elm trees growing in the Waikato	Determine the incidence of staining in the inner growth rings of elms growing in an area where Dutch elms disease is not present.	Post-Border	Identification methods	Ministry of Agriculture and Forestry	45,000	To be confirmed	2001-2002
386	Systems for early detection and control of Tasmanian grass grubs		Post-Border	Invertebrate pests	AGMARDT	Unknown	Awhitu Peninsula Land Group	2000-2002
388	Controlling Kelly's citrus thrips, a new citrus pest		Post-Border	Invertebrate pests	AGMARDT	Unknown	NZ Citrus Growers	2000-2001
389	Identification of sustainable clover flea control options		Post-Border	Invertebrate pests	AGMARDT	Unknown	Northland Clover Pest Interest	2001-2002
394	Biological control of fireblight: antibiosis of <i>Erwinia amylovora</i> , the fire-blight pathogen, by the potential biocontrol agent <i>Erwinia herbicola</i>		Post-Border	Invertebrate pests	AGMARDT	Unknown	Canterbury Uni	2000-2002
397	Biological control of the clover root weevil <i>Sitona lepidus</i> Gyllenhal		Post-Border	Invertebrate pests	AGMARDT	Unknown	Post-doc	2001-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
65	Molecular identification of clover root weevil	Using molecular biology to identify the origin of the clover root weevil infestation in New Zealand	Post-Border	Invertebrate pests	Dairy Board	10,000	AgResearch	2000-2001
281	Aerial poisoning of wasps	The aim of this project is to determine the feasibility of aerial baiting. The attractiveness, palatability, and effectiveness of pelletised baits in simulated aerial distribution will be determined, and non-target species that would be affected by the baits will be identified.	Post-Border	Invertebrate pests	Department of Conservation	23,000	Landcare	1999-2000
297	Control methods for paper wasps	The Asian paper wasp is an abundant introduced predator in northern New Zealand, preying predominantly on Lepidoptera. An earlier review of potential control strategies identified feeding attractants as the only technique that has been used for paper wasps elsewhere in the world. Field test products to determine their attractiveness and efficacy. If trapping alone is ineffectual and an integrated approach is needed, a trap incorporating pathogen and attractant will be developed.	Post-Border	Invertebrate pests	Department of Conservation	39,320	Landcare	1999-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
300	Argentine ant: ecological impacts, status and control strategies	In order to begin to assess this threat and options for dealing with populations that spread into key conservation sites, such as offshore islands, we need to review what is known about the ant's distribution, ecology, and the various control methods used overseas. Potential distribution for New Zealand will be prepared using climate envelope mapping.	Post-Border	Invertebrate pests	Department of Conservation	21,000	Landcare	1999-2001
64	Strategies for the eradication or control of gypsy moth in New Zealand	Combine the AgResearch and FR groups to revise the document "Strategies for eradication and control of gypsy moth in New Zealand", using the latest palatability studies and data on the effectiveness of microbial controls of gypsy moth in the northern hemisphere	Post-Border	Invertebrate pests	Forest Owners Association	15,000	AgResearch	2001-2002
193	Biosystematics of New Zealand Terrestrial Invertebrates	This programme will increase the knowledge and understanding of the biosystematics of New Zealand's endemic and introduced terrestrial invertebrate fauna. Definitive systematic studies will be prepared of selected invertebrate groups important in agricultural and horticultural ecosystems, conservation, and biosecurity.	Post-Border	Invertebrate pests	FRST	1,417,000	Landcare	2000-2001

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200	Biological Control of Wasps	This research will relieve the predatory pressure on native wildlife by the two species of adventive, alien wasps. My research has identified at least a dozen insect species in the northern hemispheric range of wasps that kill wasps, and which are totally specific to wasps.	Post-Border	Invertebrate pests	FRST	56,000	Consultants	2000-2002
427	Risk profiles for biosecurity decision-making.	Develop methods for assessing the potential for establishment and ecological impact of exotic invertebrates in New Zealand's natural ecosystems.	Post-Border	Invertebrate pests	FRST	466,000	Landcare	2000-2002
428	Management strategies for key invasive invertebrates.	Develop and improve management strategies for controlling key invasive invertebrates (wasps, ants) in New Zealand's natural ecosystems.	Post-Border	Invertebrate pests	FRST	734,000	Landcare	2000-2002
5	Development of a synthetic pheromone for use in the gum leaf skeletoniser eradication programme	Develop a synthetic pheromone for the gum leaf skeletoniser in order to help MAF to provide a more effective monitoring tool for detecting any residual (or future) population and indicating where to apply treatment measures to increase the probability of a successful eradication.	Post-Border	Invertebrate pests	Ministry of Agriculture and Forestry	95,000	To be confirmed	2001-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
20	The production of a broad-spectrum attractant for use in quarantine monitoring and surveillance of Scolytidae and Cereambycidae in New Zealand	Identify a primary attractant that will be useful in monitoring wood-boring beetles from the families Scolytidae and Cerambycidae	Post-Border	Invertebrate pests	Ministry of Agriculture and Forestry	67,482	Canterbury Uni	1999-2000
381a	Electronic detection of biohazards (arachnids and reptiles)	MAF Biosecurity is interested in rapidly determining whether a particular container shipment contains unwanted arachnids and/or reptiles. Second objective is identifying signature chemical compounds in wood packaging in shipping containers.	Post-Border	Invertebrate pests	Ministry of Agriculture and Forestry	Unknown	AgResearch	2001-2002
382	Argentine Ant (Linepithema humile) eradication programme operational report.	This project aims to investigate the effectiveness of experimental ant bait (toxicant: Fipronil) as an eradication or control tool for Argentine ants in NZ in an urban environment.	Post-Border	Invertebrate pests	Ministry of Agriculture and Forestry	Unknown	Regional/local govt.	2001-2002
383	Sassure in New Zealand: distribution and potential host range	The research investigated the extent of spread of the yellow flower wasp. The report concludes that the yellow flower wasp populations are localised.	Post-Border	Invertebrate pests	Ministry of Agriculture and Forestry	Unknown	AgResearch	2000-2001
384	Argentine Ant investigation	The objective is to carry out a national survey of the geographical distribution of Argentine ant and to determine the habitat preferences of the ant in both the natural and urban environment.	Post-Border	Invertebrate pests	Ministry of Agriculture and Forestry	Unknown	AgResearch	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
162	Investigating the life cycle and pesticide use and effectiveness on tropical grass webworm		Post-Border	Invertebrate pests	Ministry of Agriculture and Forestry, Regional/local govt. and Meat NZ	340,000	Ministry of Agriculture and Forestry, Meat NZ and Kiwi North	2000-2002
55	Willow Sawfly	Manage willow sawfly	Post-Border	Invertebrate pests	River Managers Group (Regional Councils)	Confidential	HortResearch	2000-2001
474	Post harvest control of insect pests on organically grown apples	Testing and developing new methods of post harvest control of insect pests on organically grown apples. To develop and extend laboratory research to field research.	Post-Border	Invertebrate pests	Technology NZ and Consultants	16,300	J and M Bostock	2000-2001
201	Factors Affecting the Restoration of Island Biodiversity	Our understanding of restoration process is still rather limited. How rapidly does plant diversity change after rabbits are removed from an island? What is the effect on plant diversity of removing possums? How have kiore rats affected regeneration of native trees in coastal and lowland forests (including that of the mainland)? etc.	Post-Border	Island research	FRST	100,000	Consultants	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
294	Impacts of hedgehogs on native biota in Northland	The hedgehog is an animal that, from the conservation perspective, has been largely unstudied in New Zealand. This study aims to investigate the impacts of hedgehogs on biota in coastal and forest sites through dietary analysis, radio tracking and video surveillance work.	Post-Border	Mammalian pest	Department of Conservation	33,500	Auckland Uni	1999-2002
396	Dynamics of rabbit calicivirus disease: effect of predators.		Post-Border	Mammalian pests	AGMARDT	Unknown	Lincoln Uni	2000-2002
276	Effects of pest control on forest invertebrates	Assess the benefits to forest invertebrates of large scale control of their mammalian predators.	Post-Border	Mammalian pests	Department of Conservation	83,700	Massey Uni	1999-2003
289	Test of a potential long-distance lure for deer and goats	A major problem in the control of red deer and goats is the low density of animals. Attractants similar to those successful with rabbits, possums and elephants are being trailed by measuring differential response of farmed deer and goats to randomised exposure to the attractant and to a control substance. Similar trials are then undertaken in forests amongst wild populations.	Post-Border	Mammalian pests	Department of Conservation	88,000	HortResearch	1999-2001
298	Alternative toxicants for wallaby control	This work will review current knowledge of toxicants for wallaby control and conduct a pilot toxicity study.	Post-Border	Mammalian pests	Department of Conservation	16,000	Landcare	1999-2000

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
445	Economic and social sustainability of pest management	Increase awareness and understanding of the ecological, social and economic costs and benefits of mammalian pest management. Increase the awareness of pest managers, researchers, and the general public of recent developments in possum management.	Post-Border	Mammalian pests	FRST	220,000	Landcare	2000-2002
446	Pest Ecology	Improve understanding and models of the processes of pest density dependence, rates of increase, and spatial distribution and spread. To include: Determine the drivers of annual variation in possum numbers. Calibrate near infrared reflectance spectroscopy for assaying the nutritional value of diet of free ranging possum. Characterise the timing and distance of natal dispersal by juvenile stoats, and their survival. Identify optimum configuration for a new 'trapping web' method for estimating the absolute density of possum populations.	Post-Border	Mammalian pests	FRST	527,000	Landcare	2000-2002
448	Improved protection of native animals from predation	Improve protection of native fauna, through better understanding and management of predation by introduced mammals.	Post-Border	Mammalian pests	FRST	504,000	Landcare	2000-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
449	Improved protection of ecosystems from introduced mammals.	Identify the interactive effects of mammalian pests on ecosystems. To include: Determine the nature of the interactions between mice, ship rats, and stoats in beech forest, and the ecological costs of removing any one of them. Determine the effects of single and multiple pest removal on measures of ecosystem resilience in a forest ecosystem. To measure the interaction between possum density, ship rat numbers and impacts on the abundance of selected large invertebrates and birds in conifer-broadleaf forests.	Post-Border	Mammalian pests	FRST	618,000	Landcare	2000-2002
169	Pest Animal Impacts	Developing data collection methods, data bases and analytical tools to measure and monitor pestplant impacts in Southland	Post-Border	Mammalian pests	Regional/local govt.	60,000	Regional/local govt.	2001-2004
62	Mussel spat separation technologies	Development of technologies for the separation of mussel spat from toxic dinoflagellate cysts	Post-Border	Marine	Animal Health Board, Technology NZ and Mussel Industry Council	48,000	Cawthron Institute	2001-2002
325	Assessment of risks to marine ecosystems from introduction of exotic organisms.	This investigation will identify valued marine natural communities and sites and then assess which are most at risk from introductions of exotic marine organisms.	Post-Border	Marine	Department of Conservation	12,500	Cawthron Institute	1999-2000

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366	Effects of Gallant for Spartina Control: Investigation of sediment remobilisation and Spartina decomposition	An experiment to quantify the potential effects of Spartina eradication on sediments is currently being undertaken in the Manukau Harbour. The experimental results will provide a basis to predict potential effects of Spartina eradication on the wider estuarine environment.	Post-Border	Marine	Department of Conservation	35,000	NIWA	1999-2002
191	Invasive, toxic and noxious marine species	Improve the ability to recognise nuisance or alien invertebrate and microalgae in New Zealand waters for the mitigation of biosecurity risk, and protection and rehabilitation of marine biodiversity.	Post-Border	Marine	FRST	138,000	NIWA	2000-2002
442	Harmful algal bloom ecology and management	Describe the bio-geography of toxic dinoflagellate resting cysts to identify the seed sources of harmful blooms and develop models of harmful algal bloom dynamics to guidance for industry and environmental managers on mitigation options, reduction in monitoring costs and development of a predictive capability.	Post-Border	Marine	FRST	99,000	Cawthron Institute	2000-2002
443	Micro-algae toxins and shellfish physiology	Improve the accuracy of assays and analysis of marine biotoxins, and influence regulatory procedures in NZ and internationally by providing the crude toxin preparations for the development of analytical standards and reference materials.	Post-Border	Marine	FRST	112,800	Cawthron Institute	2000-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
444	Biochemical and molecular probes for marine biotoxins.	Provide a higher level of security against marine biotoxin contamination events in near real time, at reduced cost, by developing and carrying out field trials of new oligo-nucleotide probe technology against various toxic phytoplankton groups.	Post-Border	Marine	FRST	183,200	Cawthron Institute	2000-2002
72	Introduced marine algae	This research documents the distribution and biology of marine macroalgae as they are discovered. It also contributes to a research advisory review team for the Undaria eradication programme on Steward Island	Post-Border	Marine	FRST, Department of Conservation, Te Papa, NIWA and Cawthron Institute	Unknown	Te Papa	Ongoing
400	A strategy for managing the Asian kelp Undaria	Development of a national pest management strategy for Undaria pinnatifida.	Post-Border	Marine	Ministry of Fisheries	78,500	Cawthron Institute	1999-2000
402	Delimitation survey of the toxic coastal dinoflagellate Gymnodinium catenatum in NZ	Determining the distribution and abundance of G.catenatum in Ninety Mile Beach, NZ's main shipping ports, and in the north eastern North Island oyster growing regions, and whether or not this species is present in Marlborough Sounds, Coromandel and Big Glory Bay.	Post-Border	Marine	Ministry of Fisheries	79,700	Cawthron Institute	2000-2001
403	The distribution of the tubeworm Chaetopterus sp. off the coast of north-eastern NZ	Determining the distribution, potential impacts and taxonomic status of Chaetopterus sp.	Post-Border	Marine	Ministry of Fisheries	78,600	Auckland Uni	2001-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
404	Ecology and distribution of <i>Arenigobius bifrenatus</i> in northern NZ estuaries.	Determining the distribution, density, diet, reproductive biology and growth of bridled goby in north eastern NZ.	Post-Border	Marine	Ministry of Fisheries	16,120	Auckland Uni	2001-2002
405	Surveillance for exotic marine organisms	Development of selection criteria and recommendations for high value areas and locations at risk of invasion by exotic marine organisms.	Post-Border	Marine	Ministry of Fisheries	27,230	NIWA	2000-2001
411	Incursion response tools for marine species	Review of methods used for marine incursion response and pest control programmes world wide, and recommendations on available tools that could be used to respond to incursions in NZ. Recommendations on further development of incursion response tools for use in the NZ marine environment.	Post-Border	Marine	Ministry of Fisheries	37,600	Consultants	2001-2002
412	reducing the spread of <i>Undaria</i>	Reducing the threat of vectors such as boats, trailers and fishing gear transferring <i>Undaria</i> to areas of national and global importance.	Post-Border	Marine	Ministry of Fisheries	Unknown	To be confirmed	2001-2002
413	Surveillance for exotic marine organisms	Design and implementation of an ongoing surveillance regime to detect new exotic marine organisms in locations with at-risk biodiversity and in locations that are at risk of invasion.	Post-Border	Marine	Ministry of Fisheries	Unknown	To be confirmed	2001-2004
418	Development of incursion response tools for the marine environment.	Ongoing research. The nature and extent of specific projects in this area have yet to be determined.	Post-Border	Marine	Ministry of Fisheries	Unknown	To be confirmed	2001-2004

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
477	To develop a method to deliver spat that is 100% free of <i>Gymnodinium catenatum</i>	Not given	Post-Border	Marine	Technology NZ and Marlborough Mussel Co.	36,800	Cawthron Institute	2001-2002
61	Biofouling control on marine farms	Investigating means of environmentally friendly control of biofouling pests on aquaculture structures	Post-Border	Marine	Technology NZ and Mussel Industry Council	512,000	Cawthron Institute	2001-2003
49	Various	New Technology to Improve market access	Post-Border	Market access	MRST	75,000	HortResearch	2000-2001
50	Fireblight information to improve market access	Not specified	Post-Border	Market access	MRST	75,000	HortResearch	2000-2001
51	Commercial pesticide trials for new selective pesticides in horticulture	Commercially-funded trials for AgChem cos., products will help market access	Post-Border	Market access	Various	Confidential	HortResearch	2000-2001
53	Various	Improved market access	Post-Border	Market access	Zespri International Ltd	Confidential	HortResearch	2000-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
284	Vertebrate pesticide residue database and analytical service	There is a continued concern over 1080 and brodifacoum impacts and the flow of vertebrate pesticides through the food web. The vertebrate pesticide residue database collates data from the analyses of residues in plants, soil, baits, and target and non-target species. The residue database is being extended to cover the other pesticides in a range of media so that the data is readily accessible for use by managers and researchers. The database is accompanied by a toxicant residue analytical service, for samples collected after the use of toxic baits for pest control.	Post-Border	Monitoring	Department of Conservation	200,000	Landcare	1999-2003
68	Weed population growth and spread	Develop models for analysing the population growth and spread of existing weeds and their potential distributions in New Zealand as influenced by management decisions and climate change	Post-Border	Monitoring	FRST	178,000	AgResearch	2001-2002
154	Automatic radio-tracking	Develop and field test an automatic radio-tracking system	Post-Border	Monitoring	FRST	15,000	Landcare	2000-2001
126	Monitoring and indicators for Indigenous Forest Ecosystem Management	The project is designed to provide simple state of the environment indicators for modified lowland indigenous forest ecosystems. Such indicators are essential to provide assessment of features such as biodiversity, pressures from weeds, animal pests and forest sustainability.	Post-Border	Monitoring	MfE	Unknown	Consultants	not specified

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
67	Monitoring nassella tussock populations in Canterbury	To use field sample data to measure the long-term trend in nassella tussock populations under Environment Canterbury's Regional Pest Management Strategy.	Post-Border	Monitoring	Regional/local govt.	30,000	AgResearch	1999-2002
165	Pest Plant Monitoring	Establishing methodologies for measuring pest plant distribution, density and impact to enable performance of pest management strategies/programmes to be monitored	Post-Border	Monitoring	Regional/local govt.	5,000	Regional/local govt. and Landcare	2000-2002
171	Forest Health Monitoring	To determine relationships between pest control and species diversity and abundance	Post-Border	Monitoring	Regional/local govt.	Unknown	NIWA	Ongoing
367	EIA for temephos	Evaluation of the suitability of temephos as a control agent for exotic mosquitoes	Post-Border	Mosquitoes	Ministry of Health	15,000	AgriQuality	1999-2000
368	Data Analysis	An analysis of the data accumulated by the Eradication Team in Napier, includes light trap, dip sampling and larval densities.	Post-Border	Mosquitoes	Ministry of Health	67,000	ESR	1999-2000
369	Process Review of Program in Hawke's Bay	Review of the Control and Eradication program of Aedes camptorhynchus in Napier	Post-Border	Mosquitoes	Ministry of Health	80,000	ESR	1999-2000
370	Review of Mosquito Control Agents	Review of mosquito control agents available within New Zealand	Post-Border	Mosquitoes	Ministry of Health	18,000	Healthcare Hawkes Bay	1999-2000
371	Literature Review for SSM	Review of published literature re exotic mosquitoes	Post-Border	Mosquitoes	Ministry of Health	35,000	ESR	1999-2000
372	Inland Saline Pools mosquito survey	Survey of the saline pools within the East Coast Region to determine potential SSM habitats	Post-Border	Mosquitoes	Ministry of Health	1,000	Consultants	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
373	Taxonomy	Screening and identification of mosquito samples collected by the Public Health Services	Post-Border	Mosquitoes	Ministry of Health	35,000	Consultants	2000-2001
375	Modelling Potential Habitats for Mosquitoes of PH Importance	Use of ecological modeling to identify potential habitats for exotic mosquitoes	Post-Border	Mosquitoes	Ministry of Health	Unknown	To be confirmed	2001-2002
100	Improved methods for trapping and monitoring ferrets	Investigation of factors that affect the trappability of ferrets.	Post-Border	Mustelids	Animal Health Board	21,136	Landcare	2000-2001
101	Sustainable control of ferrets		Post-Border	Mustelids	Animal Health Board	49,000	Pest Tech Ltd	2000-2001
107	Ferrets as maintenance hosts of Bovine Tb	To determine whether ferrets are spillover or maintenance hosts of bovine tuberculosis, and to quantify the relative contribution of tuberculous ferrets to the incidence of TB in cattle.	Post-Border	Mustelids	Animal Health Board	507,540	Landcare	1998-2002
108	Ferret trappability with live versus dead prey	A study to determine whether ferrets prefer live prey in winter and spring.	Post-Border	Mustelids	Animal Health Board	335,700	Landcare	2001-2003
109	Ferret neophobia to traps	A study to determine whether ferrets are averse to novel objects in the environment in winter and spring.	Post-Border	Mustelids	Animal Health Board	260,000	Landcare	2000-2002
110	Movements and home ranges of female ferrets in winter		Post-Border	Mustelids	Animal Health Board	118,000	Consultants	1999-2001
143	Anal gland scent as a method of attracting ferrets	To determine the effectiveness of ferret anal gland scent to attract ferrets to traps and bait stations in mid-winter and early summer.	Post-Border	Mustelids	Animal Health Board	56,138	Landcare	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
166	Monitoring Wild Ferret Populations	Determining methods to measure populations of wild ferrets and changes due to control	Post-Border	Mustelids	Animal Health Board and Regional/local govt.	140,000	Consultants	2000-2003
299	Evaluating the use of tracking tunnels used to monitor rodents as a method for also monitoring mustelids	Ink footprint tracking tunnels are now commonly used at many conversation sites to monitor the effects of pest control operations on rodent activity and abundance. Assist in participating with trails to assess the effectiveness of a revised tracking tunnel layout for providing indices of both rodents and mustelids.	Post-Border	Mustelids	Department of Conservation	40,000	Department of Conservation	1999-2003
302	Evaluation of new toxins for mustelid control	Methaemoglobin-inducing agents and non-steroidal anti-inflammatory agents might be promising. All mustelid species are pests in New Zealand and sustainable, humane, and cost-effective mustelid control tools are essential.	Post-Border	Mustelids	Department of Conservation	100,000	Landcare	1999-2001
303	Testing the efficiency of options for best practice stoat control during the predicted stoat population irruption (summer 1999-2000) in southern beech forest ecosystems	The aims of this investigation are to measure the efficiency of landscape scale Fenn trapping and 1080 poisoning using hens eggs at improving productivity of threatened species and to compare the operational costs of different techniques	Post-Border	Mustelids	Department of Conservation	141,500	Department of Conservation	1999-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
304	Evaluation of new toxins for stoat control	Landcare research using captive animals has determined the levels of cholecalciferol and diphacinone required to kill stoats. Field trials with wild living stoats are desirable to confirm these levels. Field trials will also investigate the behaviour of wild stoats with a new toxin.	Post-Border	Mustelids	Department of Conservation	Unknown	Department of Conservation	1999-2000
305	Evaluation of Cholecalciferol as a new toxin for stoat control	Cholecalciferol can be used in areas where the use of 1080 is restricted or carries a high risk of public rejection. To date these products have not been rigorously tested in the field by DOC. These products could provide a less labour intensive method than eggs for delivering the toxins to mustelids over large areas.	Post-Border	Mustelids	Department of Conservation	70,000	Department of Conservation	1999-2000
306	Preliminary modelling of stoat control options	It is proposed to use population modelling as an inexpensive and risk-free tool for evaluating the likely cost-effectiveness of control options, assessing likely effects on native species at risk, and pinpointing exactly the field data that are needed to achieve these goals.	Post-Border	Mustelids	Department of Conservation	45,000	AgResearch	1999-2000
307	Scoping review: feasibility of immunocontraception for managing stoats in New Zealand	The Government has recently initiated a five-year research programme on integrated control of stoats. This project is a scoping review of the potential for the development of immunocontraceptive techniques for stoat control	Post-Border	Mustelids	Department of Conservation	46,135	CSIRO Wildlife and Ecology	1999-2000

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
338	Review of potential 'Achilles Heel' characteristics of the stoat (Mustella erminea)	An "Achilles Heel" review attempts to identify anomalies in the pest that permit better research planning in order to develop target-specific methods of control. Many potentially useful publications concerning the biological anomalies of New Zealand Australian pest species have not been considered.	Post-Border	Mustelids	Department of Conservation	20,000	Victorian Institute of Animal Research	2000-2002
339	Paired trial of long-life stoat baits in northern coastal environment	Recent legislation changes allow managers to reduce the frequency of trap checks. If any natural prey item, could be "treated" to preserve its attractiveness for extended periods, trapping operations would become increasingly cost effective.	Post-Border	Mustelids	Department of Conservation	30,000	Department of Conservation	2000-2002
340	Ferracol for stoat control	Currently, 1080 injected into hen eggs is the only toxic bait registered for stoat control. A ready-made bait would be more cost-effective, and increase the arsenal of techniques available for stoat control. Feral Control (Auckland) has developed a prototype bait made from egg powder and dried, granulated mouse.	Post-Border	Mustelids	Department of Conservation	62,500	Feral R and D Ltd	2000-2001
341	Modelling the dynamics and control of stoats	The first year will use models to assist DOC in screening and prioritising research options for novel control methods such as the use of pathogens and immunocontraception.	Post-Border	Mustelids	Department of Conservation	40,000	AgResearch	2000-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
342	Using colour to increase trap and tracking success rates of stoats	This research will use control stations of four different colours and compare the tracking and trap success of the different coloured equipment and subsequent testing of the two most "successful" colours.	Post-Border	Mustelids	Department of Conservation	37,094	Consultants	2000-2001
343	Bait marker for stoats	A bait marker to determine the proportion of a stoat population that eats baits (containing either a toxicant or a biocontrol agent) is a prerequisite for several projects on the development of new toxic baits and biocontrol techniques for stoats.	Post-Border	Mustelids	Department of Conservation	12,750	Landcare	2000-2001
346	Cost-effectiveness of exclusion fencing for reducing the impact of stoats on threatened fauna	We aim to determine the cost-effectiveness of exclusion fencing compared to conventional control for protecting threatened fauna from stoats and other pests in localised areas.	Post-Border	Mustelids	Department of Conservation	25,000	AgResearch	2000-2001
347	Density of monitoring and control stations to manage stoat threats to indigenous biota	This study captures the benefits of much of the earlier research to design more cost-effective control strategies, especially to apply control over much larger areas than previously.	Post-Border	Mustelids	Department of Conservation	146,270	Consultants	2000-2004

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
348	Prey odours as lures for stoats	Preliminary research by us has shown that rodent odours are attractive to captive stoats. The proposed research will develop methods for capturing natural prey odours and encapsulating them into a long-life, slow-release matrix, and will attempt to demonstrate that the encapsulated odour is attractive to captive stoats.	Post-Border	Mustelids	Department of Conservation	127,500	Landcare	2000-2003
351	Evaluating a low intensity stoat control regime on large inshore islands	Mainland islands are able to reduce stoat densities to levels low enough to support some relatively endangered species. It follows that the same techniques will reduce stoats to even lower densities on large inshore islands where the stoat reinvasion rate is low.	Post-Border	Mustelids	Department of Conservation	82,460	Department of Conservation	2000-2004
353	Stoat artificial reproductive technology	Assisted reproductive technologies (ART) for the stoat will be developed so that aspects of their reproduction may be controlled and in captive breeding and the future identification, development and testing of unique reproduction-based targets for biocontrol.	Post-Border	Mustelids	Department of Conservation	160,000	Landcare	2000-2002
24	Distribution, seasonality and prevalence of the biting stable fly, stomoxys calcitrans in New Zealand	Determine the distribution, seasonality and prevalence of Stomoxys calcitrans using a simple, adhesive trap and employing principally the services of school children in rural areas.	Post-Border	National surveys	Ministry of Agriculture and Forestry	32,000	AgResearch	1999-2000

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
44	National Survey of Argentine Ant	Provide national distribution of Argentine Ant (joint with AgriQuality)	Post-Border	National surveys	Ministry of Agriculture and Forestry	Confidential	HortResearch	2000-2001
66	Population dynamics of nassella tussock (nassella trichotoma)	Improve the efficiency of nassella tussock management in New Zealand grasslands. It will use experimental and modelling approaches to quantify key aspects of the population ecology of nassella.	Post-Border	Pastoral	AGMARDT	74,000	AgResearch	1999-2001
426	Technologies to exploit bioactive compounds.	Develop new biologically based technologies to build capability and foster a New Zealand biotechnology industry in bioactive compounds. To include: Insecticidal virulence genes entomopathogenic bacteria and the toxic proteins investigated for use as bioactive compound for insect, fungus or nematode control.	Post-Border	Pastoral	FRST	1,064,000	AgResearch	2000-2002
464	Provision of environmentally/market acceptable pest management technologies	This research will develop technologies to protect existing and new production systems against pasture pests, while maintaining the environmental components of the value chain. The research will develop (i) bio-intervention tactics (ii) rapidly-applicable IPM systems and (iii) an IPM industry and novel products with international markets.	Post-Border	Pastoral	FRST	2,642,000	AgResearch	2000-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
279	Impacts of feral pigs on invertebrates	A recent review of the status of feral pigs and some studies of their diet suggest that they may have a significant adverse impact on invertebrates such as native land snails and earthworms.	Post-Border	Pigs	Department of Conservation	41,330	Landcare	1999-2003
293	Measuring, monitoring and reducing feral pig impacts	This study aims to measure the ecological impacts of pigs on Great Barrier and Chatham Islands and develop techniques on how to monitor pigs.	Post-Border	Pigs	Department of Conservation	14,125	Department of Conservation	1999-2000
286	Environmental risks of using brodifacum at managed sites	This investigation seeks a better understanding of pathways of brodifacoum through the food chain via invertebrates, and the environmental risks which may be involved in its frequent use in native forest ecosystems.	Post-Border	Poison/traps	Department of Conservation	46,000	Auckland Uni	1999-2002
89	Assessing the efficacy of zinc phosphide paste for the control of possums		Post-Border	Poisons/baits	Animal Health Board	23,215	Pest Tech Ltd	2000-2001
90	Does cellulose bind 1080		Post-Border	Poisons/baits	Animal Health Board	7,500	Landcare	2000-2001
91	Preparation of BCG for oral delivery to possums		Post-Border	Poisons/baits	Animal Health Board	443,148	Otago Uni	2001-2003
92	Evaluation of an improved 1080 paste for control of possums		Post-Border	Poisons/baits	Animal Health Board	39,935	Pest Tech Ltd	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
93	Improving possum control using a new apple bait		Post-Border	Poisons/baits	Animal Health Board	18,500	Pest Control Research	2000-2001
94	Completing the development of Cholecalciferol gel bait	Field trials to compare the cost effectiveness of cholecalciferol gel bait and 1080 pellets in bait stations.	Post-Border	Poisons/baits	Animal Health Board	60,528	Landcare	1999-2001
96	Long life baits		Post-Border	Poisons/baits	Animal Health Board	239,924	Landcare	1999-2001
97	Feratox for ferrets		Post-Border	Poisons/baits	Animal Health Board	90,000	Landcare	2000-2002
98	Low cost bird repellents for possum baits		Post-Border	Poisons/baits	Animal Health Board	30,000	AgResearch	2000-2001
133	Impact of 1080 dust on invertebrate populations	To determine the impact of 1080 dust and chaff on ground dwelling invertebrate populations.	Post-Border	Poisons/baits	Animal Health Board	96,971	Landcare	2000-2001
141	Risk assessment: human exposure to poison through food	To determine whether commonly used vertebrate pesticides are transferred to milk and the effects of cooking on food residues.	Post-Border	Poisons/baits	Animal Health Board	65,813	Landcare	2000-2001
142	ELISA 1080: rapid assay for field use	To develop a rapid assay method for 1080 using radioimmune assay	Post-Border	Poisons/baits	Animal Health Board	66,650	Landcare	2000-2001
135	Invertebrate repellents for toxic baits	To identify repellents that will be effective in reducing invertebrate feeding on toxic baits.	Post-Border	Poisons/baits	Department of Conservation	80,000	Landcare	2000-2002
138	Brodifacoum in snails & earthworms	Brodifacoum, snails, earthworms, non-targets	Post-Border	Poisons/baits	Department of Conservation	11,246	Landcare	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
139	Non Target Effects of Feracol	Non-target effects, Feracol	Post-Border	Poisons/baits	Department of Conservation	22,505	Landcare	2000-2001
150	Vertebrate Pesticide Residue Database and Analytical Service	The vertebrate pesticide residue database will extend and collate data from analyses of pesticide residues in plants, soil, baits, and target and non-target animals, for use by managers and researchers.	Post-Border	Poisons/baits	Department of Conservation	56,930	Landcare	2000-2001
151	Non-invasive determination of anti-coagulant effects in non-target and target species	To develop blood-based assay procedure for measuring target and non-target exposure to anticoagulants, especially brodifacoum.	Post-Border	Poisons/baits	Department of Conservation	45,900	Landcare	2000-2001
152	Evaluation of new toxicants for mustelid control	To evaluate the sensitivity and humaneness of captive stoats and ferrets to new, potentially mustelid-specific toxicants.	Post-Border	Poisons/baits	Department of Conservation	56,255	Landcare	2000-2001
282	Species-specific rodent bait preferences and bait stability	Knowing which currently available bait works best with which rodent species or species combination would enable DOC to target control operations more effectively.	Post-Border	Poisons/baits	Department of Conservation	30,000	Landcare	1999-2000
290	Non-invasive determination of anti-coagulant effects in non-target and target species	There is a growing concern over brodifacoum impacts and physiological resistance in rats to long-term anticoagulant rodenticides. This project directly evaluates sublethal effects in non-target species and resistance development in target species.	Post-Border	Poisons/baits	Department of Conservation	85,000	Landcare	1999-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
330	Non-target effects of FeraCol	FeraCol offers a tangible alternative to brodifacoum. However, there is little data in respect to the non-target effects of the active ingredient cholecalciferol in terms of persistence or non-target susceptibility and the risk or lack of risks involved in using FeraCol. This project will provide additional data on the susceptibility of non-target species to cholecalciferol, e.g., invertebrates including earthworms, snails, honeybees, and weka. This project will provide more definitive data on the insecticidal and avicidal properties of cholecalciferol and information on whether it is likely to be transferred through the food chain, after the deployment of FeraCol.	Post-Border	Poisons/baits	Department of Conservation	60,000	Landcare	2000-2003
332	Review of information gaps for vertebrate pesticides	Nationally and internationally there is a complex array of environmental and human health risk assessment data and information with regard to vertebrate pesticides. The purpose of this project is to establish what information is missing or inadequate so that a research programme can be put in place to address these needs. The focus of the project will be on those currently available pesticides. New products that in the pipeline will also be reviewed from a similar standpoint.	Post-Border	Poisons/baits	Department of Conservation	17,750	Landcare	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
334	Residue risks for warfarin, pindone, diphacionone, coumatetralyl and brodifacoum in rodents	Control strategies for rodents using poisoned baits currently rely on the use of a range of anticoagulant rodenticides. Brodifacoum is a highly effective toxicant, however, sustained use at mainland sites has led to residue contamination in a range of non-target species. Several conservancies have been trying alternatives such as warfarin, diphacinone, pindone, or coumatetralyl for rodent control, and there is an urgent need for efficacy versus risk assessment data.	Post-Border	Poisons/baits	Department of Conservation	110,000	Landcare	2000-2002
337	Testing the attractiveness, palatability and longevity of novel stoat lure bait formulations	We will test the attractiveness to captive stoats of lures in various formulations, using video recordings of preference tests. We will also measure palatability, chewability and longevity of attractiveness.	Post-Border	Poisons/baits	Department of Conservation	47,500	Consultants	2000-2003
350	Development of a long-life bait for control of stoats	Long life bait will be developed by measuring the palatability of potential ingredients to individually-caged stoats. A combination of ingredients that is more preferred by stoats will then be waterproofed with polymer additives.	Post-Border	Poisons/baits	Department of Conservation	16,275	Pest Tech Ltd	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
354	Accumulation and toxicity of brodifacoum in Powelliphanta snails and earthworms	There is a paucity of data on the effects and persistence of brodifacoum in invertebrates, and no soft tissue invertebrates lacking in exoskeleton have been tested. The toxicity of brodifacoum to these two types of invertebrates will be assessed, followed by evaluation of persistence of this toxicant at a sublethal dose.	Post-Border	Poisons/baits	Department of Conservation	20,000	Transit NZ	2000-2002
358	effectiveness of feratox and feracol for possum and rat control	This proposal outlines research aimed at providing information on the best practice and constraints when using these two pesticide baits.	Post-Border	Poisons/baits	Department of Conservation	60,000	Pest Control Research	2000-2003
57	Vertebrate Pest Control: New technologies to add value to existing biological industries	Development of baits, bait additives and dispensing technologies to improve the efficacy of existing vertebrate pest control measures	Post-Border	Poisons/baits	FRST	100,000	HortResearch	2000-2002
452	Improved pest control technologies	Determine the humaneness, environmental and non-target health risks, and efficacy of new and existing pest control technologies and use patterns.	Post-Border	Poisons/baits	FRST	622,000	Landcare	2000-2002
453	Biotechnology for novel rodenticides	Identify physiological processes and receptor sites that can be targeted by 'greener' and more humane species-specific control products.	Post-Border	Poisons/baits	FRST	390,000	Landcare	2000-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
36	Control of reproduction by targeting the possum pituitary gland through the use of GnRH-toxin conugates	Control reproduction by targeting the possum pituitary gland through the use of GnRH-toxin conugates	Post-Border	Poisons/baits	Ministry of Agriculture and Forestry	43,000	AgResearch	2000-2001
476	To eliminate persistence of 1080 toxin in dead animals	Not given	Post-Border	Poisons/baits	Technology NZ and Feral Control	224,000	Landcare	2001-2002
472	Enteric coated toxic pellets	Development of enteric coated toxic pellets for vertebrate pest control	Post-Border	Poisons/baits	Technology NZ and Feral R and D	288,000	unknown	2000-2001
475	Helicopter bait distribution system	Not given	Post-Border	Poisons/baits	Technology NZ and unknown	553,000	Lakeland Helicopters	2001-2003
95	Effect of habitat, season, trap shyness and timing on RTC estimate	To determine the magnitude and predictability of variation in residual trap catch (RTC) estimates caused by environmental and management factors.	Post-Border	Possums	Animal Health Board	388,572	Landcare	2000-2002
102	Improved monitoring by using genotype to correct for biases in assessing possum abundance	To improve monitoring of possum populations by correcting for bias in the residual trap-catch index.	Post-Border	Possums	Animal Health Board	68,000	Landcare	2000-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
103	Detecting the presence of possums in low-density possum populations	To determine the cost-effectiveness of a low-cost system for detecting low-density possums.	Post-Border	Possums	Animal Health Board	49,800	Landcare	2000-2001
104	Novel cues to improving the cost-effectiveness of possum control	To identify effective ways to attract possums to baits or traps	Post-Border	Possums	Animal Health Board	28,500	Landcare	2000-2001
111	Mapping Possum Dispersal Across buffers with Genetic Markers	To evaluate genetic markers as a tool for assessing and improving the efficacy of TB buffers Possums, DNA markers, dispersal, buffers.	Post-Border	Possums	Animal Health Board	84,008	Landcare	1999-2001
112	Determining the relationship between RTC% and domestic disease (AgriQuality)		Post-Border	Possums	Animal Health Board	15,500	AgriQuality	2000-2001
129	Eradication of tuberculosis from possum populations	To determine the residual trap catch index below which bovine tuberculosis has a high probability of being eradicated	Post-Border	Possums	Animal Health Board	254,475	Landcare	2000-2001
130	Longitudinal study of the survival of Tb possums	To determine survival times of wild possums after clinical symptoms of TB infection are detected to improve possum/TB models	Post-Border	Possums	Animal Health Board	27,567	Landcare	2000-2001
144	Antagonists to prevent bait shyness in possums	To assess the value of using 'appetite enhancers' and 'memory blocks' in preventing or overcoming bait shyness in possums that eat sub-lethal baits.	Post-Border	Possums	Animal Health Board	27,567	Landcare	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
147	Development of chemical markers for possum control	To provide markers that can be detected in hair/whiskers, blood or tissue of possums that have eaten bait.	Post-Border	Possums	Animal Health Board	29,363	Landcare	2000-2001
134	Diet of possums from the Hurunui Mainland Island	Identify the diet of possums from Hurunui Mainland Island	Post-Border	Possums	Department of Conservation	14,175	Landcare	2000-2001
137	Optimising possum maintenance control by adaptive management	Design and begin adaptive management experiment to test the relative efficiency of 3 different control triggers (each set a 2 or 3 levels) for the maintenance control of possums.	Post-Border	Possums	Department of Conservation	214,880	Landcare	2000-2001
272	Kiwi, possum and poison relationship	Under investigation are the survival and productivity of brown kiwi in Northland forest patches subject to different types of experimental management of introduced predators. The results will be used to develop operational plans for the management and recovery of kiwi populations throughout New Zealand.	Post-Border	Possums	Department of Conservation	23,000	Department of Conservation	1999-2002
275	Impact of an aerial 1080 - carrot possum poisoning operation on Kaka and Kereru at Whirinaki	This project assesses the costs and benefits of aerial possum control operations on kaka and kereru by capturing, radio-tagging and monitoring mortality, survival and breeding success.	Post-Border	Possums	Department of Conservation	472,300	Department of Conservation	1999-2003

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
277	Using possum densities to index control targets	This investigation aims to measure the effect of 3-4 different levels of sustained possum control on the canopy condition of some key susceptible tree species in order to determine whether trap-catch indices of possum density can provide a simple index of how much control is needed to protect particular conservation values.	Post-Border	Possums	Department of Conservation	8,000	Department of Conservation	1999-2000
278	Intermittent possum control: how long before next time?	Seeks to identify the rate of recovery after possum control of many of the key canopy species most heavily impacted and measure the rates at which possum populations recover following "one-hit" possum control and to identify the possum densities at which possums begin to once again adversely affect each of the indicator species monitored. The 10 year study was initiated in 1995/96.	Post-Border	Possums	Department of Conservation	727,070	Landcare	1999-2005

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
283	Optimising possum control by adaptive management	This programme aims to improve the quality and defensibility of decisions on the maintenance control of possums at an operational level by developing a spatial model that links the behaviour of possums and managers to the impact of the pest. It also aims to develop a prototype system to collate information to support decision on budget allocations and priority-setting systems within DoC and to co-ordinate between agency planning on pest control.	Post-Border	Possums	Department of Conservation	490,000	Landcare	1999-2002
288	Measuring benefits of possum control using leafrollers	Possums through direct consumption and competition for leaves affect the larvae of native leafrollers. Their presence and density are readily measured and they may thus provide a cost-effective tool for measuring efficacy of possum control operation.	Post-Border	Possums	Department of Conservation	61,700	HortResearch	1999-2003
295	Calibration of possum monitoring using raised trap sets with the standard ground set protocol	At present possum abundance is determined by recording the numbers caught in a predetermined number of traps using a standard trap-catch protocol. This investigation will calibrate the commonly used methods for raised sets with the standard ground set method. The work will provide a calibration index that will convert raised set estimates of possum abundance with ground set estimates.	Post-Border	Possums	Department of Conservation	19,580	Canterbury Uni	1999-2000

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
329	Effectiveness of feratox and feracol for possum and rat control	In recent years there has been concern regarding the use of brodifacoum baits for possum control because they have been shown to contaminate food chains with native forests. DOC has identified two alternative pesticide baits that could be effective. These are Feratox and Feracol. This proposal outlines research aimed at providing information on the best practice and constraints when using these two pesticide baits.	Post-Border	Possums	Department of Conservation	60,000	Pest Control Research	2000-2003
359	Possum-specific gut transport mechanisms	The primary aim is to identify specific mechanisms that could be targeted in possums, either by new toxins or by new delivery systems, without risk of non-target effects on native birds.	Post-Border	Possums	Department of Conservation	50,000	AgResearch	2001-2003
140	Antifeedants and possum browsing	Predict the browsing patterns of brushtail possums in New Zealand forests based on antifeedant compounds present in the foliage of affected tree and shrub species.	Post-Border	Possums	FRST	28,000	Landcare	2000-2001
155	Optimising aerial control of possums	To summarise and integrate past research on effectiveness, efficiency and safety of aerial 1080 control of possums; to determine how this is affected by seasonal availability of natural food and to assess alternative formulations of bait to help combat bait shyness	Post-Border	Possums	FRST	33,750	Landcare	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
156	DNA Typing for identification and monitoring of pests	Using DNA technology to Improve estimates of population abundance and population dynamics of possums	Post-Border	Possums	FRST	120,000	Landcare	2000-2001
202	Measurement of Contact Rates between Possums	By directly measuring contacts between possums in the wild, this programme will improve the utility of epidemiological models on which the planned biological control of possums is based.	Post-Border	Possums	FRST	100,000	Auckland Uni	2000-2002
447	Improved protection of native plants from herbivory	Improve protection of native flora, through better understanding and management of herbivory by introduced mammals. To include: Determine the medium-term benefits (7-8 years) after possum control by measuring the ongoing responses in forest canopy cover. Determine the ability of anti-feedant chemical levels in foliage to predict variability in possum damage to native forests.	Post-Border	Possums	FRST	381,000	Landcare	2000-2002
161	Possum fertility control - product research and development	To develop fertility control baits for possum management	Post-Border	Possums	Landcare	475,000	Landcare	2000-2001
374	Competence of Possums as a Disease Reservoir	An evaluation of the Brush Tail possum as a vertebrate host of Ross River and Barmah Forest Viruses	Post-Border	Possums	Ministry of Health	Unknown	To be confirmed	2001-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
163	Trial calibrating bait interference methods with trap-catch as a means of assessing residual possum population in highly mixed vegetation/land use		Post-Border	Possums	Regional/local govt.	40,000	Consultants	2001-2002
174	Various studies on topics related to possum control	Development of new toxins. Development of biological control methods. Development of delivery systems for toxins and biological control agents.	Post-Border	Possums	Regional/local govt.	5,000	Unknown	2000 - Ongoing
335	Social acceptability for the various control options for stoats	Research into the social acceptability of the various control options for stoats has been identified as a priority area for stoat research funding. Our research will determine the social acceptability of new stoat control techniques, as well as the acceptability of existing trapping and poisoning techniques.	Post-Border	Public behaviour	Department of Conservation	150,000	Landcare	2000-2003
125	Pest-proof fencing for rural indigenous forest protection	To develop, test and produce one or more fence designs capable of effectively excluding all (the sizeable majority) of the environmentally significant vertebrate pests when constructed on the margins of indigenous bush	Post-Border	Restoration Research	MfE	Unknown	Natural Logic	not specified

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
280	An assessment of the risks of the Talon baiting	This project directly evaluates the tendency of brodifacoum to pass through the food web and the proportion and extent of contamination of wildlife species.	Post-Border	Risk assessment	Department of Conservation	17,500	Landcare	1999-2000
312	Border control for ecological weeds	Assessing the risk to indigenous biota of new exotic plant taxa and genetic material not yet in New Zealand	Post-Border	Risk assessment	Department of Conservation	2,500	Landcare	1999-2000
328	Fish management with rotenone - an ecological risk assessment and review of toxicity data.	Although rotenone has been used for fish management in NZ, little data is available on the potential sensitivities of native fishes and invertebrates. This project will review all available data on rotenone toxicity to aquatic invertebrates, fishes, wildfowl and humans as a basis for an ecological risk assessment of the use of rotenone in bait or crude form for noxious fish management in NZ	Post-Border	Risk assessment	Department of Conservation	6,375	Waikato Uni	1999-2001
333	Comparative risk assessment of vertebrate pesticides	To date there has been no ranking of the relative risk of each rodenticide to humans, non-target wildlife, or the environment as a whole. Choice of poisons to be used, discontinued, or rejected (new poisons) by DOC needs to be underpinned by a national selection process.	Post-Border	Risk assessment	Department of Conservation	7,500	Landcare	2001-2002
197	Ecosystem Change Processes and their Management	Our goal is to provide the knowledge necessary to predict the effects of global change, ecosystem management, new or unwanted organisms on our productive sector environment	Post-Border	Risk assessment	FRST	1,292,000	AgResearch	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
220	Environmental Impacts of New Technologies	New biologically-based technologies are under development in New Zealand. The goal of this programme is to predict the impact of new technologies on physical and biological resources, thereby assuring their safety and public acceptance. This programme will develop a risk assessment and system modelling approach to environmental impact assessment, which will highlight key knowledge gaps and potential areas of impact.	Post-Border	Risk assessment	FRST	1,194,000	AgResearch	2000-2002
466	Vulnerability and resilience of native grassland to exotic organisms.	Predict and mitigate threats to biodiversity in native grassland ecosystems, by assessing impacts of introduced biocontrol agents, and through inventory of invertebrate and microbial fauna/flora.	Post-Border	Risk assessment	FRST	802,000	AgResearch	2000-2002
2	Investigation of the suitability of NZ forest flora for reproduction and development of Lymantriid species	Assess the susceptibility of key elements of NZ's indigenous forest flora to two or more Eurasian Lymantriids, and provide an assessment of the risks posed by these defoliators.	Post-Border	Risk assessment	Ministry of Agriculture and Forestry	75,000	To be confirmed	2001-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
30	Survey of the health status of New Zealand wildlife	Survey of nominated wild avian and freshwater finfish species will be conducted to determine baseline health status for nominated diseases. Future surveys could then be carried out to reveal trends in the health status of our wildlife for use in the development of import risk analysis.	Post-Border	Risk assessment	Ministry of Agriculture and Forestry	200,000	to be arranged	2001-2002
377	Impacts of unwanted organisms and disease outbreaks	Impacts on tourism, lifestyle and other intangibles that are currently not assessed in the Cost Benefit Analysis of incursion impacts.	Post-Border	Risk assessment	Ministry of Health	Unknown	To be confirmed	2001-2002
78	Advice in preparation of plant pest management strategy	Evaluation of weed potential for spp. Included in strategy	Post-Border	Risk assessment	Regional/local govt.	Confidential	NIWA	2000-2001
170	High Value Areas Identification and Assessment	Developing data collection methods, data bases and analytical tools to identify areas of Southland which have specific values which are or could be adversely impacted on by pests.	Post-Border	Risk assessment	Regional/local govt.	60,000	Regional/local govt.	2001-2004
429	New tools for Biosecurity Risk Assessment	Provide new knowledge-based tools, methodologies and information to reduce the threats from establishment of unwanted plant pests and diseases, and help to contain those pests and diseases which have already become established.	Post-Border	Risk management	FRST	1,000,000	HortResearch	2000-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
430	Modelling, Risk Management & Policy	Quantitative modelling of biophysical processes, bioremediation technologies and biosecurity threats will be integrated into a suite of Dialogue and Decision Support systems (D2S2) for development of innovative production and protection systems, management of risks, and the development of protocols and policy for the sustainable management of productive-sector environments.	Post-Border	Risk management	FRST	400,000	HortResearch	2000-2002
185	Economic assessment of a number of plant and animal pest management strategies		Post-Border	Risk management	Regional/local govt.	14,000	Consultants	1999-2000
218	Improved management of tourism flows and effects	To develop an enhanced procedure for monitoring tourist movement in detail and to deliver an enhanced understanding of tourist movement at the meso and micro scales around New Zealand so that specific tourist effects can be better predicted.	Post-Border	Risk pathways	FRST	108,000	Lincoln Uni	2000-2002
292	Seasonal differences in bait take by rats following aerial 1080	Currently little is known of any seasonal differences in bait take by rats following aerial 1080 operations. Timing the possum control operations to maximise the by-kill of rats and to coincide with the breeding season of most forest birds could produce greater conservation gains.	Post-Border	Rodents	Department of Conservation	6,000	Department of Conservation	1999-2003

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
296	Alternative anticoagulants for rodent control	Recent data has shown that a number of non-targets (including game species and rare birds) have been contaminated with brodifacoum, through either directly consuming baits, or indirectly, through secondary poisoning. This investigation will focus on developing a safe non-anticoagulant toxicant to use alongside a safer slow-acting anticoagulant toxicant and determining the comparative retention times for four currently-used anticoagulants.	Post-Border	Rodents	Department of Conservation	90,000	Landcare	1999-2002
357	Developing tools to detect recent rodent invasions on islands		Post-Border	Rodents	Department of Conservation	40,000	Department of Conservation	2000-2002
449	Improved protection of pastures from rabbits.	Define further the epidemiological and ecological behaviour of rabbit haemorrhagic disease (RHD), and determine the optimal way to integrate its effects with conventional rabbit control.	Post-Border	Rodents	FRST	600,000	Landcare	2000-2002
179	Understanding RHD		Post-Border	Rodents	FRST and Regional/local govt.	100,000	Landcare	2000-2003
167	Monitoring the effects of RHD	Sampling and monitoring rabbit populations in specified areas of Southland to determine the impacts of Rabbit Haemorrhagic disease	Post-Border	Rodents	Regional/local govt.	30,000	Regional/local govt. and Landcare	2000-2003

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
478	Improve the effectiveness of warfarin bait to control rodents	Not given	Post-Border	Rodents	Technology NZ and Feral Control	50,000	unknown	2001-2002
336	Gotcha electronic trap system	This electronic trap system has been developed in an attempt to provide an efficient trapping system. There are 2 models - one a live trap the other a kill trap.	Post-Border	Traps	Department of Conservation	10,000	Gotcha traps	2000-2001
344	Develop a prototype kill-trap for stoat control	We propose to develop a new prototype kill-trap that will halve costs, kill effectively and be more compact so that less labour is required to locate and set them in the field.	Post-Border	Traps	Department of Conservation	5,000	Pest Control Research	2000-2001
349	Development of an automatic multiple kill trap for stoats	Traps still offer a non-toxic control alternative especially when and where poisons are not effective or environmentally acceptable. The basic killing system that has already been developed as a prototype, now needs to be optimised for capturing and killing stoats.	Post-Border	Traps	Department of Conservation	30,000	Lincoln Uni	2000-2001
74	Bulldog, a new kill trap for animal pests	Research and development of a new multi-kill trap capable of up to ten kills without resetting. The trap will meet requirements concerned with mitigating animal suffering	Post-Border	Traps	Department of Conservation and Lincoln Uni	30,000	Lincoln Ventures	2000-2001
153	Novel mechanical pest control tools	Complete final development and optimisation of the Bulldog Trap	Post-Border	Traps	FRST	17,000	Landcare	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
73	Bulldog, a new kill trap for animal pests	Research and development of a new kill trap that is highly effective (high kill rate) and meets requirements concerned with mitigating animal suffering.	Post-Border	Traps	Lincoln Uni	Unknown	Landcare and Lincoln Ventures	2000-2001
176	"Control of Chilean Needle Grass"	Booklet for land occupiers outlining biology of Chilean needle grass and control options.	Post-Border	Weeds	AGMARDT	Unsure	AgResearch	2000-2002
393	An integrated weed management approach to the control of Chilean needle grass in Hawke's Bay.		Post-Border	Weeds	AGMARDT	Unknown	Hawkes Bay Chilean Needlegrass Group	2001-2002
398	Managing the threat of invasion from nassella tussock		Post-Border	Weeds	AGMARDT	Unknown	Post-doc	2001-2002
313	Pampas grass control strategy and techniques for difficult habitats	A comprehensive review of pampas control techniques being used by the Department and Regional Councils. The results of the review will be used to assess which techniques provide best results and to identify any future research needs.	Post-Border	Weeds	Department of Conservation	39,500	Department of Conservation	1999-2001
274	Weed eradication programme on Raoul Island, Kermadec Islands Nature Reserve: Scientific review	The current eradication plan has a systematic approach and targets 13 species as top priorities for eradication.	Post-Border	Weeds	Department of Conservation	3,500	Department of Conservation	1999-2002

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308	Hieracium Control Trust	DOC has since 1995 made an annual grant to the Hieracium Trust, a trust administered by South Island Federated Farmers to support research on biological and other means of control of hawkweeds.	Post-Border	Weeds	Department of Conservation	10,000	Heiracium Trust	1999-2001
311	Information transfer for weeds	To provide advice and assistance to the public and others in the Department of Conservation on weed issues.	Post-Border	Weeds	Department of Conservation	36,000	Department of Conservation	1999-2006
314	Development of a protocol for monitoring of weed control	Protocols for outcome monitoring of animal pest control need to be extended to weed control. Cost effectiveness and achievements are being measured and these will lead to a best-practice protocol for measuring effectiveness of control.	Post-Border	Weeds	Department of Conservation	75,000	Department of Conservation	1999-2001
315	Broom control performance monitoring, for western Ruapehu	As a surrogate for measuring the effectiveness of control of a range of weeds, isolated patches of broom in the Tongariro National Park are being monitored to assess whether they are captured by the control regime.	Post-Border	Weeds	Department of Conservation	Unknown	Department of Conservation	1999-2000
316	Development of a national weeds database	There is no nationally accessible resource for assessing the potential impact of weeds on conservation values and learning about best practice for their control. The database will enable intranet access to best-practice information.	Post-Border	Weeds	Department of Conservation	96,180	Department of Conservation	1998-2001

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317	Development of an ecological weeds surveillance plan	A surveillance plan will enable the early detection of new weed invasions to improve the chance of effective control and minimise the impact on conservation values.	Post-Border	Weeds	Department of Conservation	49,500	Department of Conservation	1999-2001
318	Best weed management practices for use of herbicidal gels	Research to date has taken the cut stem concept from an idea through to a practical weed management tool. The excellent results to date give confidence that effective herbicidal gels used with a range of non-spray techniques can be determined for killing an extended range of weed species and vegetation types.	Post-Border	Weeds	Department of Conservation	120,000	HortResearch	1999-2003
323	Weed risk assessment within New Zealand	This proposal attempts to refine existing WRA models, and to incorporate recent work on invasiveness in two submodels dealing with a range of life form/functional groups of plants.	Post-Border	Weeds	Department of Conservation	15,000	Landcare	1999-2001
355	Experiments to detect the effects of weeds and weed control on plant biodiversity.	DOC undertakes weed control work on the assumptions that the weed is having an impact, and that our management will create a desirable response in the native community. Experimental work provides the best evidence of a cause and effect relationship.	Post-Border	Weeds	Department of Conservation	45,000	Department of Conservation	2001-2003
362	Factors causing vulnerability of ephemeral wetlands to weed invasion	to be developed	Post-Border	Weeds	Department of Conservation	22,000	Department of Conservation	2001-2002

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363	Managing forest edges to reduce invasive weed entry	New Zealand protected natural areas are under siege from weeds. The intactness of the edge and the type of adjacent vegetation is therefore likely to be of particular importance for weed invasion of reserves. Appropriate vegetation adjacent to the edge may buffer against weed invasions, slowing or halting the egress of weeds into the reserve core.	Post-Border	Weeds	Department of Conservation	41,000	Landcare	2001-2003
364	Effectiveness of weed monitoring	To be developed	Post-Border	Weeds	Department of Conservation	75,000	Department of Conservation	2001-2003
195	Invasive Weeds	This programme uses comparative and experimental techniques to determine the characteristics of woody and lowland invasive weeds in New Zealand, the properties that make selected natural lowland ecosystems prone or resistant to weed invasion, and the impacts of gorse, wild ginger and Tradescantia on indigenous biodiversity and ecosystem function.	Post-Border	Weeds	FRST	1,456,000	Landcare	2000-2001
84	Submerged aquatic weeds in Waitaki Valley	Surveillance plan for weeds	Post-Border	Weeds	Meridian Energy	Confidential	NIWA	2000-2001
127	Guidelines for non-spray applications of herbicides and mycoherbicides	This project will provide guidelines for land managers to sustainably manage invasive weeds in native ecosystems	Post-Border	Weeds	MfE	Unknown	Regional/local govt.	not specified
85	Weeds in the Waikato Hydro-lakes	Potential new weeds/management strategies	Post-Border	Weeds	Mighty River Power	Confidential	NIWA	1999-2002

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
75	Manchurian wild rice control	Control options and impacts of control on environment	Post-Border	Weeds	Regional/local govt.	Confidential	Regional/local govt. and NIWA	1999-2001
76	Management Plans for High Priority Plants		Post-Border	Weeds	Regional/local govt.	Confidential	NIWA	2000-2001
77	Management of egeria in Lake Taupo	New weed incursion in lake	Post-Border	Weeds	Regional/local govt.	Confidential	NIWA	2001-2002
79	Ceratophyllum in Wairarapa	New weed incursion in region	Post-Border	Weeds	Regional/local govt.	Confidential	NIWA	2000-2001
80	Evaluation of potential new weeds	Weed risk assessment of new spp. found in Auckland	Post-Border	Weeds	Regional/local govt.	Confidential	NIWA	2001-2002
81	Advice to Biosecurity Section	Advice on species in RPMS	Post-Border	Weeds	Regional/local govt.	Confidential	NIWA	2000-2001
82	Advice to Biosecurity Section	Advice on species in RPMS	Post-Border	Weeds	Regional/local govt.	Confidential	NIWA	
83	Management of egeria in Avon River	New weed incursion in river	Post-Border	Weeds	Regional/local govt.	Unknown	NIWA	1999-2001
168	Pest Plant Impacts	Developing data collection methods, data bases and analytical tools to measure and monitor pest plant impacts in Southland	Post-Border	Weeds	Regional/local govt.	60,000	Regional/local govt.	2001-2004
172	Pest Plant Monitoring	To develop methodologies to determine whether policy objectives are being met for pest plants	Post-Border	Weeds	Regional/local govt.	Unknown	Unknown	2000-2001

Project no	Title	Description of Project	Meta-Category	Sub Category	Funder(s)	Cost (\$)	Provider(s)	Year
177	Biology of Chilean Needle Grass and possible control methods	Research into reproductive system of Chilean needle grass and how this relates to current control methods and implications for future control methods.	Post-Border	Weeds	Regional/local govt.	4,000	AgResearch	2000-2002
178	Ecology of <i>Nasella tussock</i>		Post-Border	Weeds	Regional/local govt.	60,000	AgResearch	2000-2003
180	Monitoring systems for plant pests		Post-Border	Weeds	Regional/local govt.	63,000	Landcare	2001-2002
183	Impact of wild Thyme, egeria, boneseed in Canterbury		Post-Border	Weeds	Regional/local govt.	4,000	Landcare	1999-2000
184	Impact of wilding conifers in Canterbury		Post-Border	Weeds	Regional/local govt.	2,000	Consultants	1999-2000
468	Chemical control of hornwort	To test the herbicide 'Endothall' for control of the weed hornwort.	Post-Border	Weeds	Regional/local govt. and NIWA	18,000	NIWA	2000-2001
360	Biological monitoring of worker 1080 exposure levels	DOC has developed standard operating procedures for this work and further monitoring is now required to ensure that these procedures have consistently reduced the 1080 exposure risk.	Post-Border	Worker safety	Department of Conservation	51,500	Landcare	2000-2003

