PRIORITY BIOSECURITY SCIENCE RESEARCH LIST: 2010/2011

A new biosecurity science system, outlined in the Biosecurity Science Strategy (2007), is providing a fundamental change to the way in which science needs are prioritised. Advisory groups bring together a range of biosecurity expertise to look at research needs within sectors and across the overall biosecurity system. The advisory groups conduct annual prioritisation rounds, considering research needs identified by the biosecurity community, to produce a list of priority areas and needs for research.

In the 2010 process the advisory groups focussed on refining the 2009 priority list. However, it is anticipated that next year a full prioritisation round based on needs identified by the biosecurity community will occur.

Below is the 2010/11 priority list of research areas. The priorities identified in the list are not MAF priorities, but priorities for New Zealand's biosecurity system as a whole. In some of the priority areas identified there is research already underway, while in other areas there may be critical gaps. The priority list does not, at this stage, consider current research initiatives and make that distinction, but provides a guide for investment by identifying areas where additional or new research effort can drive the greatest improvements in biosecurity outcomes.

The priority list builds upon Goal 1 of the Biosecurity Science Strategy, which is Science Direction: To clearly identify and address research needs". The priority research areas are outlined under the objective of the science strategy within which they fall (note that not all objectives of the Strategy have a priority need within them, and some objectives have multiple priority needs).

The needs identified are broad, with potential applications beyond biosecurity, and span the entire research spectrum from longer-term basic targeted research to short-term operational research.

We urge all those who invest in or undertake research within the biosecurity space to consider this list. Collectively directing our efforts towards the highest priority needs will maximise the benefits gained from our investment, and help ensure New Zealand's Biosecurity System remains robust and ready and able to protect our natural resources.

PRIORITY BIOSECURITY SCIENCE RESEARCH LIST: 2010/2011

SUBJECT AREAS	RESEARCH NEEDS
Biosecurity Science Strategy Objective 1.1 ***Forecast Emerging Biosecurity Risks and Develop Contingency Plans***	
Identifying emerging threats	Better *methods to identify, assess and prioritise organisms* that are most likely to emerge as pests, weeds and diseases are needed across all sectors (i.e. animal, aquatic, plant). Among the range of factors that influence emerging pests, weeds and diseases, research should consider: changing climate, land (or water) use, trade and tourism patterns, industry and social dynamics. Particular needs are methods relevant to: • pathogens of plants and animals; • zoonotic diseases, especially sources and transmission pathways; • domestic exotic plants emerging as weeds; including forage species; • redistribution of indigenous plants into new geographical areas; • confirming current status and identifying future threats to pastoral agriculture; • methods for aquatic environments generally.
Biosecurity Science Strategy Objective 1.2 ***Understanding the Characteristics of High Priority Pests and Diseases***	
Understanding aquatic pests and diseases	Research is needed to improve our understanding of the risk characteristics of potential pests and diseases for both the marine and freshwater environments. For the marine environment specifically, we need a better understanding of how non-indigenous marine organisms behave in novel New Zealand environments. This will help inform development of effective management tools.
Biosecurity Science Strategy Objective 1.3 ***Analyse Risk Pathways and Vectors for Entry and Dispersal of Priority Pests and Diseases***	
Understanding pathways into and around New Zealand	We require better tools for the risk analysis of pathways by which high priority organisms enter New Zealand and, once established, are disseminated. Particular needs are for new and improved tools and models to better understand and manage: • the inanimate pathways associated with the entry of specific invertebrate groups (such as ants and mosquitoes, plus ticks as vectors for animal pathogens); • post border pathways to predict the potential natural and human mediated spread of high priority organisms after their initial establishment, including pathways into indigenous ecosystems; and • the relative risks between pathways.
Biosecurity Science Strategy Objective 1.5 ***Develop Enhanced Tools for Inspection and Detection***	
Detection tools for Pre-border and Border	Optimal detection and inspection offshore and at the border (noting that at the border we are trying to move more from inspection to verification) is a critical need across all sectors (animal, aquatic, plant). Particular needs are: • enhanced pre border, border and post-entry quarantine tools to improve detection of risk species including hitchhiker species, cryptic plant pests, arthropods, and tissue borne diseases; and • enhances tools to improve detection of risk marine taxa in pathways, especially biofouling taxa.
Biosecurity Science Strategy Objective 1.6 ***Develop Methods for Rapid Identification of Pests and Diseases***	
Rapid Diagnostics	We require diagnostic tools, and aligned taxonomic research, that enable rapid identification of agreed high priority risk organisms including their taxonomy.

SUBJECT AREAS	RESEARCH NEEDS
	Particular needs are new/improved diagnostic tools for: • aquatic species; • priority arthropods; and • pathogens.
Biosecurity Science Strategy Objective 1.7 ***Develop Improved Treatment Technologies***	
Treatment Technologies	We require treatments for risk goods which are more cost-effective, safer and environmentally acceptable. Particular needs with regards to treatments are new/improved treatments for: • biofouling on vessels (including complex structures such as mobile drilling rigs); • sea containers (inside and outside) – to effectively manage the range of risk species associated with these pathways; and • fumigation, including replacements for methyl bromide (note- replacements may also need to obtain appropriate regulatory approval, including approval by countries importing New Zealand produce). We also require: • tools to confirm that treatments have been applied and/or are effective as required.
Biosecurity Science Strategy Objective 1.8 ***Develop Cost-Effective Surveillance Tools and Methods and Apply within Integrated Surveillance Systems***	
Early detection tools for surveillance (post border)	We need to develop surveillance tools and approaches that enable earlier detection of pests and diseases post border across all sectors (i.e. animals, aquatic, plants). These tools are likely to be different from those needed for use at the border. The need includes techniques designed to detect priority organisms which are difficult to detect at low prevalence or density.
Efficacy of surveillance	Our surveillance systems are under increasing demand and we need to better understand, and increase, the efficacy of both existing and new surveillance tools and systems. Particular needs in the area of efficacy of surveillance are: • New methods to evaluate the efficacy of current approaches to surveillance tools and systems are needed across all sectors (plant, animal, aquatic). • Assessment of the sensitivity and specificity of tools for detecting pests and pathogens is needed across all sectors, but particularly for plant pests (as there are many detection tools for plant pests but their efficacy has not been assessed) and animal pests and pathogens. • Developing and optimising more effective approaches to targeted surveillance, considering the application of detection tools and the design of sampling schemes. This is most important for the detection of pests and pathogens at low densities. • Developing new bioeconomic model-based tools, which consider the effects of climate change, for prioritising surveillance activities across all sectors. This is important for winged vectors, such as midges and mosquitoes. • Social research to enhance the acceptability to and active engagement from, the general population. • Methods for proving absence of pest, weed and disease organisms.
Aquatic Surveillance	Existing tools for marine and freshwater surveillance are limited, not very sensitive, and lagging well behind what is available for terrestrial surveillance. Aquatic pests, diseases and pathogens are poorly understood in New Zealand which makes aquatic surveillance even more difficult for these taxa. Particular needs are: • Better tools or sampling methods, and approaches for aquatic surveillance, including for pests, diseases and pathogens.

SUBJECT AREAS	RESEARCH NEEDS
Biosecurity Science Strategy Objective 1.9	
Develop Control, Eradication and Containment methods for Potential and Established Priority Pests and Diseases	
Marine Pest Control Tools	Existing tools for eradication or control of pests in the aquatic environment are very limited and very basic (e.g. wrapping techniques and physical removal). Particular needs are: • The development of more effective and efficient tools that enable a more strategic approach to eradication or control of pests in the aquatic environment. Research must consider the acceptability of tools.
Acceptable Pest Control	Key pests are successfully controlled using a variety of control tools; however some of these tools (e.g. toxins) are increasingly unacceptable for social, cultural or environmental reasons. Moreover, many control tools will by their nature remain unacceptable to many groups. We need more control tools which are humane, socially and culturally acceptable and minimise impacts on non-target species and the environment. Particular needs are more effective and acceptable tools for: • vertebrate pests, and pests of vertebrates; • plant pests, including making greater use of biocontrol options; and • use in the freshwater environment.
Vertebrate pest control tools for low densities	As key vertebrate pests are reduced to very low densities current control methods are not adequate. Research into new control tools for vertebrate pests is a high priority for reduction (and elimination) of disease risks (e.g. bovine tb) as well as for the protection of endangered native species. Particular needs are: • New techniques for detection and more effective control of vertebrate pests at low densities, including methods for eradication.
Biosecurity Science Strategy Objective 1.10	
Develop a Comprehensive Understanding of Human Values and Behaviour in Creating and Managing Biosecurity Risks	
Values and Behaviour	Social research can improve our understanding of attitudes towards, and compliance with biosecurity and help ensure out biosecurity management measures are effective. Particular needs are: • To understand how different cultures or groups, including new migrants, value organisms and create and respond to biosecurity risks to improve engagement and biosecurity management. • Research on acceptability. We need to understand and appreciate the broad meanings of "unacceptable" to different groups and the cultural and social impacts in order to develop broad guidelines that inform development of new tools and management systems.
Engagement with Māori	As Treaty partners and significant stakeholders, how Māori approach biosecurity can have a significant influence on the management of biosecurity risks. Particular needs are: • To understand how Māori value organisms, how this shapes their responses to biosecurity, and how biosecurity agencies can engage more effectively with Māori.
Biosecurity Science Strategy Objective 1.11	
Assess the actual and potential Biosecurity Risks to Ecosystems	
Ecosystem Risks	A critical research need is to better understand and quantify the actual and potential impacts of pests and diseases on ecosystems, i.e. more of a systems approach to risk. A framework and methods are needed for assessing, measuring and predicting impacts and uncertainty. These must capture all values (economic, environmental, social and cultural) and contribute to risks assessments which help in biosecurity decision-making. This is needed for use in all environments, but is a particularly critical need for the aquatic environment.