

Draft for comment

Forest Biosecurity Research Council Research Strategy

February 2005

Prepared by FBRC Research Strategy Subcommittee

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FOREST BIOSECURITY RESEARCH COUNCIL

The biological and economic risks that insect pests and diseases pose to New Zealand forestry and trade in wood products have increased significantly in the last decade with the expansion of trade and tourism. New Zealand has had to deal with xx new insect incursions in the last five years alone, at a cost in excess of \$xx million, and pitch canker has spread from Mexico and the SE USA to California, South Africa, Chile, and Spain. Greater research efforts are required to protect New Zealand's forests and wood products trade from this increased risk.

The Forest Biosecurity Research Council (FBRC) was established in August 2004 as an unincorporated JV between the New Zealand Forest Owners Association, Ministry of Agriculture and Forestry, NZ Forest Research Institute, Lincoln University (representing the Bio-protection CORE), and the Forest Health Research Collaborative. The Mission of the FBRC is to protect and improve the health of New Zealand's forests and wood export trade by developing a forest biosecurity research strategy, raising funds, and managing research programmes. The objectives of the FBRC are to:

- Establish a forest biosecurity research, science & technology strategy
- Manage the implementation of the strategy
- Obtain funding to enable Research Projects to be undertaken as, and when, required;
- Share information and findings from Research Projects with all Members and, where appropriate, the wider forestry sector and the general public of New Zealand;
- Provide effective management of research programmes

The scope of the FBRC is New Zealand forestry, including commercial plantations, indigenous forests and urban forests. The major focus is currently on research into invertebrate pests and diseases of commercial plantation forestry including trade (phytosanitary issues mainly overcoming unjustified phytosanitary barriers and reducing compliance costs), reflecting both the stakeholders main interests as well as the current funding sources. However, indigenous and urban forestry is still considered to be very important, as are related aspects of commercial plantation forestry such as nutrition, weeds, and vertebrate pests. The scope is described in the diagram (Figure 1)

This document meets the first objective of FBRC, which is to develop a research strategy.

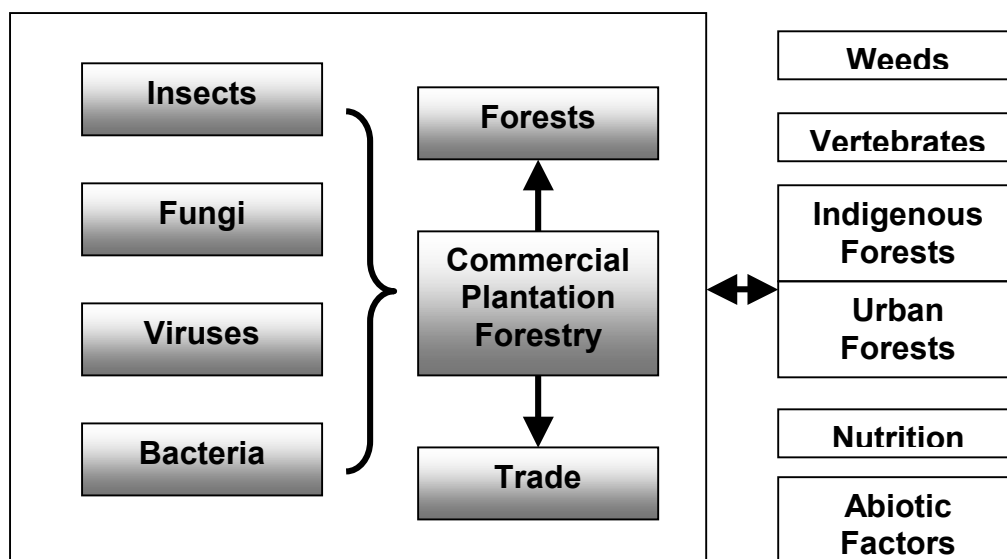


Fig. 1. Main focus of FBRC is pests and diseases of commercial plantation forestry but also it considers other aspects of forestry that impact on biosecurity and health.

FBRC RESEARCH STRATEGY

The strategy is a living document that has been developed in consultation with a wide range of stakeholders. Those who have contributed are listed in Appendix 7. The Research Strategy has a five-year focus. An Operating Plan is to be produced annually, which basically indicates how the Research Strategy is to be implemented (see Appendix 1 for the Current Year's Operating Plan).

The strategy is organised in the following hierarchy:

1. Goal
- 1.1 Objective
- 1.1.1 Project Area

Projects are identified in the Operating Plan.

The Scope for the Research Strategy is the same as the Scope for FBRC.

PURPOSE OF THE RESEARCH STRATEGY

The purpose of the Research Strategy is to provide a framework to ensure that effective biosecurity research is conducted to meet the needs of New Zealand forestry. The Research Strategy will be used as a guide to prioritise research, source funding, manage research, and provide confidence to investors that the biosecurity risk is being effectively addressed. A key purpose is to identify knowledge gaps that limit our ability to deal with pests and diseases.

FBRC RESEARCH STRATEGY GOALS

The FBRC has identified three major goals to be addressed in this research strategy.

1. Healthy forests
2. Safe wood products trade, and
3. Resource and capability management

Each goal contains a number of Objectives that need to be addressed to achieve the Goal. The Objectives are broken into Project Areas and the Operating Plan lists the actual Projects. The current year's Operating Plan is included in Appendix 1.

Goal 1 – Healthy forests

The goal is to maintain, or even enhance, the health of New Zealand's forests. New Zealand plantation forests, native forests, and urban forests are under increasing threat from invertebrate pests and diseases as trade and travel expand. In the last several decades New Zealand has experienced serious invasions of a number of insects and fungi, some of which have not been eradicated and are having a serious economic impact on the economy as well as on social and environmental values. For example *Dothistroma* has now been established in New Zealand for over 50 years and the only option available to commercial plantation forestry is to drift spray pine forests with low levels of copper fungicide. While this has significant costs the presence of the fungus has also greatly limited the variety of tree species that can be planted in New Zealand. More recently we have experienced incursions of the white spotted tussock moth, painted apple moth, Asian gypsy moth, Dutch elm disease, fall webworm, and gum leaf skeletoniser to name some of the more prominent pests. After several very expensive aerial spray campaigns most of these incursions have now been eradicated, but some continue to cause problems and management plans have been put in place to deal with them. While *Dothistroma* is mainly a problem for pine forests, the other insects and fungi listed above are also a threat to native forests and urban tree plantings.

Healthy commercial plantation forests will not only lead to greater profitability in the long term, but will enhance investor confidence in the short term. Healthy indigenous and urban forests will enhance non-economic as well as economic values including tourism and quality of life. Research to achieve this goal may also reduce trade barriers if pests and diseases are eradicated when possible and controlled and distribution understood when not possible. Research will also reduce crop impacts and management input costs by developing smarter ways of managing health problems.

This goal contains a number of research objectives that cover both onshore and offshore threats and also research to enhance the resilience of our forests.

Objective 1.1 Understanding offshore threats

Purpose – To identify and assess the economic, social, and ecological risk from pests and diseases not present in New Zealand and to prioritise these risks to help determine research priorities.

1.1.1 Project area – Identifying potential pest threats

Definition: Covers insects pests and fungi as well as other classes of micro-organisms (e.g., bacteria, viruses, mycoplasmas) currently not in New Zealand. Research focuses on identifying major threats and understanding them in order to prevent them entering New Zealand or dealing with them should they arrive.

1.1.2 Project area – Identifying pest and pathway risk assessments

Definition: Covers pathways by which organisms may reach New Zealand, including seed imports, passenger travel, used cars and machinery, containers, wind blown, etc. Research focuses on assessing risk and ways to reduce risk.

1.1.3 Project area – Pest impact assessments

Definition: Covers the likely impact of pests not currently in New Zealand. Research focused on economic, social, and environmental impact as well as the more direct biological impact of a pest.

1.1.4 Project area – Ecosystem vulnerability

Definition: Covers research on the vulnerability of New Zealand forest ecosystems to overseas pests and diseases.

Objective 1.2 Detections and identification of new pests

Purpose - To provide early detection of pests and diseases in order to increase response options and limit impact. Technologies can be applied in other objectives.

1.2.1 Project area – New detection technologies

Definition: Covers new technologies that can be developed, and/or deployed to improve the ability to detect insects and fungi (etc) at the border or post-border.

1.2.2 Project area – Attractants and lures

Definition: Covers the development of, and/or on the deployment of insect attractants and lures, including synthetic pheromones to determine the presence of insects of concern.

1.2.3 Project area – Surveillance, sampling methods and technology

Definition: Covers the development of, and/or the application of surveillance and sampling technology to detect insects and fungi. Includes, for example, the application of airborne or satellite-based spectral imagery as well as the development of new sampling strategies.

1.2.4 Project area – Taxonomic keys

Definition: Covers the development of new taxonomic keys for identification of new organisms

1.2.5 Project area – Molecular diagnostic methods

Definition: Covers development and/or the application of molecular diagnostic tools for the identification of organisms considered a biosecurity threat.

1.2.6 Project area – Species baselines – knowing what's here

Definition: Covers research to understand pests already in New Zealand with regard to threats that we might have missed.

1.2.7 Project area – Modelling detection patterns and spread

Definition: Covers the development of forensic tools and models to assist in determining where a new detection has come from.

Objective 1.3 Incursion response

Purpose - To be prepared for new incursions of pests and diseases and minimise their impact through effective response.

1.3.1 Project area – Ecology, phenology/population dynamics of new pests and diseases

Definition: Covers research on the ecology, phenology/population dynamics of new pests and diseases required to understand the potential spread, the pattern of development, and impact of the organism and to provide information to augment control options. Includes specific technologies and case studies.

1.3.2 Project area – Efficacy of treatments

Definition: Covers research on the effectiveness of treatment technologies on new incursions of insect and fungi.

1.3.3 Project area – Aerial application

Definition: Covers research on the development and/or deployment of aerially-based treatment technologies that may be applied in an incursion response.

1.3.4 Project area – New technologies

Definition: Covers research on new technologies that may be applied in an incursion response that are not covered in other project areas.

1.3.5 Project area – Community interaction.

Definition: Covers research on social reaction to biosecurity issues including spraying.

Objective 1.4 Manage impact of current pests and diseases

Purpose – To reduce the impact of current pests and diseases on New Zealand forests and associated values.

1.4.1 Project area – Pest impact assessments

Definition: Covers research on the economic, social, and ecological impact of existing pests and diseases.

1.4.2 Project area – Biological control

Definition: Covers research on the development of biological control technologies to assist with the management of existing pests and diseases.

1.4.3 Project area – Management and control methods

Definition: Covers research on management and control technologies to deal with current pests and diseases, except for biological control and resistance, which are covered separately.

Objective 1.5 Improved tree and forest resistance

Purpose – To improve the resistance of New Zealand trees and forests to pests and diseases, both endemic and offshore, in order to reduce potential impacts.

1.5.1 Project area – Tree and forest treatments

Definition: Covers research and treatments that can be applied to trees (at all stages) or forests that can lead to improved resistance to pests and diseases.

1.5.2 Project area – Breeding and genetic modification linkages

Definition: Covers linkages to research on breeding and genetic modification that is designed to improve tree and forest resistance to pests and diseases.

Objective 1.6 Abiotic disorders and vertebrates

Purpose – To understand the biosecurity-related impacts of abiotic disorders on New Zealand forestry, including tree physiology (e.g., UMCY), wind, fire, and climate change; and the impact of vertebrates and weeds on New Zealand forestry.

1.6.1 Project area – Wind linkages

Definition: Covers linkages to research on wind damage that may have implications to biosecurity issues. For example, wind damage may make trees more vulnerable to fungal damage.

1.6.2 Project area – Physiological linkages

Definition: Covers linkages to research on physiological aspects that may have implications to biosecurity issues. For example, nutritional imbalances may make trees more susceptible to insect attack, or prolonged wet periods may result in a physiological reaction by the tree.

1.6.3 Project area – Vertebrate pest management linkages

Definition: Covers linkages to research on vertebrates that may have implications to biosecurity issues. For example, animal grazing damage may make trees more susceptible to fungal attack.

1.6.4 Project area – Weed linkages

Definition: Covers linkages to research on weeds that may have implications to biosecurity issues. For example, weed competition may make trees drought stressed and more susceptible to insect attack.

Goal 2 – Safe and profitable wood products trade

New Zealand's export trade in wood products totals approximately \$3 billion/year and is expected to grow substantially as the annual plantation harvest increases as the country's 1.8 million ha of plantation forest matures. Currently there are many trade restrictions already in place and more are in the pipeline as the world becomes increasingly anxious about protecting natural forest ecosystems. For example, pine wilt nematode (PWN) caused considerable problems for Canadian export lumber to Europe and Asia eventually necessitating that all lumber exports be kiln dried to prevent the spread of this pest. The new international wood packaging standard recently implemented will necessitate all wood packaging for export purposes, including pallets, be heat treated or fumigated before use.

A major threat to New Zealand is the imposition of greater restrictions on log exports to major trading partners. Currently logs require methyl bromide or phosphine treatment prior to export, primarily to control insect pests. However, should pitch canker, for instance, establish in New Zealand log exporters could be faced with even more serious challenges if countries currently free of pitch canker impose requirements to guarantee pitch canker free logs prior to export. New Zealand may also experience similar restrictions on log and lumber exports should pine wilt nematode become established.

Pests and diseases threaten safe and profitable wood products trade because of restrictions that may be imposed by importing countries if New Zealand hosts pests and diseases that are considered a threat to their forests. This goal focuses research on ensuring that we understand the risks to trade and take measures to minimise the risk.

Objective 2.1 Phytosanitary treatments

Purpose – To improve our ability to detect pests and diseases on trade products and related goods and to treat goods to reduce or eliminate hazardous organisms to meet trading partner or international requirements

2.1.1 Project area – Detection technologies

Definition: Covers the development and/or application of new technologies for detecting insects or fungi (etc) on export products or related material (e.g., packing).

2.1.2 Project area – Treatment technologies

Definition: Covers the development and/or application of new technologies to treat log and wood product exports to eliminate pests and diseases.

2.1.3 Project area – System approaches

Definition: Covers research on the development of systems that if deployed will reduce the threat of pests and diseases on wood exports. An example is a system approach to reduce sapstain fungal contamination.

2.1.4 Project area – Pest threats to trading partners

Definition: Covers research on the threat of pests to trading partners. This covers real as well as perceived threats.

Goal 3 – Resource and capability management

New Zealand needs to maintain capability in biosecurity research in order to effectively deal with any incursions and also to conduct investigations on potential threats in order to minimise the risk should they arrive in New Zealand. It is also important that we maintain adequate diagnostic capability and support the associated databases. This Goal also contains objectives to ensure effective technology transfer and communication of research results.

For the last several decades New Zealand has realised the need to build and maintain scientific and technical capability, and the corresponding resources, to deal with biosecurity risks. This capability is constantly being called upon to deal with new incursions as well as to manage existing pests and diseases. The challenge is to get the right balance and mix of skills to match New Zealand's needs. We also have the opportunity to collaborate and tap into overseas expertise, especially for limited skills and resources.

We also have to be aware that technology is rapidly changing and new skills and tools are becoming available to help us combat new and existing threats. Therefore, part of the strategy is to keep up with new developments and identify how new technologies can be most effectively applied in New Zealand.

Objective 3.1 Capability management

Purpose – To maintain diagnostic capability, including databases and collections, and also the maintenance of critical scientific skills to address current and future research needs in forest biosecurity.

3.1.1 Project area – Databases and collections

Definition: Covers the development and maintenance of databases and collections required to underpin biosecurity efforts.

3.1.2 Project area – Critical skills maintenance

Definition: Covers efforts to ensure that New Zealand maintains a critical balance of skills to reduce the risk of pest and disease incursions and to deal with existing organisms.

Objective 3.2 Resource use

Purpose – To ensure that a prioritisation process is in place, that the process is in place to secure ongoing funding, and that there is a balanced research programme.

3.2.1 Project area – Prioritisation processes

Definition: Covers the effort to prioritise research.

3.2.2 Project area – Funding

Definition: Covers the effort to ensure ongoing research funding.

3.2.3 Project area – Balancing investment

Definition: Covers the effort to ensure a balanced investment portfolio to prevent any significant research gaps.

Objective 3.3 Technology implementation and extension

Purpose – To communicate research findings from FBRC to stakeholders and more general audiences in order to ensure continued support and relevance, and to maintain linkages with other key.

3.3.1 Project area – Technology implementation

Definition: Covers the transfer of research findings, including the development of tools, to end-users. The Forest Health Research Collaborative will play a major role in this project area.

Objective 3.4 Programme management

Purpose – To provide appropriate administration and management in FBRC and to ensure successful communication and promotion of research activities and results.

3.4.1 Project area – Administration and management

Definition: Covers costs associated with providing administration and management to FBRC.

3.4.2 Project area – Communication and promotion

Definition: Covers communication and promotion of the activities of FBRC, rather than communication of specific research project results.

STRATEGIC PRIORITY ASSESSMENT

Process for Setting Priorities

High-level goals have been established by the FBRC to guide research programmes. These are unlikely to change substantially with time. Objectives and Project Areas, as well as specific projects contained in the annual Operating Plan, will evolve as problems are solved, new knowledge and information comes to hand, and new risks and threats are identified.

An assessment of strategic priorities has been undertaken by the Research Strategy subcommittee in consultation with all members of the FBRC (in process) and other stakeholders (in process) to identify gaps in the existing research programme. The process followed was for the subcommittee to first identify what they believed were strategic priorities at the Project Area level and additional stakeholders were (and are) asked to comment. An additional step will be to identify specific projects within the Project Areas that require more research effort. This will be done as part of the Process for Setting the Annual Work Programme.

The intention is to review the FBRC strategy every two or three years, depending on perceived need, and to then consult with stakeholders, including industry, Government (MAF), funding organisations and research providers regarding any change to strategic priorities. Key communication linkages for forest biosecurity research are included in [Appendix 4](#). Current knowledge of key pests and diseases is referenced in [Appendix 6](#).

Process for Setting the Annual Work Programme (Operating Plan)

The process for setting priorities follows (due to timing - a modified process will be used for 1 July 2005 funding¹). Should the process for setting the annual work programme covered below identify a shortfall in funds for high priority research

¹ Funding process for 1 July 2005 will simply be:

- (i) Research priority ideas canvassed at 1 Mar 2005 workshop
- (ii) FBRC administrator collates suggestions into a format for FBRC to review
- (iii) FBRC develops RFPs for finalising at FBRC meeting 20th April 05
- (iv) RFPs circulated and proposals received before 30 May 05
- (v) FBRC makes decisions on proposals at 15 June 05 meeting for funding 1 July

projects, the FBRC will develop a plan to raise these funds. Potential funding sources are listed in [Appendix 8](#).

Timetable

Step	Action	Approx. date
1.	Sub-committee reviews programme for the following year (i.e. July 1 of next year) in terms of ongoing commitments, research priorities and balance factors. Recommendations are made on priority funding areas and circulated to members and providers for comment.	October 31
2.	Review feedback from end-user/providers and send out call for proposals with revised priority guidelines. Also send out proposal template, (see Research Proposal.doc). <i>Note: Proposals for funding in the subsequent financial year (i.e. 18 months hence will also be considered). The advantage of this longer-term view is to enable a more definite strategy for targeting proposals for funding from other sources e.g. SFF, SMF</i>	December 15
3.	Deadline for submission of proposals	January 31
4.	FBRC Administrator sends copies of proposals to FBRC research sub-committee for appraisal.	February 7
5.	FBRC research sub-committee assesses all proposals and submits recommendations to sub-committee chair. <i>(Note: this timing would normally include the MAF/FOA Workshop and would be a good time to discuss overall research directions, current projects, and balance factors.)</i>	February 28
6.	FBRC sub-committee meet to discuss recommendations (consideration of balance factors, co-funding requirements, alignment to research priorities, allocation of 2 FBRC reviewers).	March 16
7.	Seek clarification from applicants of points of concern, consult with other agencies if appropriate eg MAF.	March 31
8.	Sub-committee recommendations tabled at full FBRC meeting for approval and sign off.	April 15
9.	Applicants informed of decisions by FBRC Administrator.	April 30
10.	Successful applicants submit service agreement for signing (FBRC Services Agreement.doc) and work plan (Work Plan.doc). Administrator completes work sheet template (Work Sheet Template.doc) in consultation with Project Leader prior to entry of details into FOBIS.	May 16
11.	Service agreement signed off.	June 15

12. Projects commence.

July 1

[Appendix 3](#) includes a list of document templates available from FBRC.

It is intended to obtain a balanced research portfolio that covers priority research areas but also funds both short-term and long-term research and covers the range of research horizons from the very applied to the more innovative and higher risk programmes. [Appendix 5](#) provides information on the present mix of research programmes currently being funded by FRST, MAF, and industry.

Initial Strategic Priorities

The initial assessment of strategic priorities at the Project Area level was undertaken by the Strategy subcommittee, with further input from additional stakeholders (in process). Subcommittee members ranked Project Areas according to how they saw the need for more effort in these areas consider existing knowledge; management impacts, risk, and acceptability. The priority rankings are shown in the spreadsheets in [Appendix 2](#), both sorted by Project Area and sorted by priority, with highest ranking first.

The assessment indicates the following top 18 areas needing greater research effort:

- 1.4.3 - Management & control methods
- 2.1.1 - Detection technologies
- 1.2.5 - Molecular diagnostic methods
- 1.1.1 - Identifying potential pest threats
- 1.1.3 - Pest impact assessments
- 1.2.4 - Taxonomic keys
- 1.3.6 - Other treatments and new technologies
- 1.4.2 - Biological control
- 1.5.2 - Breeding & Genetic Modification linkages
- 2.1.2 - Treatment technologies
- 2.1.4 - Pest threats to trading partners
- 1.1.4 - Ecosystem vulnerability
- 2.1.3 - System approaches
- 1.4.1 - Pest impact assessments
- 1.1.2 - Pest and pathway risk assessments
- 1.2.1 - New border detection technologies
- 1.2.3 - Surveillance & Sampling methods/technologies
- 1.3.4 - Aerial application

APPENDICES

1. [FBRC 2004/2005 Operating Plan](#)
2. [Strategic priority assessment summary](#)
3. [FBRC templates](#)
4. [Key communication linkages](#)
5. [Current balance of research programmes](#)
6. [Current knowledge on key insects and diseases](#)
7. [List of contributors to Initial Research Strategy](#)
8. [Funding sources for biosecurity research](#)

Appendix 1 - FBRC 2004/2005 Operating Plan²

Goal 1 Healthy Forests

Objectives	Project Areas	Projects () = FRST milestone number	
1.1 Understanding offshore threats	1.1.1 - Identifying potential pest threats	1.1.1.1 F(4.8) Potential insect vectors of pine pitch canker	
		1.1.1.2 FOA Joint pine pitch canker project with CoRE (Rebecca Ganley)	
	1.1.2 - Pest and pathway risk assessments	1.1.2.1 F(1.8) Relevance of some invasion parameters on the establishment success of exotic pests	
		1.1.3 - Pest impact assessments	1.1.3.1 F(3.9) Bark beetles and rusts impact assessment
		1.1.4 - Ecosystem vulnerability	1.1.4.1 F(1.5) Nothofagus ecology and pest impact resistance
1.1.4.2 F(1.6) Understorey diversity and pest impact			
1.2 Detection and identification of Pests	1.2.1 - New detection technologies		
	1.2.2 - Attractants & Lures		
	1.2.3 - Surveillance & Sampling methods	1.2.3.1 FOA Improved surveillance methodologies (Andrew Dunningham)	
		1.2.4 - Taxonomic keys	
	1.2.4.1 F(3.10) Taxonomic methods and descriptions of forest fungi		
	1.2.5 - Molecular diagnostic methods		
	1.2.6 - Species baselines - know what is here		
	1.2.8 - Modelling detection patterns & spread		
1.3 Incursion Response	1.3.1 - Ecology, phenology/population dynamics of new pests		
	1.3.3 - Efficacy of treatments	1.3.3.1 F(2.10) Btk efficacy against lymantriids	
		1.3.3 - Aerial application	
	1.3.4 - New technologies	1.3.4.1 F(2.8) Incursion response modelling	
	1.3.6 - Community interaction	1.3.5.1 F(2.6) Community dialogue in incursion response	
		1.3.6.1 F(2.11) Guide to future research in community interaction	

² See www.fbrc.org.nz for more details

Objectives	Project Areas	Projects () = FRST milestone number
1.4 Manage Impacts of Current Pests	1.4.1 - Pest impact assessments	1.4.1.1 F(3.6) Pest and disease impact - Dothistroma, Cyclaneusma, Nectria, Armillaria and Essigella
		1.4.1.2 F(3.7) Pest and disease impact - Phaeophleospora, Phaeocryptopus and Uraba
		1.4.1.3 FOA Nectria surveys
		1.4.1.4 FOA Nectria disease infection process and development ecology
		1.4.1.4 FOA Literature Review - Armillaria
	1.4.2 - Biological control	1.4.2.1 F(4.7) Biocontrol of Buddleja by Cleopus
		1.4.2.2 F(4.10) Biological control of Paropsis and Uraba
		1.4.2.3 F(4.11) Biocontrol agent and elicitors against pine nursery diseases
		1.4.2.4 F(4.12) Biocontrol agents for use by Maori
		1.4.2.5 L(1) Improved management of bark beetle in P. radiata plantations using innovative biocontrol methods
		1.4.2.6 FOA Potential for intraguild predation by the ladybird, <i>Cleobora mellyi</i> , on egg parasitoids of <i>Paropsis charybdis</i> (Sarah Mansfield)
	1.4.3 - Management & control methods	1.4.3.1 F(1.7) Armillaria ecology and management
		1.4.3.2 F(2.9) Bark beetle and Pseudocoremia monitoring systems
		1.4.3.3 F(4.9) Distribution of Chondrosterum purpureum in NZ
		1.4.3.4 FOA Stem injection of insecticides for the control of herbivorous insects (<i>Uraba lugens</i> & <i>Paropsis charybdis</i>) on amenity trees in urban areas (Stefan Gous)
1.5 Improved Resistance to Pests	1.5.1 - Tree & Forest treatments	1.5.1.1 L(2) Demonstrate enhanced seed and propagule health by using beneficial micro-organisms/natural products
		1.5.1.2 L(3) Deliver novel biological management practices to forest propagation systems
		1.5.1.3 L(4) Microbial inoculants and plant resistance stimulants to enhance tree health and vigour in nursery beds
		1.5.1.4 L(5)+ FOA - Validate superior performance nursery enhanced stock in forest plantation sites
		1.5.1.5 L(6) + FOA Assay potential stump-protectant micro-organisms and wound protectant isolates/natural products.
	1.5.2 - Breeding & Genetic Modification linkages	1.5.2.1 FOA - Resistance variation in seedlings and conifers
		1.5.2.2 FOA - Susceptibility in other conifers

Objectives	Project Areas	Projects () = FRST milestone number
1.6 Abiotic Disorders & Vertebrates	1.6.1 - Wind linkages	
	1.6.2 - Physiological linkages	1.6.2.1 F(3.8) Physiological influences on needle decline
	1.6.3 - Vertebrate pest management	
	1.6.4 - Weed linkages	
2.1 Phytosanitary treatments	2.1.1 - Detection technologies	
	2.1.2 - Treatment technologies	2.1.2.1 F(2.7) Trapping and treatment technologies for Arhopalus ferus
	2.1.3 - System approaches	
	2.1.4 - Pest threats to trading partners	
3.1 Capability management	3.1.1 - Databases and collections	
	3.1.2 - Critical skills maintenance	
3.2 Resource Use	3.2.1 - Prioritisation processes	
	3.2.2 - Funding	
	3.2.3 - Balancing investment	
3.3 Technology implementation/extension	3.3.1 - Technology implementation	
3.4 Programme management	3.4.1 - Admin & Management	
	3.4.2 - Communication/Promotion	

Appendix 2 – Strategic Priority Assessment Summary

Strategic Priority Assessment Summary Sorted by Project Area

EBRC Res Strat draft 17 Feb 05

Risk or Opportunity	Knowledge		Management		Risk		Acceptability (I,L,M,H,R)	Priority (1,2,3,4,5)
	Adequacy (P,L,M,H,E)	Opportunity (N,S,M,L,I)	Imperative (N,S,M,L,I)	Urgency (1,3,5,>5yrs)	Consequence (N,S,M,L,I)	Likelihood (R,L,M,H,A)		
1.1.1 - Identifying potential pest threats	M	L	L	3	M	M	H	4
1.1.2 - Pest and pathway risk assessments	M	L	L	3	M	M	R	3
1.1.3 - Pest impact assessments	M	L	L	3	M	H	H	4
1.1.4 - Ecosystem vulnerability	L	L	M	5	M	M	M	4
1.2.1 - New border detection technologies	M	L	L	3	S	M	H	3
1.2.2 - Attractants & Lures	L	L	M	5	S	M	H	3
1.2.3 - Surveillance & Sampling methods/technologies	M	M	L	3	M	L	H	3
1.2.4 - Taxonomic keys	L	L	L	3	L	L	R	4
1.2.5 - Molecular diagnostic methods	P	I	L	3	M	M	H	4
1.2.6 - Species baseline knowledge	L	L	S	>5	M	L	R	2
1.2.8 - Modelling detection patterns & spread	L	L	M	5	L	M	R	3
1.3.1 - Ecology of new pests	L	L	M	3	M	L	R	3
1.3.3 - Efficacy of treatments	L	L	M	3	S	M	H	3
1.3.4 - Aerial application	H	M	L	3	L	M	H	3
1.3.6 - Other treatments and new technologies	L	L	L	1	L	M	H	4
1.3.7 - Pest impact assessments	L	M	M	3	M	M	R	3
1.3.8 - Community interaction	M	M	M	5	M	M	H	3
1.4.1 - Pest impact assessments	L	L	I	1	I	M	H	3
1.4.2 - Biological control	L	L	L	3	M	L	M	4
1.4.3 - Management & control methods	L	L	I	1	I	H	H	5
1.4.4 - Social aspects	M	M	M	5	M	M	H	3
1.5.1 - Tree & Forest treatments	L	M	M	3	M	M	H	3
1.5.2 - Breeding & Genetic Modification linkages	L	L	L	3	L	M	R	4
1.6.1 - Wind linkages	M	S	S	5	S	L	R	1
1.6.2 - Nutrition linkages	M	M	M	3	M	M	H	3
1.6.3 - Vertebrate pest management	M	S	S	5	S	M	M	2
1.6.4 - Weed linkages	M	M	M	5	S	L	M	2
2.1.1 - Detection technologies	L	L	M	2	M	H	H	5
2.1.2 - Treatment technologies	M	L	L	3	L	H	M	4
2.1.3 - System approaches	L	L	M	1	L	M	H	4
2.1.4 - Pest threats to trading partners	L	L	L	3	L	M	M	4

Risk or Opportunity	Knowledge		Management		Risk		Acceptability (I,L,M,H,R)	Priority (1,2,3,4,5)
	Adequacy (P,L,M,H,E)	Opportunity (N,S,M,L,I)	Imperative (N,S,M,L,I)	Urgency (1,3,5,>5yrs)	Consequence (N,S,M,L,I)	Likelihood (R,L,M,H,A)		
1.4.3 - Management & control methods	L	L	I	1	I	H	H	5
2.1.1 - Detection technologies	L	L	M	2	M	H	H	5
1.2.5 - Molecular diagnostic methods	P	I	L	3	M	M	H	4
1.1.1 - Identifying potential pest threats	M	L	L	3	M	M	H	4
1.1.3 - Pest impact assessments	M	L	L	3	M	H	H	4
1.2.4 - Taxonomic keys	L	L	L	3	L	L	R	4
1.3.6 - Other treatments and new technologies	L	L	L	1	L	M	H	4
1.4.2 - Biological control	L	L	L	3	M	L	M	4
1.5.2 - Breeding & Genetic Modification linkages	L	L	L	3	L	M	R	4
2.1.2 - Treatment technologies	M	L	L	3	L	H	M	4
2.1.4 - Pest threats to trading partners	L	L	L	3	L	M	M	4
1.1.4 - Ecosystem vulnerability	L	L	M	5	M	M	M	4
2.1.3 - System approaches	L	L	M	1	L	M	H	4
1.4.1 - Pest impact assessments	L	L	I	1	I	M	H	3
1.1.2 - Pest and pathway risk assessments	M	L	L	3	M	M	R	3
1.2.1 - New border detection technologies	M	L	L	3	S	M	H	3
1.2.3 - Surveillance & Sampling methods/technologies	M	M	L	3	M	L	H	3
1.3.4 - Aerial application	H	M	L	3	L	M	H	3
1.2.2 - Attractants & Lures	L	L	M	5	S	M	H	3
1.2.8 - Modelling detection patterns & spread	L	L	M	5	L	M	R	3
1.3.1 - Ecology of new pests	L	L	M	3	M	L	R	3
1.3.3 - Efficacy of treatments	L	L	M	3	S	M	H	3
1.3.7 - Pest impact assessments	L	M	M	3	M	M	R	3
1.3.8 - Community interaction	M	M	M	5	M	M	H	3
1.4.4 - Social aspects	M	M	M	5	M	M	H	3
1.5.1 - Tree & Forest treatments	L	M	M	3	M	M	H	3
1.6.2 - Nutrition linkages	M	M	M	3	M	M	H	3
1.6.4 - Weed linkages	M	M	M	5	S	L	M	2
1.2.6 - Species baseline knowledge	L	L	S	>5	M	L	R	2
1.6.3 - Vertebrate pest management	M	S	S	5	S	M	M	2
1.6.1 - Wind linkages	M	S	S	5	S	L	R	1

Appendix 3 – FBRC Templates

These templates are available from the FBRC website, www.fbrc.org.nz or from the FBRC Administrator.

Doc.	Content
1	Proposal application form
2	Service agreement
3	Work plan
4	Work sheet template
5	Report template
6	Report writing instructions
7	Approving payment on invoices and processing reports

Appendix 4 – Key Communication Linkages

To be developed

[This section is all about including a list of key international researchers relevant to the strategy and FBRC]

Appendix 5 – Current Balance of Research Programmes

Balance of Short-term vs Long-term and Applied vs Strategic and Innovative

tbd

Projects that Address Current (2005) Priority Research Areas (as determined in the strategy)

Priority Research Areas	Current Projects 2004/05	Value (\$K) (Provider)	
1.4.3 - Management & control methods	1.4.3.1 Armillaria ecology and management	(FR)	
	1.4.3.2 Bark beetle and Pseudocoremia monitoring systems	(FR)	
	1.4.3.3 Distribution of Chondrosterum purpureum in NZ	(FR)	
2.1.1 - Detection technologies	none		
1.2.5 - Molecular diagnostic methods	none		
1.1.1 - Identifying potential pest threats	1.1.1.1 Potential insect vectors of pine pitch canker	(FR)	
1.1.3 - Pest impact assessments	1.1.3.1 Bark beetles and rusts impact assessment	(FR)	
1.2.4 - Taxonomic keys	1.2.4.1 Taxonomic methods and descriptions of forest fungi		
1.3.6 - Other treatments and new technologies (or is it 1.3.4?)	1.3.4.1 Incursion response modelling	(FR)	
1.4.2 - Biological control	1.4.2.1 Biocontrol of Buddleja by Cleopus	(FR)	
	1.4.2.2 Biological control of Paropsis and Uraba	(FR)	
	1.4.2.3 Biocontrol agent and elicitors against pine nursery diseases	(FR)	
	1.4.2.4 Biocontrol agents for use by Maori	(FR)	
	1.4.2.5 Improved management of bark beetle in P. radiata plantations using innovative biocontrol methods	\$135 CORE	
1.5.2 - Breeding & Genetic Modification linkages	[check with Breeding Company and FR]		
2.1.2 - Treatment technologies	2.1.2.1 Trapping and treatment technologies for Arhopalus fesus	(FR)	
2.1.4 - Pest threats to trading partners	none		
1.1.4 - Ecosystem vulnerability	1.1.4.1 Nothofagus ecology and pest impact resistance	(FR)	
	1.1.4.2 Understorey diversity and pest impact	(FR)	
2.1.3 - System approaches	none		
1.4.1 - Pest impact assessments	1.4.1.1 Pest and disease impact - Dothistroma, Cyclaneusma, Nectria, Armillaria and Essigella	(FR)	
		(FR)	

	1.4.1.2 Pest and disease impact - Phaephleospora, Phaeocryptopus and Uraba		
1.1.2 - Pest and pathway risk assessments	1.1.2.1 Relevance of some invasion parameters on the establishment success of exotic pests		
1.2.1 - New border detection technologies	none		
1.2.3 - Surveillance & Sampling methods/technologies	none		
1.3.4 - Aerial application	none		

Appendix 6 – Current Knowledge on Key Insects and Diseases

To be developed following 2005 workshop

Appendix 7 – List of Contributors to Initial Research Strategy

FBRC Research Strategy Subcommittee Members: Peter Thomson (convenor), Simon Anderson, Nigel Heron, Wei-Young Wang, Brian Richardson, Bill Dyck

Additional People Consulted

Person	Organisation
Lindsay Bulman	NZFRI
Alison Stewart	Lincoln Bio-protection CORE
Rob McLagan	Forest Owners Association
Jeremy Fleming	CHH Forests
Robert Hill	Biodiscovery

Appendix 8 – Funding Sources for Biosecurity Research

Source	Focus	Contact
Public Good Science Fund	Scientific research: <ul style="list-style-type: none"> • Research for Industry • Ecosystems Research 	www.frst.govt.nz
Sustainable Farming Fund	Applied research for land-based productive sectors ³	www.maf.govt.nz
AGMARDT	Post-doc fellowships	www.agmardt.org.nz
Tech NZ - TBG	Funding towards commercialising technology	www.frst.govt.nz
Tech NZ - TIF	Funding graduate students and post docs ⁴	www.frst.govt.nz
MAF – Operational Research	Research that assists MAF meet its operational objectives	www.maf.govt.nz

³ The purpose of the Sustainable Farming Fund (the Fund) is to support projects that will contribute to improving the financial and environmental performance of the land-based productive sectors.

The Fund aims to help the land based sectors solve problems and take up opportunities to overcome barriers to economic, social and environmental viability. It will do this by bringing together “communities of interest”. These are groups of people drawn together by a shared problem and/or opportunity in the sustainable use of resources.

The Fund focuses on projects that are practical and show value for money.

⁴ The Technology for Industry Fellowships (TIF) Programme enables students and experienced researchers to complete R&D projects in companies.

TIF supports science, technology and engineering projects conducted in, and managed by, companies. The Fellow must spend a minimum of 50% of his/her time on the project in the company.