Manaaki Whenua
Landcare Research

Knowledge transfer of biodiversity and biosecurity research

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Knowledge transfer of biodiversity and biosecurity research

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Manaaki Whenua – Landcare Research

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Summary

Project and Client

- Manaaki Whenua – Landcare Research (Manaaki Whenua) was contracted by Environment Southland to undertake a review of bioscience research conducted by regional and unitary authorities (RUAs), Crown Research Institutes (CRIs), and National Science Challenges (NSCs) in response to the priorities in the Strategic Roadmap for Biodiversity and Biosecurity Research (SRBBR).

Objectives

To examine the extent to which biosecurity and biodiversity research undertaken by RUAs and CRIs is being applied and incorporated into regional RUA policy and activity, and identify the key science gaps that remain to be addressed by:

- assessing awareness of the SRBBR by research providers and determining the extent to which it guides their research
- identifying bioscience (biodiversity and biosecurity) research undertaken by CRIs and NSCs both relevant to and guided by the SRBBR during 2015 to 2018
- identifying bioscience research undertaken by RUAs both relevant to and guided by the SRBBR during 2015 to 2018
- assessing how effectively the SRBBR is being used to influence government-funded science and to prioritise RUA efforts, and the extent to which research providers and RUAs are aligning research to the roadmap
- assessing the relevance and quality of the research and the extent to which research findings are being implemented or incorporated into management decisions and how this could be improved.

Methods

- A questionnaire was sent to each RUA. This was followed up by phone and email if further information was required.
- Manaaki Whenua, AgResearch, Scion, NIWA, Cawthron Institute, and the Biological Heritage and Our Land and Water National Science Challenges were canvassed to gauge their engagement with the SRBBR and alignment of projects, publications and reports.
- Documents and reports were sourced from RUA and the Envirolink web sites.
- Documents and reports were assigned codes for habitat type, research focus, and SRBBR Strategic Research Priority to facilitate searching and analysis.

Results

- The priorities in the SRBBR were not well known in most RUAs and research providers and had little direct influence on research planning.
- Some concerns about Roadmap focus were identified.

- The difficulty some RUAs had in providing the requested information suggested a need for system improvements.
- The research focus of both the RUAs and research providers was nevertheless reasonably well-aligned with the SRBBR priorities because both addressed a set of common desired outcomes for biosecurity and biodiversity.
- There was good uptake of research findings within originating RUAs, but much opportunity for better sharing of information among RUAs and application of new knowledge from external research providers.

Conclusions

- The Roadmap would be improved by better integration with marine and freshwater outcomes and a systems approach linking to water and land management priorities.
- RUAs need to place greater emphasis on the Roadmap priorities if they want to improve research provider engagement with them.
- Research does not feature as a priority activity in most current regional biosecurity and biodiversity plans.
- Transfer of knowledge among RUAs and between research providers and RUAs needs significant improvement.

Recommendations

- RUAs should use existing internal and external partnerships more effectively (i.e. improve reporting and coordination through Special Interest Groups (SIGS) – Biomanagers, Biodiversity Working Group, Biosecurity Working Group).
- RUAs should ensure copies of all non-confidential Envirolink reports are made available for posting on the Envirolink web site. It would also be helpful if the Envirolink administrator corrected classification code errors in the database and added an improved search capability.
- A funding mechanism (shared model; Envirolink) should be identified to support the relevant research institutes (MWLR, NIWA, Scion, AgR, Cawthron, BH NSC) to jointly provide a list and summary of relevant science publications and reports. This compilation should focus on the implications of the research for RUA biodiversity and biosecurity outcomes as specified in the relevant RUA plans, and on alignment with the SRBBR.
- RUAs should improve their internal systems to enable more effective sharing of data and information. This would enable efficient compiling and distribution amongst themselves of an annually updated version of the database of RUA research projects collated for this project. RUAs should also consider making the database a current, as well as a historical one, by including projects at the time of their initiation.
- Given the volume of relevant bioscience research, its variable accessibility and the demands on capability and capacity in extracting relevant information by individual RUAs, the role of knowledge brokers within or between RUAs should be explored as a priority.

1 Introduction

Regional councils and unitary authorities (henceforth collectively RUAs) provide regional leadership for biosecurity, and are responsible under the Resource Management Act (1991) for the maintenance of indigenous biodiversity. Robust science is needed to support this work, but the management issues and research needs are complex. Bioscience research often requires long-term studies and studies that cover multiple environments and situations. Such studies are generally beyond the means and scope of individual RUAs so central government funded research (e.g. through Crown Research Institutes (CRIs) and National Science Challenge (NSC) programmes) is needed along with coordinated RUA research.

The RUA Biomanagers Special Interest Group (SIG) works together on national biodiversity and biosecurity issues. Biomanagers share ideas, allocate funding and support work of national importance and contribute to bio-science research. In 2014–15 the Biomanagers SIG recognised the need for improved research coordination and used an Envirolink grant (1474-ESRC265) to develop a Strategic Roadmap for Biosecurity and Biodiversity Research (SRBBR; 'the Roadmap'). Its purpose was to develop a clear set of goals that all regional RUAs would use to plan and prioritise research, as well as to contribute to national collaborative prioritisation efforts. It was also to inform CRIs and other research providers of RUAs' research needs. The SRBBR was intended to help direct resources and research needs and help resolve key problems in biodiversity and biosecurity for the next 10-20 years and beyond. Since the completion of the SRBBR RUAs have developed their own research strategy (2016) and the Ministry for the Environment and Department of Conservation have developed a National Conservation and Environment Science Roadmap (2017), both of which include long-term high-level research priorities for biodiversity and biosecurity.

2 Background

The SRBBR is now three years old. Its analysis and conclusions helped shape the current Regional RUA Research, Science and Technology Strategy (2016). However, the extent to which the priorities and recommendations of the SRBBR have been adopted and applied by RUAs and the influence of the Roadmap on central government science funding and research priorities of CRIs and NSCs is unclear. Similarly, the contribution of current research by RUAs to the long-term goals of the Roadmap and environmental outcomes is unclear. It was therefore considered timely to undertake an evaluation of how well the SRBBR has been adopted and implemented and to assess whether there are opportunities to improve its effectiveness and usefulness.

The SRBBR highlighted 5 priority outcomes as the focus for future research:

- Halting biodiversity decline
- Reduce land use impacts on aquatic systems
- Integrity of ecosystem services and natural capital
- Increased community awareness
- Resilience and future-watch.

The SRBBP acknowledged that the technical knowledge and expertise to achieve these outcomes was currently inadequate and therefore highlighted 10 Strategic Research Priorities (SRP) that would need to be addressed to assist RUAs to achieve their environmental outcomes. These were:

1 Landscape scale management

2 Ecological monitoring

3 Surveillance and detection

4 New/better tools

5 Pathways analysis

6 Data management

7 Social and citizen science

8 Risk analysis and prioritisation

9 Ecosystem services

10 Future-watch

Among its recommendations the SRBBR highlighted the need for multi-year funding to be aligned to these priorities. Apart from internal RUA funding, the Envirolink programme is the only significant source of short-term funding for research to address these priorities available to RUAs. Envirolink (http://envirolink.govt.nz) is a regional RUA-driven funding scheme, with funds administered by the Ministry of Business, Innovation & Employment - Science and Innovation. Investment funding of $1.6 million (excluding GST) per annum is available to less well-resourced regional RUAs to contract government-funded research organisations to transfer environmental research knowledge. The Envirolink scheme funds research organisations (Crown Research Institutes, universities and some not-for-profit research associations) to provide regional RUAs with advice and support for research on identified environmental topics and projects. The scheme aims to support regional RUAs in two areas of environmental management: adapting management tools to local needs, and translating environmental science knowledge into practical advice.

The scheme's objectives are to:

- improve science input to the environmental management activities of regional RUAs
- increase the engagement of regional RUAs with the environmental research, science and technology sector
- contribute to greater collective engagement between RUAs and the science system generally.

Nine of the RUAs are eligible to apply for Envirolink advice grants, namely:

- Northland Regional Council
- Gisborne District Council
- Hawke's Bay Regional Council
- Horizons Regional Council

- Nelson City Council
- Marlborough District Council
- Tasman District Council
- West Coast Regional Council
- Environment Southland

In addition to small and medium advice grants, Envirolink Tool Development funding is available to support development and adaptation of natural resource and environmental management tools for use by all RUAs.

To assess current awareness and application of the SRBBR, Manaaki Whenua was contracted by Environment Southland on behalf of the Council Biomanagers Group (Envirolink 1936-ESCR504) to undertake an analysis and stocktake of relevant bioscience (biodiversity and biosecurity) research conducted by RUAs and applicable CRIs and NSCs that was directly guided by the Roadmap, and research that has been carried out or funded by RUAs since 2015. The investigation was to consider all types of research, including formal and informal projects, as well as published and unpublished research, and to cover terrestrial, freshwater and marine environments. It was also intended to examine RCs' and UAs' individual bioscience research priorities to identify the extent to which they align with the SRBBR priorities. The results were to be used to help determine if research is addressing the SRBBR priority science needs effectively and contributing positively to achieving its outcomes. The review was also expected to highlight areas where new research and/or additional work is needed and assist RUAs to better share research information and reduce the risk of unnecessarily duplicating research. The project was also intended to make it easier for the wider community to access research findings leading to more effective management practices and better decision-making on the ground.

3 Objectives

To examine how and the extent to which scientific knowledge in biosecurity and biodiversity undertaken by RCs, UAs and relevant Crown Research Institutes and National Science Challenges is being recognised, accessed, applied, and incorporated into regional RUA policy and activity, and identify the key science gaps that remain to be addressed by:

- assessing awareness of the SRBBR by research providers and determining the extent to which it guides their research;
- identifying bioscience (biodiversity and biosecurity) research undertaken by CRIs and NSCs both relevant to and guided by the SRBBR during 2015–2018;
- identifying bioscience research undertaken by RUAs both relevant to and guided by the SRBBR during 2015–2018;
- assessing how effectively the SRBBR is being used to influence government-funded science and to prioritise RUA efforts, and the extent to which research providers and RUAs are aligning research to the roadmap;
- assessing the relevance and quality of the research and the extent to which research findings are being implemented or incorporated into management decisions and how this could be improved.

4 Methods

A questionnaire (Appendix 1) was developed with input from several members of the Biomanagers SIG. This was the main method of information collection. The questionnaire was sent to a previously identified contact person in each of the RUAs. This was followed up by phone conversations and emails if and when clarification or further information was required. One RUA indicated they undertook no relevant research during the period in question; one RUA only undertook Envirolink projects; three RUAs did not respond to the request for information; and four responded only in part, quoting more urgent priorities, staff shortages, restructuring, and operational systems that were not amenable to ready extraction of the requested information. Additional information for all RUAs was sourced from plans and documents available on RUA web sites.

While RUAs undertake biodiversity and biosecurity research for their own purposes to varying extents, external research providers (principally CRIs and NSCs) also undertake such research with outcomes of direct interest to RUAs, and engage in collaborative research with RUAs. The most relevant of the external organizations covering terrestrial, freshwater and marine research were therefore canvassed to gauge their knowledge of and extent of engagement with the SRBBR. These included the research institutes Manaaki Whenua, AgResearch, Scion, NIWA, and the Cawthron Institute, and the Biological Heritage and Our Land and Water National Science Challenges.

These organizations were asked to respond to the following two questions, and to provide a list of biosecurity and biodiversity research projects and non-confidential publications/reports covering the period July 2015 to December 2018.

1 To what extent are your research managers and research project leaders aware of the Regional Council Strategic Roadmap for Biosecurity and Biodiversity Research (SRBBR)?

2 In what ways and to what extent has the plan guided research proposals and projects?

Envirolink advice grant and tools reports were accessed at http://envirolink.govt.nz/envirolink , but the advice grant report database suffers from an inadequate search capability and some errors in classification codes of projects. An Excel copy of the database was provided on request by the Envirolink Regional RUA Coordinator, Bill Dyck and used to identify and codes reports relevant to this project during the period July 2015 to December 2018. In the Excel Database projects were coded, among other criteria, by Regional RUA and an Environment code (Appendix 2). The projects listed in Appendix 3 are mostly those assigned Environment codes for Freshwater (FW), Marine (M) and Terrestrial (T) combined with codes for Biodiversity (BD) and Biosecurity (BS), or coded only BD or BS (if relevant). The time frame covered projects with ID numbers between 1571 and 1914 in the database at http://envirolink.govt.nz/envirolink-reports (accessed 28 May 2019). Advice grant projects and tools projects were classified according to their perceived relevance to the 10 Strategic Research Priorities (SRP) in the SRBBR, so that the nature of previous research investment could be assessed.

However, not all Envirolink project reports or documentation is available on the web site despite the topics of projects often likely to have been of wider interest than just to the sponsoring RUA. Although some project reports are confidential or projects did not have a written output (e.g. workshops), this deficiency is mostly because the relevant RUA did not, despite request from the Envirolink manager, provide a copy of the report to the Envirolink administrator (B Dyck, pers. comm.). This limits the opportunity for information sharing among RUAs and, for this project, to associate Envirolink-funded research with the priorities in the SRBBR.

Other publications and non-confidential reports were sourced directly from research providers. Lists of publications were edited to remove those considered not central to RUA interests in biodiversity or biosecurity (such as epidemiology of bovine TB or fishing catch statistics), or with subject matter not related to New Zealand. These publications have been assigned the relevant Envirolink code for habitat/type and the most appropriate SRP codes to facilitate searching by RUAs who wish to access the data (**Excel database**). Some publications addressed more than one habitat type and/or SRP. Others (n = 197), primarily taxonomic ones, were not allocated a SRP code as none of those codes were judged appropriate. All publications were also allocated one or more research focus codes to further facilitate searching (see Appendix 2).

5 Results

5.1 General Comments

Regional RUAs and unitary authorities differ greatly in geographical size, population base and land use, including protected areas such as reserves and land administered by the Department of Conservation. It is hardly surprising, therefore, that the type, extent (both geographic and financial) and focus of biodiversity and biosecurity research and the priority given to such research relative to other issues facing RUAs vary greatly among them. For example, one RUA indicated it did not have a budget for research; biodiversity and biosecurity issues were dealt with by one RUA staff member; and it had been involved in 11 advice grants through Envirolink during the 2015–18 period totalling $100,000. Another RUA, not eligible for Envirolink grants, over the same period spent a combined total of $1,270,000 on biodiversity and biosecurity internal research projects and collaborative projects with external research providers.

Research requirements are a reflection of needs. Such needs are usually spelled out in policy and strategy documents. While all 16 RUAs had pest management strategies and plans accessible on their web sites, only 8 had specific multi-year biodiversity plans or strategies (ECAN, WRC, AC, NCC, HBRC, GWRC, ORC, ES). The other 8 listed biodiversity-related priorities and activities (often in annual plans) but appeared to have no long-term strategy, although some referenced the regional RUA 'thinkpiece' on the future of biodiversity management in New Zealand – Addressing New Zealand's Biodiversity Challenge (Willis G., Enfocus #1886721) in that context.

All the RUAs mentioned research in their regional pest management plans (RPMPs; previously strategies) except Otago (whose plan is currently under revision). Generally,

wording was included in the plan that allowed RUAs to participate in, adopt improvements from, facilitate, and/or commission research. However, only the Auckland, Waikato, and Greater Wellington RPMPs noted specific research projects that were either to be undertaken by RUA staff or were listed as collaborative opportunities for research providers. Despite the primary purpose of RPMPs as a regulatory pest management tool, some RUAs are giving research a higher profile as part of the RPMP revisions. Auckland RUA, for example, hardly mentioned research in its previous strategy but research priorities are listed in detail in the current draft RPMP.

The structure and content of RUA biodiversity plans were much more diverse than the RPMPs, and there was little specific detail in most about biodiversity research priorities or research projects other than collaborations, particularly with community groups, and research undertaken by RUA staff. Only the Otago Regional RUA biodiversity plan had an explicit statement of priority research projects.

5.2 Envirolink

Information about biosecurity and biodiversity-focussed Envirolink advice and tools projects during the relevant period and their associated reports (when available) are summarised in Appendices 2–5. Most (93%) of the research providers for advice projects were five CRIs (MWLR, NIWA, ESR, Scion, AgR) and the Cawthron Institute, with the remainder conducted by universities. Marine and freshwater topics accounted for 74% of all advice projects. Most of the advice projects (90%) were related to three of the Roadmap SRPs, namely ecological monitoring and reporting, novel and improved tools for threat management, and risk analysis and prioritisation (Table 1).

Table 1. Envirolink projects undertaken during July 2015 to December 2018 and their focus in relation to the SRBBR Strategic Research Priorities (SRP). Some projects were relevant to more than one SRP

Strategic Research Priority	No. of Envirolink advice projects (%)
1. Scaling up; landscapes and seascapes	0
2. Ecological monitoring and reporting	65 (37.8)
3. Surveillance and detection	2 (1.2)
4. Novel and improved tools, tactics and strategies for threat management	53 (30.8)
5. Pathway analysis	1 (0.6)
6. Data management	0
7. Social and citizen science	11 (6.4)
8. Risk analysis and prioritisation	36 (20.9)
9. Ecosystem services and valuation of natural assets	0
10. Modelling to predict future scenarios and risks	4 (2.3)

Apart from Northland Regional RUA, which had 24 advice projects during this period, each of the other eligible RUAs had 10-14 advice projects. Investment in Envirolink advice grants over the 2015-18 period amounted to $1519K, distributed to Freshwater $673,000 (FW 25k; FWBD 380K; FWBS 268K); Marine $419K grants (M 321K; MBD 40K; MBS 58K); Terrestrial $395K (TBD $212; TBS $183K); and $42K on General grants. Investment in biodiversity projects ($632K) was 24% greater than in biosecurity projects ($509K), and that in aquatic projects 276% greater than in terrestrial projects.

To date there have been 20 Envirolink tools projects, of which five are classed as Biosecurity and Biodiversity. There were also Inland Water and Marine tools projects some of which were relevant to SRBBR Research Priority Areas. Tools reports are available at https://envirolink.govt.nz/envirolink-tools/ (accessed 13 June 2019). Relevant Tool reports (n = 13) are listed in Appendix 5. As with most advice projects, tools projects (11 out of 13) were focussed on the Roadmap SRPs Monitoring and reporting, and Risk analysis and prioritisation.

5.3 Bioscience (biodiversity and biosecurity) research

5.3.1 Publicly available research publications and reports produced by CRIs and NSCs relevant to and/or guided by the SRBBR

Much of CRI and NSC BH research is aimed at solutions to nationally systemic issues facing biodiversity and biosecurity (such as declining populations of native plants and animals and the need for more efficient and effective pest and weed management and eradication tools). CRI and NSC BH research is therefore likely to have benefits for all the RUAs who deal with the same issues but at regional and local scales. Deliberate alignment of research with the SRBBR was rare, but much of the research was highly relevant because of the common biodiversity and biosecurity outcomes sought by RUAs and research providers.

Between 2015 and 2018 the relevant CRIs, the Cawthron Institute and the BH NSC produced 1125 biodiversity and biosecurity science papers and reports, excluding articles in newsletters (the number of reports is an underestimate because of client confidentiality) (**Excel File**).

With regard to Envirolink classification, most publications (54%) related to terrestrial projects (27% biodiversity, 26% biosecurity); 22% to freshwater projects (11% biodiversity, 11% biosecurity); and 25% to marine projects (15% biodiversity, 9% biosecurity).

Publication links to SRPs were strongest in the areas of risk analysis and prioritisation; novel and improved threat management; and ecological monitoring and reporting. Only the data management SRP had no associated publications (Table 2).

Table 2. Research institute publication alignment with Roadmap Strategic Research Priorities. Some publications were relevant to more than one SRP

Strategic Research Priority	No. of Publications (%)
1. Scaling up; landscapes and seascapes	12 (0.6)
2. Ecological monitoring and reporting	396 (24.3)
3. Surveillance and detection	89 (5.5)
4. Novel and improved tools, tactics and strategies for threat management	296 (18.2)
5. Pathway analysis	34 (2)
6. Data management	1 (0.06)
7. Social and citizen science	91 (5.6)
8. Risk analysis and prioritisation	616 (37.8)
9. Ecosystem services and valuation of natural assets	44 (2.7)
10. Modelling to predict future scenarios and risks	53 (3.3)

All research focus areas featured in the list of publications, but research was most frequently focussed on threat management and assessment; impact on resources and changes in impacts after management; conservation, biodiversity and restoration; biology, ecology and taxonomy; methodology; and pest management and eradication (Table 3).

Table 3. Publications by research institutes – focus and frequency

Focus Code	Coverage	Number of publications (%)
B	Biology, ecology, taxonomy	322 (12.1)
C	Conservation, biodiversity, restoration	338 (12.7)
CC	Climate change	23 (0.9)
E	Economics, cost-benefit	33 (1.2)
ES	Ecosystem services	27 (1.0)
I	Invasion, invasive species	61 (2.3)
IM	Impact on resources, impact changes after management	452 (17.0)
M	Methodology	320 (12.0)
P	Policy	23 (0.8)
PM	Pest management, eradication	303 (11.4)
S	Social, cultural	96 (3.6)
T	Threat management, threat assessment	656 (24.7)
W	Animal welfare	6 (0.2)

While the c. 280 publications a year undoubtedly vary in relevance to RUAs, the sheer volume of material suggests that RUAs may have a problem keeping up to date with the latest research findings. Research providers, to some extent, address this issue by publication of newsletters that provide summarised versions of some of their new research (Table 4). But these articles do not address in any detail implications of the research for RUAs.

Table 4. Publicly available science newsletters produced by Research Institutes

Focus	Publisher	Web link
Weed Biocontrol	MWLR	https://www.landcareresearch.co.nz/publications/newsletters/biological-control-of-weeds
Animal Pest Research	MWLR	https://www.landcareresearch.co.nz/publications/newsletters/kararehe-kino
Regional Research update	MWLR	https://www.landcareresearch.co.nz/publications/newsletters/regional/issue-2
Research highlights	AgResearch	http://www.agresearchcareers.co.nz/our-people/science-stories/
Research highlights	Scion	https://www.scionresearch.com/about-us/about-scion/corporate-publications/scion-connections https://www.scionresearch.com/services/science-publications
Research highlights	NIWA	https://www.niwa.co.nz/publications/wa/water-atmosphere-22-june-2019
Research news	Cawthron	https://cawthron.org.nz/publication/corporate-documents/scope-issue-13-2019/
Research news	BH NSC	http://www.biologicalheritage.nz/news/newsletter

5.3.2 Research undertaken by regional RUAs and unitary authorities

A database of internal and collaborative projects (n = 284) with a link (if available) to any associated publication was compiled from information provided by responding RUAs (**Excel file**). Most projects related to Terrestrial Biosecurity (120) and Biodiversity (101); then Freshwater Biodiversity (82) and Biosecurity (37); and lastly Marine Biodiversity (35) and Biosecurity (15). Overall, Biodiversity-related projects (218) outnumbered Biosecurity projects (172).

Projects were assigned one or more of the SRP codes (1-10) so that their association with SRBBR SRPs could be assessed (Table 5). The four SRPs most commonly associated with projects were the same ones as those linked most frequently to Envirolink Projects, namely Ecological Monitoring and Reporting, Novel and Improved Tools and Strategies, Risk Analysis and Prioritisation, and Social and Citizen Science.

Table 5. Numbers of internal and collaborative projects undertaken by RUAs during July 2015 to December 2018 and their focus in relation to the SRBBR SRPs. Some projects were relevant to more than one SRP. Not all RUAs responded to the request for project lists

Strategic Research Priorities	No. of projects (%)
1. Scaling up; landscapes and seascapes	2 (0.6)
2. Ecological monitoring and reporting	175 (53.2)
3. Surveillance and detection	8 (2.4)
4. Novel and improved tools, tactics and strategies for threat management	86 (26.1)
5. Pathway analysis	0
6. Data management	0
7. Social and citizen science	25 (7.6)
8. Risk analysis and prioritisation	26 (7.9)
9. Ecosystem services and valuation of natural assets	3 (0.9)
10. Modelling to predict future scenarios and risks	4 (1.2)

The most common focus areas for RUA projects were threat management and assessment; methodology; pest management and eradication; conservation, biodiversity and restoration; and impact of resources and changes after management (Table 6). These five areas were also among the most frequent focus areas of research institute publications (cf. Tables 3 and 6). The only major difference between the focus of research institutes and RUAs was in the area of biology, ecology and taxonomy; fundamental research that largely falls outside RUAs' management-oriented areas of interest. For the same reason, climate change, policy and animal welfare focused research projects were absent from the RUAs' portfolio.

Table 6. RUA research project focus and frequency

Focus Code	Coverage	Number of projects (%)
B	Biology, ecology, taxonomy	11 (1.5)
C	Conservation, biodiversity, restoration	127 (17.4)
CC	Climate change	0
E	Economics, cost-benefit	5 (0.7)
ES	Ecosystem services	10 (1.4)
I	Invasion, invasive species	4 (0.5)
IM	Impact on resources, impact changes after management	88 (12.1)
M	Methodology	133 (18.2)
P	Policy	0
PM	Pest management, eradication	129 (17.7)
S	Social, cultural	29 (4.0)
T	Threat management, threat assessment	194 (26.6)
W	Animal welfare	0

5.4 RUA questionnaire responses

5.4.1 Assessment of research against the Roadmap which identifies how RUAs, Manaaki Whenua and other research providers and are using the roadmap to direct research

RUAs varied greatly in the processes they used to identify and prioritise research and allocate funding. In general, internal processes and documents were used to a much greater extent than the SRBBR. The documents used were most often the RUAs' own plans and strategies. Responses (Appendix 6a) indicated that processes varied from limited prioritisation through to a formal review of previous projects and future needs and decision making. Even within some RUAs the process varied between work sections. The SRBBR also had little impact on decision making and funding allocation, although SRBBR priorities were often aligned to some extent with RUA priorities and needs (Appendix 6b).

RUAs' research priorities, if listed at all, were generally found in various RUA plans and strategies, although in HBRC they were project-specific, and established annually in consultation with research providers (Appendix 6c). All RUAs that responded indicated that they consulted with stakeholders and research providers, either through direct consultation or their involvement in working groups (Appendix 6d). Collaboration among RUAs in identifying research needs occurred at the Biomanagers Special Interest Group (SIG) and the Biodiversity and Biosecurity Working Groups meetings, and also through direct engagement between RUAs sharing similar projects or issues (e.g. Dama wallaby control; rook control; national weed biocontrol collective; predator-free projects in Taranaki and Hawke's Bay) (Appendix 6e). These shared projects tended to be the exception rather than the rule, and most research addressed region-specific issues. Some of the RUAs that had tertiary institutions or research institutes in their regions had developed strong working relationships with them, and used that to signal research opportunities to improve alignment of student projects with RUA priorities.

Responses from external research providers about awareness and use of the SRBBR are summarised in Appendix 7. In general, senior staff in the research institutes were largely ignorant of the SRBBR, with the partial exceptions of MWLR and NIWA. Nevertheless, the priorities driving much of the research undertaken by the research institutes align to varying extents with priorities in the SRBBR. The links, not surprisingly, were strongest where RUA staff had contributed to the development of research institute strategies. For the OLW NSC, biodiversity and biosecurity were not seen as part of its original research focus, but the importance of biodiversity for the soil, water and agricultural performance outcomes that the NSC is seeking is likely to drive its inclusion in future research. This may provide an opportunity for greater engagement with RUAs. In contrast, interaction between the BH NSC and RUAs was recognised at the outset of the Challenge as important. This has included both strategic input and, increasingly, opportunities for operational input as the BH NSC seeks to implement improved strategies and tools.

5.4.2 How well the research is aligned to the Roadmap?

Some RUAs provided information about the particular SRPs that projects addressed or were aligned with (Appendix 8). Projects in the Novel and Improved Tools, Ecological Monitoring and Reporting, Social and Citizen Science, Surveillance and Detection, and Risk Analysis and Prioritisation SRPs were undertaken by at least half the responding RUAs. However, the percentage of projects aligned with the various SRPs varied widely among RUAs, presumably reflecting differing priorities.

A few RUAs provided information about project alignment with the Roadmap SRPs. HBRC and MDC rated all their relevant internal and external projects to be well aligned (score 1–2) with the relevant SRPs, while WRC rated 93% of their projects and AC 79% of their projects well aligned.

RUAs were also asked for their views on the extent to which they thought their research should be aligned with the SRBBR priorities. In general, despite some reservations about gaps and biases in the Roadmap priorities, RUAs indicated that there should be strong alignment because the priorities were wide ranging and relevant. Alignment was already considered to be strong because much of the SRBBR was about the major strategic or operation issues facing RCs in biosecurity and biodiversity (Appendix 9). Nevertheless, comments made clear that the main focus of RUA research is often about supporting or delivering research that will a) answer operational concerns; b) remove obstacles; or c) improve effectiveness, and alignment with the SRBBR SRPs has therefore often been a secondary consideration or fortuitous.

5.4.3 The quality of the research and whether it will provide useful information

The most direct evidence that RUA research had provided useful information was through its uptake. RUAs that responded indicated a variety of impacts through the adoption of new information, usually resulting in change to their operational work programmes or policy, and affected both current programmes and future programme and policy planning (Appendix 10). In all RUAs a significant number of projects were also being undertaken to provide information for future revision or updating of various plans.

Sharing of information within RUAs relating to outcomes of internal projects generally occurred at team or group meetings. Collaborative projects often had a RUA staff member as external advisor to the collaborating agency, with part of their role being to discuss relevant findings with RUA operational staff. For projects with community involvement, sharing of information was usually direct, through newsletter or project meetings. Where there was an industry partner, their communication systems, such as newsletters, were often used to promulgate project information and outcomes.

5.4.4 How much research has been transferred to RUA use since 2015?

Appendix 10 makes it clear that adoption and implementation are the common outcomes of RC and UA internal and collaborative research. However, except where projects involved

more than one RUA formally, there was little evidence of formal sharing of project findings and outcomes across RUAs.

Those RUAs that commented on barriers to successful transfer of research findings to future RUA policy and/or practice mentioned:

- the need for social licence for adoption of management interventions indicated by research, particularly where people's value positions are likely to be diverse, or there is disagreement about whether the proposed action is the most effective one.
- the narrow scope and short-term nature of research. Even when research was broad ranging in its scope, it rarely encompasses multiple disciplines like people, ecology, and operational delivery in one coherent package. As a result, managers have to interpret how the individual bits of research might impact on policy and practice and then seek to make these changes themselves within their own organisation. This depends very much on individual leadership, regional context, and need.
- difficulty accessing non-peer-reviewed reports, particularly applied research being done by other RUAs or other agencies.
- difficulty in summing-up research in a format (such as video or YouTube etc.) that would be easily digestible and understandable by non-researchers
- delays in adoption of research findings because of financial or other constraints.

5.4.5 An assessment of the critical gaps and deficiencies to date in the delivery of the Roadmap priorities

RUAs were asked to rank the 10 SRPs from the SRBBR in order of importance (Table 7). Clearly, there was little consensus across RUAs, with the scores for each SRP ranging from a high of 1–3 to a low of 7–10. At least one SRP was ranked in the top three by all RUAs. One RUA provided separate scores from different internal units with biodiversity and biosecurity interests, showing markedly different priorities; two other RUAs made the same observation that ranking would vary between internal work areas. Average ranks fell broadly into three groups:

- scaling up; ecological monitoring and reporting; and surveillance and detection ranked highest
- novel tools, tactics and strategies and improvement of existing tools, tactics and strategies; risk analysis and prioritisation; and ecosystem services and valuation of natural assets ranked next
- pathway analysis; data management; social and citizen science; and modelling to predict future scenarios and risks ranked lowest.

The analysis of RUA projects not surprisingly showed a strong focus on threat management and assessment; methodology; pest management and eradication; conservation, biodiversity and restoration; and impact of resources and changes after management, as these represent core biodiversity and biosecurity business for the RUAs.

Table 7. Ranking of SRBBR Priority Research Areas by individual RUAs. For WRC, the ranks refer to views of the internal Catchment Management and Science and Strategy groups, respectively. For most other RUAs, the ranks reflect collective views provided by the contact person for the project. Note: three councils (HRC, GDC and ECAN) did not provide a response. Ranking: 1 = highest (or H=high, M=medium, L=low)

Roadmap Priority Research Areas	Authority												
	MDC	NCC	GW	WRC	ES	AC	ORC	HBRC	TRC	TDC	NRC	BOP	WCRC
1. Scaling up: landscapes and seascapes	2	2	1	6/2	3	3	H	6	1	7	4	7	4
2. Ecological monitoring and reporting	1	1	3	5/1	1=	5	H	5	6	4	1	9	2
3. Surveillance and detection	4	6	7	3/8	1=	6	H	2	2	1	8	1	5
4. Novel tools, tactics and strategies and improvement of existing tools, tactics and strategies	6	3	10	2/7	6	1	M	3	10	2	9	2	8
5. Pathway analysis	8	10	9	1/10	4	8	M	10	9	6	7	5	6
6. Data management	7	9	8	9/6	10	4	H	7	4	5	10	6	3
7. Social and citizen science	10	8	4	10/9	8	2	M	1	3	9	5	8	10
8. Risk analysis and prioritisation	3	7	5	4/5	5	7	H	9	8	3	3	4	7
9. Ecosystem services and valuation of natural assets	5	5	6	7/3	9	9	H	4	7	8	6	3	1
10. Modelling to predict future scenarios and risks	9	4	2	8/4	7	10	M	8	5	10	2	10	9

5.4.6 RUAs' recommendations for better utilisation of research to fulfil SRBBR goals

RUAs had a variety of suggestions for ways in which aspects of research and organizational operations could be better applied to achieve SRBBR goals. These included:

More effective use of existing partnerships (i.e. improve reporting and coordination through existing Special Interest Groups – Biomanagers, Biodiversity Working Group, Biosecurity Working Group). Enhancement of the activity of groups such as the Biosecurity Working Group and the National Biocontrol Collective that facilitate the pooling of money to fund research collectively as they add great value and allow more effective use of resources than individual RUA funding.

Better sharing of research knowledge and current plans and actions among regional RUAs, and a better system to facilitate systematic sharing of research outputs among RUAs. This could include a system of direct links and/or access to research reports through a central RUA database.

Improved collaboration and collective setting of priorities for research that aligns with the Roadmap outcomes. This may require more detail about projects and outcomes that are of a shared nature (multiple RUAs) versus individual nature (single-RUA focus). A central register/compilation/coordination of research needs (ability to identify needs of other RUAs; link to research agencies) similar to that of research undertaken.

Stronger links to national research agencies (especially for smaller RUAs with no such agencies nearby). Improve understanding of what researchers are focussing on or interested in so RUAs can understand how we can support financially or through providing input or support for funding bids. A decent repository of research for practitioners to access and inform our decision making, and better sharing of the outcomes of research.

Greater coordination about what RUA collective priorities are, while accepting that time/capacity constraints limit the extent and nature of such involvement. Need to more systematically and proactively consider roadmap priorities when agreeing to collectively fund work via Biomanagers Group.

Improved collective understanding of the research being done across RUAs and distillation of that understanding to better utilise a collective research viewpoint. One possibility might be to choose 1–2 road map priorities through the biomanagers and then run a process to understand collectively what research is being undertaken or planned on that topic. This could lead to a collective view on research that could facilitate better decision making around what we are doing and a better integration of research resources.

Strengthened working groups. At a national level, the biodiversity working group will play a vital part in moving RCs forward. Some RUAs are more advanced than others and a lot can be learnt from other RUAs. For a RUA entering this space it is important to know what research is already out there and what is easily accessible so this can be shared.

Allowing staff time to assist in local research and be more open to helping research providers and universities find local study sites.

Strengthening or implementing science navigator/broker roles in RUAs is key. Research needs to align with the Territorial and Regional responsibilities and have a greater awareness of the differing time scales for the research and the TA/RC roles (annual plans, 10-year plans, RUA elections).

Recognition that the NZ Biodiversity Strategy (2000) and the soon to be released National Policy Statement on Indigenous Biodiversity (2019) provide incentives for RUAs to detail their strategic approach to biodiversity and implement some nationally consistent prioritisation.

5.4.7 Response by RUAs to the SRBBR recommendations

The SRBBR made a number of recommendations to RUAs to enable them to better address the need for a wider strategic view of research activities and to enable them to have greater input to research planning and improve research uptake. Implementation of the recommendations has been patchy but includes:

Making the Roadmap accessible through the Envirolink web site (although knowledge of it and use of it is currently very limited).

Involving key RUA staff with research providers in planning of research activities. This has occurred principally with the BH NSC, but not much more beyond existing activity with other research providers. In 2018, a bioscience working group (a sub-group of the Regional RUA Bio-Managers' group) had significant input to informing BH NSC priorities and in co-designing better processes for deeper engagement with RUAs. In particular, RUAs provided the Challenge with a 'co-design' model that will eventually ensure commitment of key staff from their organisations at critical points along the innovation pathways. This will ensure strong alignment with RUA priority science and research needs. Similar enhanced research priority discussions and rapid implementation of research findings have occurred between researchers and council staff in those regions where there are major 'predator free' projects (e.g. Hawke's Bay, Taranaki).

Commissioning an Envirolink grant (in part the present contract) to undertake a stocktake of current research activities to familiarise RUA staff with current research activities in biosecurity and biodiversity.

Adoption of adaptive management and learning-by-doing approaches. These approaches have been implemented by Hawke's Bay Regional RUA in their Cape to City project.

Allocation of funding from RUA Biomanagers Group ($20K) for as yet undefined activity.

Reporting annually to RUAs' Chief Executives subgroup on activities undertaken that address issues and recommendations raised in the Roadmap.

6 Conclusions

In their responses, RUAs flagged some issues with the SRBBR. The Roadmap research and science outcomes were seen by some to be focused mainly on terrestrial biodiversity and biosecurity outcomes. Improvement in alignment and integration with marine and freshwater outcomes was suggested as necessary. It was also suggested that the SRBBR needed to take a systems approach to biodiversity and biosecurity priorities by, for example, better linking them to research priorities relating to water and land management.

The SRBBR has had little impact to date on the research focus of RUAs. As one RUA respondent commented, "Most RC and UA research and monitoring projects and outcomes are regionally specific and are a consequence of internal policy and operational levels of service". Within CRIs and NSCs, research leader knowledge of the Roadmap was limited, and it has rarely been used specifically to direct or align research. However, much CRI and NSC research was generally aligned with the Roadmap priorities because the research was directed at biodiversity and biosecurity outcomes shared with the priorities in the SRBBR.

RUAs have both common interests and differing regional/local interests in research to address biodiversity and biosecurity issues. They differ greatly among themselves in their financial and staff capacity to engage in in-house and collaborative research. Although the SRBBR identified 10 high-level SRPs as the focus for future RUA research it made no attempt to prioritise them. Engagement with the SRBBR thus leaves RUAs with potential conflict between their regional and local priorities and focussing on the SRPs from the SRBBR. There was also much variation among RUAs in the ranking of priorities among the 10 SRPs, suggesting pan-RUA discussions are needed to establish a set of agreed priorities for marketing to research providers. RUAs' ability to assess relative priorities between their internal needs and the Roadmap priorities would be greatly assisted by a database/repository of internal and collaborative research and associated publications. Such a resource would facilitate the preparation of a priority research needs document, both communally and for individual RUAs or smaller groups of RUAs.

Fortunately, much of RUA research aligns to varying degrees with SRBBR priorities, but that is simply because the outcomes desired from the SRBBR and the RUAs' biosecurity and biodiversity plans and activities are similar. The main point of difference is that the SRBBR has a greater future focus in its priorities for research than seen in RUA research, much of which is directed at increments in research to address immediate problems or to inform future plan revisions. Where RUA internal and collaborative research comes closest to the priorities of the SRBBR is in the partnerships and focus of those RUAs engaged in aspirational programmes, such as the Predator Free initiatives, and where there are strong links to research and tertiary institutes.

Surprisingly, biodiversity and biosecurity research needs of RUAs did not commonly feature in detail in most regional pest management strategies and plans or in the various regional biodiversity plans and strategies. This is a gap that it would benefit RUAs to address, particularly for biodiversity research, perhaps through the priority research needs document suggested above.

The stocktake of RUA and research institute reports and publications revealed the large volume of relevant material produced, and problems associated with extracting value from it. First, sharing of information among RUAs is inadequate. For example, the failure of RUAs to provide copies of all project reports to the Envirolink manager means that collectively they are missing out on much valuable information. Second, other publications, particularly scientific journal publications, may be unavailable to RUAs or RUAs may simply not have the capacity to assess the value of the large volume of material produced annually to their biodiversity- and biosecurity-related activities. RUAs would clearly benefit from access to this material if a suitable means of interpreting it for their use could be implemented.

RUA and research provider projects and publications mainly aligned with the same Roadmap priorities. This is hardly surprising given the immediate issues facing biosecurity and biodiversity. However, the marked differences between RUAs in their ranking of Roadmap priorities and the differences between their rankings and their current research activity suggests that at least some RUAs were looking to the future and the need to address particularly community engagement, scaling up, predictive modelling and data management.

The SRBBR suggested that RUAs consider funding a 'knowledge broker' position tasked with translating such material and interpreting its utility for policy development and practice improvement or, alternatively, incorporating research translation into contracts with research providers. Knowledge brokering is, to some extent, already part of the process, at least by some research providers. The BH NSC has 3 such positions, the purpose of which is to connect NSC-associated researchers with stakeholders who need their specialised knowledge. Knowledge brokers are responsible for helping facilitate alignment of Challenge research to the Challenge Mission, coordinating stakeholder engagement in research projects, and working closely with Challenge stakeholders to ensure a direct pathway to implementation and uptake of scientific outputs. Bill Dyck, who is a BH NSC knowledge broker, also has a role with regional RUAs as their "science coordinator" which has included facilitating development the RUA Research, Science & Technology Strategy (Regional RUAs 2016) and its implementation. The strategy is used to communicate priorities, both among RUAs and, externally, to relevant government agencies such as to MBIE, MPI, MfE, and DOC. NIWA has an Envirolink coordinator position that involves interaction with various RUA science, policy and other staff seeking Envirolink-funded advice on resource management issues or developing larger Envirolink Tools projects that often are oriented to national guidelines. That role also involves convening an internal sector group (the local government sector group) which is focussed on NIWA's work and important relationship with RUAs. Other arrangements also effectively act as 'brokers' between RUAs and researchers, for example, the National Weed Biocontrol Collective. A single RUA knowledge broker would have a daunting task, given the breadth of material produced by research providers. Alternative options would be for each RUA or research organization to identify a person in that role; for RUAs to fund through Envirolink an annual review by research providers of all research; or for RUAs and research providers to review research associated with Roadmap priorities jointly. However, regardless of the issue about knowledge brokers, RUAs need to improve their internal systems to enable effective sharing of data and information.

7 Recommendations

This review found that there was limited awareness and strategic use of the Roadmap in scoping and prioritising research, both within RUAs and by key research providers, with local/regional demands driving prioritisation by individual agencies. Although there was alignment between research undertaken and SRPS, this was frequently coincidental and not explicitly linked to the Roadmap. We therefore recommend:

- RUAs should collectively select 1–2 Roadmap priorities annually, and through the Biomanagers Group review what research RUAs and research providers are undertaking collectively on those priorities. This would provide a collective view of the research and of whether this facilitates better decision making about research implementation and improved integration of research resources.
- RUAs should create an annual list of high priority projects to be used as the basis for discussions with research providers about collaborative research initiatives. Such discussion would need to take place at a time appropriate to RUA and research provider funding cycles. Documenting RUA essential research needs and priorities, possibly as appendices to revised annual and long-term biosecurity and biodiversity plans, would allow potential research providers a regular snapshot of needs around which collaborative projects could be developed.
- RUAs should make more strategic use of Envirolink funding by taking a greater role in driving project identification and proposals, and seeking opportunities for projects that would have wider benefits than for just the contracting RUA. Similarly, RUAs should seek to identify potential Tools projects that align with SRBBR priorities. This could be facilitated if RUAs established a central register of research needs across all RUAs and updated that annually.

We found that engagement with the SRBBR leaves RUAs with potential conflict between their regional and local priorities and focussing on the SRPs from the SRBBR and, except where projects involved more than one RUA, there was little evidence of formal sharing of project findings and outcomes across RUAs. Despite a large volume of relevant material being produced, there are problems associated with extracting value from it in a user-friendly form; also, there is no current mechanism for sharing internal research findings and reports that may be of interest to multiple RUAs. Therefore:

- RUAs should use existing internal and external partnerships more effectively (i.e. improve reporting and coordination through SIGS – Biomanagers, Biodiversity Working Group, Biosecurity Working Group).
- RUAs should ensure copies of all non-confidential Envirolink reports are made available for posting on the Envirolink web site. It would also be helpful if the Envirolink administrator corrected classification code errors in the database and added an improved search capability.
- A funding mechanism (shared model; Envirolink) should be identified to support the relevant research institutes (MWLR, NIWA, Scion, AgR, Cawthron, BH NSC) to jointly provide a list and summary of relevant science publications and reports. This compilation should focus on the implications of the research for RUA biodiversity and biosecurity outcomes as specified in the relevant RUA plans, and on alignment with the SRBBR.

- RUAs should improve their internal systems to enable more effective sharing of data and information. This would enable efficient compiling and distribution amongst themselves of an annually updated version of the database of RUA research projects collated for this project. RUAs should also consider making the database a current, as well as a historical one, by including projects at the time of their initiation.
- Given the volume of relevant bioscience research, its variable accessibility and the demands on capability and capacity in extracting relevant information by individual RUAs, the role of knowledge brokers within or between RUAs should be explored as a priority

8 Acknowledgements

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Appendix 1 – Information required for the Envirolink Project on Knowledge Transfer of Biodiversity and Biosecurity Research

This project covers the period from July 2015 to December 2018. The July 2015 date was chosen as a start point because the Research Roadmap was not formally approved until late 2014 and it would therefore have taken some time to begin to influence research decisions and allocations.

The review is intended to cover **research** in the areas of **biosecurity** and **biodiversity**. By research is meant systematic investigation in order to establish facts and reach new conclusions. For example, undertaking pest control is not considered research unless it also addresses a question, such as comparing efficacy of trapping and bait stations

There are 7 areas that the review will cover. The bullet points under each of the seven areas listed below outline the information needed to address each bullet point and complete the review successfully.

The overarching Roadmap Goals and the 10 Roadmap Priority Research Areas are listed at the end of this document.

Information requested from your Council/Territorial Authority

1 Bibliography of relevant research providers and RUA biosecurity and biodiversity research (July 2015-December 2018)

a List of Envirolink projects

b List of internal (i.e. RUA -funded) **research** projects such as

- Pest control trials e.g. effectiveness of herbicides
- Planting trials (eg. novel planting methods, hydroseeding)
- Ecological Surveys and Reports
- Citizen science projects
- Tier 1 and Tier 2 ecological monitoring
- State of the Environment monitoring
- Species distribution research (pest and indigenous)
- Ecosystem mapping

c List of collaborative projects with external research providers (either lead by RUAs/UAs or the external research provider)

For each project please provide

- Project title and duration
- Project leader and contact details
- Project objectives and desired outcome
- Project budget (annual if multi-year)
- Copy of or link to project report

- Note of which of the 10 Roadmap priority areas the project primarily aligns with (if not aligned , record as N/A)

2 Assessment of research against the Roadmap which identifies how RUAs, Manaaki Whenua and other research providers and are using the roadmap to direct research

a Description of process for identifying and prioritising research (both internal and external/collaborative), and allocating funding

b Description of how and to what extent Roadmap priorities influence decision making and budget allocations

c List of biodiversity and biosecurity research priorities during the July 15 to December 18 period

d Evidence of consultation, planning, etc. (internal, and with external research providers)

e Evidence of collaboration across RUAs/UAs to address Roadmap research priorities of common concern

3 How well the research is aligned to the Roadmap

a List each research project, **including Envirolink projects,** and assign a score to each on a scale of 1 (well aligned) to 5 (not aligned) to the relevant Roadmap priority research area (see list below)

b Accepting that RUAs/TAs also need to address problems/issues that arise unexpectedly, please provide your views of the nature of and extent to which research should be aligned to Roadmap?

4 The quality of the research and whether it will provide useful information

For each project you have listed please provide

a Evidence for the projects you have listed that their outputs/results have been adopted

b Evidence for these projects of how the project outcomes have resulted in change in policy and/or practice

c Evidence of how the results have been shared with the rest of your RUA, externally to your RUA

5 How much research has been transferred to council use since 2015

a This will be addressed primarily by the answers you provide to Questions #1 and #4

b What are the main barriers to successful transfer of research findings to future policy and/or practice

6 An assessment of the critical gaps and deficiencies to date in the delivery of the Roadmap priorities

Different councils/TAs are likely to place different emphasis on the ten Research Priority Areas because particular issues vary in significance. So that this can be taken

into account in assessing gaps and deficiencies in delivery of the priorities, for your council/TA please rank the 10 Roadmap Priority Research Areas.

7 Recommendations to help RUAs better utilise research to fulfil Roadmap goals

Views on how RUAs could individually and/or jointly better utilise research to fulfil the Roadmap goals. By 'utilise' research I include both individual and collective prioritisation, planning and conduct of research among RUAs/TAs and between RUAs/TAs and external research providers.

Appendix 2 – Abbreviations used in the report

Regional councils and unitary authorities (* Envirolink code)

BoP:	Bay of Plenty Regional Council
ECAN:	Canterbury Regional Council
HBRC*:	Hawke's Bay Regional Council
HZLC*:	Manawatu-Wanganui Regional Council
NLRC*:	Northland Regional Council
ORC:	Otago Regional Council
ESRC*:	Southland Regional Council
TRC:	Taranaki Regional Council
WRC:	Waikato Regional Council
GW:	Greater Wellington Regional Council
WCRC*:	West Coast Regional Council
GSDC*:	Gisborne District Council
MLDC*:	Marlborough District Council
NCC*:	Nelson City Council
TSDC*:	Tasman District Council

Research Providers

MWLR:	Manaaki Whenua Landcare Research
NIWA:	National Institute of Water and Atmospheric Research
AgR:	AgResearch
Scion:	New Zealand Forest Research Institute
Cawthron:	Cawthron Institute
BH NSC:	Biological Heritage National Science Challenge
OLW NSC:	Our Land & Water National Science Challenge

Envirolink Project Area Focus Codes (assigned by B Dyck)

FW:	Freshwater
FWBD:	Freshwater biodiversity
FWBS:	Freshwater biosecurity
G:	General
M:	Marine
MBD:	Marine biodiversity
MBS:	Marine biosecurity
TBD:	Terrestrial biodiversity
TBS:	Terrestrial biosecurity

Focus codes for research institute publications and reports

Code	Coverage
B	Biology, ecology, taxonomy
C	Conservation, biodiversity, restoration
CC	Climate change
E	Economics, cost-benefit
ES	Ecosystem services, natural capital
I	Invasion, Invasive species
IM	Impact (on resources, or changes after management)
M	Methodology
P	Policy
PM	Pest Management, eradication
S	Social, cultural
T	Threat management, threat assessment
W	Animal welfare
nr	Project not directly relevant

Appendix 3 – Details of all Envirolink projects on biodiversity and biosecurity undertaken between July 2015 and December 2018, sorted by Topic Code and assigned a SRBBR Strategic Research Priority code number

http://envirolink.govt.nz (accessed 28 May 2019), (DNP = did not proceed)

E-link ID	RUA Identifier	Provider	Topic Code	Brief Description	Funding ex GST	Project Report	Assigned Strategic Research Priority
1611	TSDC118	LCR	FW	Innovative communication with the community to improve water quality	5000		7
1617	TSDC119	Cawthron	FW	River water quality monitoring design - TDC	10000	1617-TSDC119	2
1632	ESRC161	Cawthron	FW	Interpreting RHA data for tuna and trout	5000	1632-ESCR161	2
1744	HBRC224	Cawthron	FW	Establishing methodology to monitor fish communities in larger rivers	5000		2
1615	HZLC125	NIWA	FWBD	Lamprey monitoring	20000		2
1634	HZLC128	LCR	FWBD	Revision of wetland biodiversity monitoring	5000		2
1635	HZLC129	NIWA	FWBD	Coastal lake prioritisation	5000		2,8
1639	GSDC127	NIWA	FWBD	Training in IFIM Habitat Survey Methodology	19838		2
1651	NLRC190	NIWA	FWBD	Fish passage guidelines	20000		2
1657	GSDC132	UCAN	FWBD	Inanga habitat enhancement	5000		4
1658	ESRC275	Cawthron	FWBD	Modelling and analysis of invertebrate drift	40000		10
1659	TSDC123	LCR	FWBD	Wetland significance framework	19900		2
1722	NLRC194	NIWA	FWBD	Status of dune lake galaxias	20000	1722-NLRC194	2
1733	HBRC223	NIWA	FWBD	Catchment ecosystem health workshop	20000	1733-HBRC223	2,7
1747	HBRC225	Cawthron	FWBD	RUA surveys and scoping exercise for the EMAR freshwater habitat subgroup	9675		2
1761	HBRC227	Cawthron	FWBD	Revision of rationale for assessing fish flow requirements for minimum flow	20000		2
1766	WCRC162	LCR	FWBD	Sphagnum moss harvesting impacts	20000		2
1788	WCRC164	Cawthron	FWBD	Stream habitat monitoring	5000		2
1789	NLCC97	Cawthron	FWBD	Monitoring relative effects of water quality stressors workshop	5000		2
1838	HZLC143	NIWA	FWBD	Managing groundwater sustainably: an ecosystem perspective	37959	1838-HZLC143	2,4,8
1849	HZLC144	Cawthron	FWBD	Deep coastal lake restoration	18550	1849-HZLC144	2,4

E-link ID	RUA Identifier	Provider	Topic Code	Brief Description	Funding ex GST	Project Report	Assigned Strategic Research Priority
1850	HZLC145	Cawthron	FWBD	Shallow coastal lake restoration	12923	1850-HZLC145	2,4
1855	NLRC205	Cawthron	FWBD	Effects of low flow and water allocation limits on aquatic biodiversity	20000		2,4
1861	TSDC143	ESR	FWBD	Assessing groundwater ecosystems	20000	1861-ESRC143	2
1871	WCRC172	NIWA	FWBD	Wetlands protection and natural hazard management in Kongahu wetlands			2
1903	TDSC148		FWBD	Wetland delineation protocols	20000	1903-TDSC148	2
1638	GSDC126	NIWA	FWBS	Potential freshwater aquatic pests - Gisborne	5000		8
82	WCRC12	NIWA	FWBS	Glyceria and Phalaris control	5000		4,8
226	HZLC24	NIWA	FWBS	Phragmites australis eradication	5000	226-HZLC24	4
254	NLRC34	NIWA	FWBS	Aquatic weed control options	5000		4
307	NLRC48	NIWA	FWBS	Manchurian wild rice trial Wairoa River	5000		4
433	ESRC208	NIWA	FWBS	Environmental risk of Didymo	20000		8,2
443	HZLC47	NIWA	FWBS	Elodea assessment at Piriaka	13180	443-HZLC47	8,2
444	HZLC48	NIWA	FWBS	Aquatic pest plant species dispersing from Lakes Rotoaira and Otomangakau	9950	444-HZLC48	8,2
447	HZLC51	NIWA	FWBS	Blue-green algae communication workshop - Wanganui	5000		7,8,4
485	TSDC37	NIWA	FWBS	Lagarosiphon eradication	5000		4,8
542	NLRC82	NIWA	FWBS	Manchurian wild rice trial Wairoa River	5000		4,8
622	NLRC86	NIWA	FWBS	Manganui River pest plants	5000	622-NLRC86	4,8
661	NLRC92	NIWA	FWBS	Grass carp behaviour - Swan Lake	5000		8,4
717	NLRC102	NIWA	FWBS	Dune lake and hornwort control	5000		8,4
812	NLRC111	NIWA	FWBS	Silver carp environmental assessment	20000		2,8
938	WCRC84	NIWA	FWBS	Largarosiphon workshop	5000		7,4
1248	HZLC93	LCR	FWBS	Biocontrol of Lagarosiphon major	19950	1248-HZLC93	4
1307	HZLC260	Cawthron	FWBS	Reviewing Horizons' cyanobacteria monitoring programme – Phase One	10000		2,8
1456	WCRC130	NIWA	FWBS	Parrot's feather pest plant delineation	5000		8,4
1457	NLCC81	Cawthron	FWBS	Phormidium advice	5000		8
1458	NLRC170	NIWA	FWBS	Best practice guidance for aquatic weed control	19740		4,2

E-link ID	RUA Identifier	Provider	Topic Code	Brief Description	Funding ex GST	Project Report	Assigned Strategic Research Priority
1470	NLRC171	NIWA	FWBS	Pest fish introductions - Northland	5000	1470-NLRC171	8
1565	WCRC141	NIWA	FWBS	Parrot's feather control	5000		8,4
1566	WCRC142	NIWA	FWBS	Aquatic pest surveillance work in relation to lakes within the West Coast region.	20000		4
1642	NLCC90	Cawthron	FWBS	Periphyton workshop - Nelson	5000		2,7
1781	ESRC169	Cawthron	FWBS	Cyanobacteria communication	5000	1781-ESRC169	7
1782	ESRC280	Cawthron	FWBS	Forecasting *Phormidium* blooms in Southland rivers		1782-ESRC280	10
1779	TSDC135	NIWA	FWBS	Willow control options	5000		4
1805	ESRC280	Cawthron	FWBS	Forecasting *Phormidium* blooms in Southland rivers	20000		10
1818	WCRC166	NIWA	FWBS	*Lagarospihon eradication* feasibility Aromahana Lagoon	5000		4,8
1820	WCRC167	Cawthron	FWBS	Cyanobacteria risk and monitoring	5000		8,2
1865	NLCC100	NIWA	FWBS	Vietnamese parsley investigation	5000		4,8,2
1729	HZLC137	LCR	G	National Protocols for Site Numbering and Naming	20000	1729-HZCL137	2
1833	ESRC172	UO	G	Interdisciplinary approach to research in differing environmental and social landscapes	5000	1833-ESRC172	7,4
1864	HBRC236	LCR	G	Mātauranga Māori in Environmental Monitoring	DNP		
1881	NLCC103	Cawthron	G	Kotahitanga mo te Taiao Nature Conservation Strategy	16900		2,8,4
1605	NLRC186	Cawthron	M	Benefit-Cost Framework for Managing Marine Biosecurity Risk Pathways	19651		5,8,7
1608	ESRC160	Cawthron	M	Bilge water risk to Fiordland marine area		1608-NLRC185	8
1610	NLRC187	LV/LA	M	Hull scanner for detection of exotic species	18400		8,4
1631	ESRC273	Cawthron	M	Review of benthic invertebrate metrics for assessing stream ecosystem health	27707		2
1643	TSDC121	Cawthron	M	The Coastal Marine Area of Tasman and Golden Bays - A summary of the state of the environment.	10000	1643-TSDC121	2
1660	MLDC113	Cawthron	M	Marine environmental data needs – Marlborough Sounds	20000	1660-MLDC113	2
1710	NLCC94	Cawthron	M	Marine ecological information – Nelson	20000	1710-NLCC94	2
1725	MLDC123	NIWA	M	Aquaculture effects on biogenic habitats	5000	1725-MLDC123	2,4

E-link ID	RUA Identifier	Provider	Topic Code	Brief Description	Funding ex GST	Project Report	Assigned Strategic Research Priority
1734	MLDC126	NIWA	M	Sediment effects on bivalves	5000	1734-MLDC126	4,2
1735	MLDC127	Cawthron	M	Monitoring the state of the Picton Bays environment	19900	1735-MLDC127	2
1750	ESRC279	NIWA	M	Urban contamination of New River Estuary	20000		2,4
1763	GSDC140	Cawthron	M	Shellfish monitoring improvements	DNP		
1772	MLDC131	NIWA	M	Monitoring underwater noise	20000		2
1776	GSDC144	ESR	M	Shellfish health guidelines	DNP		2
1852	NLRC204	Cawthron	M	Estuary monitoring methods			2
1859	MLDC138	Cawthron	M	Monitoring for fish farms			2
1866	NLCC101	Cawthron	M	Design of a state of the environment monitoring programme in Tasman and Golden Bays	20000		2
1705	HBRC221	NIWA	MBD	Ahuriri investigation	5000		2,8,4
1713	MLDC120	NIWA	MBD	Shellfish restoration advice - Pelorus	5000		4,2
1815	MLDC137	Cawthron	MBD	Effects of moorings on different marine habitat types	20000	1815-MLDC137	8,4
1814	NLCC98	Cawthron	MBD	Marine science communication Delaware Bay	5000	1814-NLCC98	7
1839	WCRC169	NIWA	MBD	West Coast CMA biodiversity	5000		2,8
1804	ESRC286	NIWA	MBS	Tools and infrastructure for responding to marine pest incursions in Southland	18181		8,4,2
1823	NLRC200	UAUC	MBS	Northland: First Port of Call for Marine Invasives	19300		8,4,2
1824	NLRC201	NIWA	MBS	Increase in algae at Waipu Beach in Northland	10000		8,2
1827	TSDC140	Cawthron	MBS	In-water hull cleaning guidelines		1827-TSDC140	8,4
1828	GSDC147	LCR	S	Effectiveness of dung beetles	20000	1828-GSDC147	4
1609	NLRC175	LCR	TBD	Ecological Integrity and Conservation Significance of Critically Threatened Northern Heathlands (Gumlands)	20000		8,2
1647	ESRC164	LCR	TBD	Biodiversity/Biosecurity needs workshop	5000	1647-ESRC164	8,10
1666	GSDC135	UW	TBD	PMA monitoring approach	5000		2
1707	MLDC119	LCR	TBD	Wetland restoration methodology	5000	1707-MLDC119	4
1711	NLRC192	LCR	TBD	Warawara Forest bird baseline	20000		2

E-link ID	RUA Identifier	Provider	Topic Code	Brief Description	Funding ex GST	Project Report	Assigned Strategic Research Priority
1712	NLRC193	LCR	TBD	Warawara Forest vegetation map	20000		2
1764	GSDC141	LCR	TBD	Gap analysis of areas outside of Protection Management areas	20000	1764-GSDC141	2,8
1765	HBRC228	LCR	TBD	Using *Bolboschoenus* species in riparian restoration	DNP		
1769	NLCC96	LCR	TBD	Plants for water sensitive design practice	12400		4
1837	HBRC232	LCR	TBD	Upper Ripia frost flat heathland ecological integrity	20000	1837-HBR232	2
1846	GSDC149	LCR	TBD	Options for the Restoration of Tuamotu Island	20000	1846-GSDC149	4
1845	GSDC148	UCAN	TBD	Indigenous vegetation for riparian management	19596	1845-GSDC148	4
1854	GSDC150	LCR	TBD	Forestry harvesting impacts on indigenous fauna	20000	1854-GSDC150	4,2
1914	NLCC104		TBD	Nelson wildlife halo operational plan review	5000	1914-NLCC104	4,2
1602	NLRC184	Cawthron	TBS	New pest controls workshop and report	5000	1602-NLRC184	4
1603	NLRC185	LCR	TBS	Wild deer in Northland – future management options	15000		4,3,2
1636	HZLC130	LCR	TBS	Feral goats and soil conservation	5000	1636-HZLC130	2,4
1640	ESRC162	LCR	TBS	Analysis of broom control data	5000		4
1673	TSDC126	UVIC	TBS	Cat behaviour in the natural environment	5000		8
1674	HBRC222	LCR	TBS	Wide-scale predator control	15000	1674-HBRC222	4,2,7
1726	NLRC196	LCR	TBS	Wild ginger effects assessment – Northland	14580	1726-NLRC196	2
1728	TSDC128	AgRes	TBS	Yellow bristle grass management	5000		4,7
1752	MLDC129	AgRes	TBS	Nassella tussock monitoring	20000	1752-MLDC129	4
1780	GSDC145	LCR	TBS	Animal Pest Monitoring and control methods for Waingake Bush	14500	1780-GSDC145	4
1821	NLRC199	Scion	TBS	Myrtle rust surveillance app	19914		3
1841	ESRC502	LCR	TBS	Review of herbivorous mammal impacts on production landscapes	39500	1841-ESRC502	2,8
1853	HBRC234	Cawthron	TBS	Best-practice guidelines for the use of PAPP for feral cat control	17900		4

Appendix 4 – Accessible Envirolink reports on biodiversity and biosecurity published between July 2015 and December 2018

Reports are downloadable from http://envirolink.govt.nz/envirolink-reports (accessed 28 May 2019).

Code	E-link reference no. and RUA	Report title
BD	1571-NLRC182	Mapping the knowledge of insect biodiversity across Northland
BD	1572-NLRC183	Reversing the decline of *Utricularia australis* in Northland
BS	1602-NLRC184	Trends in Vertebrate Pesticide Use and the Importance of a Research Pipeline for Mammalian Pest Control in NZ
BS	1603-NLRC185	Strategic principles and tactical options for managing wild deer in Northland Region
M	1608-ESRC160	Bilge water risk to Fiordland marine area
FW	1617-TSDC119	Review of the Tasman District RUA's River Water Quality and Aquatic Ecology Monitoring Programmes
FWBD	1624-HZLC127	Manawatu-Wanganui Estuaries Habitat Mapping Vulnerability Assessment and Monitoring Recommendations Related to Issues of Eutrophication and Sedimentation
BS	1636-HZLC130	A review of feral goats as a contributor to erosion and the benefits of goat control
M	1643-TSDC121	State of the Bays - Tasman and Golden Bay marine environments
M	1660-MLDC113	Opportunities for an integrated approach to marine environmental monitoring in the Marlborough Sounds
FWBD	1632-ESRC161	Longfin tuna and brown trout habitat quality indices for interpreting habitat quality score data
TBS	1674-HBRC222	A Maungaharuru-Tangitū perspective on wide-scale pest control and biodiversity restoration
TBD	1707-MLDC119	Wetland restoration methodology
M	1710-NLCC94	Advice for the NCC Whakamahere Whakatu Nelson Plan: coastal indigenous biodiversity
FWBD	1724-NLRC194	Dune lake galaxias in the Kai Iwi Lakes
M	1725-MLDC123	Effects of mussel farming on reef-building biogenic habitats - Serpulid reefs
TBS	1726-NLRC196	Impacts caused by *Hedychium gardnerianum* infestations
G	1729-HZLC137	National environmental monitoring site identification
FWBD	1733-HBRC223	Ecosystem health in highly modified lowland catchments- Karamū catchment, Hawkes Bay
M	1734-MLDC126	Effects of sediment deposition on the New Zealand cockle, Austrovenus stutchburyi
M	1735-MLDC127	Environmental Monitoring Opportunities In Picton Bays
TBS	1752-MLDC129	Nassella tussock population monitoring system for Marlborough District RUA
TBS	1752-MLDC129 spreadsheet	Nassella tussock monitoring spreadsheet

Code	E-link reference no. and RUA	Report title
TBD	1764-GSDC141	Gap Analysis and mapping of areas of biodiversity outside Protection Management Areas in Gisborne District
TBS	1780-GSDC145	Animal pest monitoring and control methods for Waingake Bush
FWBS	1781-ESRC169	Advice on benthic cyanobacteria health risks and communication strategies in the southland region
FWBS	1782-ESRC280	Drivers of Phormidium blooms in Southland rivers and the development of a predictive model
S	1828-GSDC147	Evaluation of the effectiveness of dung beetles in improving the environmental health of land and rivers within Tairawhiti
TBD	1837-HBRC232	Conservation significance of upper Ripia frost flat heathland, a Critically Threatened Ecosystem in Hawkes Bay
FWBD	1838-HZLC143	Groundwater Ecosystems: Functions, values, impacts and management
TBS	1841-ESRC502	A review of the damage caused by wild mammalian herbivores to primary production in New Zealand
TBD	1845-GSDC148	Waimata River riparian zone description and guidance for restoration
TBD	1846-GSDC149	Restoration options for Tuamotu Island, Gisborne
FWBD	1849-HZLC144	Restoration Planning for Deep Dune Lakes – Data Review and Recommendations
FWBD	1850-HZLC145	Restoration Planning for Shallow Dune Lakes – Data Review and Recommendations
TBD	1 854-GSDC150	Conserving indigenous fauna within production forestry landscapes
FWBD	1861-TSDC143	Sampling considerations and protocols for assessing groundwater ecosystems
FWBD	1903-TSDC148	Wetland delineation protocols
TBD	1914-NLCC104	Nelson Wildlife Halo Operational Plan review

Appendix 5 – Envirolink Tools Projects relevant to SRBBR priorities

These are downloadable from http://envirolink.govt.nz/envirolink-tools/ (accessed 28 May 2019). Projects have been linked to relevant Strategic Research Priority (SRP)

Focus	SRP	Tool title
Biosecurity/Biodiversity	2,8	Threatened Environment Tool [R1-2]
Biosecurity/Biodiversity	2,8	Threatened Environment Tool
Biosecurity/Biodiversity	4	Vertebrate Pest Decision Support System [R2-3]
Biosecurity/Biodiversity	4	Vertebrate Pest Decision Support System (Landcare Research)
Biosecurity/Biodiversity	2,8	Setting Outcomes and Measuring Performance of Regional RUA Pest and Weed Management Programmes [R6-1]
Inland waters	2	National Environmental Monitoring Standards [R8-1]
Inland waters	2,8	Sediment Assessment Methods: Protocols and guidelines for assessing the effects of deposited fine sediment on in-stream values [R4-1]
Inland waters	2,8	Stream Habitat Assessment Protocols for Wadeable Rivers and Streams of New Zealand [R1-1]
Inland waters	2	The Stream Restoration Indicator Toolkit [R1-6]
Inland waters	2,8	The River Values Assessment System [R4-2]
Marine	2,8	Marine Habitat Assessment Decision Support Tool - background and operating instructions [R4-6]
Marine	2,8	NZ Estuary trophic index Screening Tool 1 - Determining eutrophication susceptibility using physical and nutrient load data
Marine	2,8	NZ Estuary trophic index Screening Tool 2 - Determining monitoring indicators and assessing estuary trophic index

Appendix 6 – Responses from external research providers relating to awareness and influence of the SRBBR

Agency	Response
MWLR	For Biosecurity-related projects, of the 27 project leaders that responded, 9 were aware of the roadmap; 5 had aligned research in a funding proposal to the Roadmap; and 1 had used the Roadmap to develop a specific research project. For Biodiversity-related projects, three of the five Research Priority Area Leaders were aware of the SRBBP, but none were using it as a key document in developing research proposals. A general comment was that although few projects had been specifically aligned with the SRBBP, much of the research undertaken in both biosecurity and biodiversity was highly relevant to one or more of the priority research areas.
Scion	Scion Forest Protection Division staff were generally unaware of the SRBBR and no specific Scion research has been aligned with it.
Cawthron Institute	Staff were not specifically aware of SRBBR, but were familiar with the Regional RUA's Research, Science and Technology Strategy which includes some of the priorities identified the SRBBR and has guided research proposals. Although the SRBBR has not directly guided Cawthron Institute projects or proposals, much of its research is aligned with its priority research areas.
AgResearch	The Biocontrol and Biosecurity Team were unaware of the SRBBR. Weed research programmes are guided by the AgResearch Pastoral Sector Weeds Research Strategy (www.agresearch.co.nz/our-science/forage-science/) which was co-developed with Regional RUAs and others involved in weed management decision-making in the pastoral sector. None of the current weeds projects are guided by the SRBBR but much of current research is directly aligned with the SRBBR priority research areas.
NIWA	A number of programmes (particularly in freshwater & marine) reference the SRBBR in setting research priorities. There is also regular engagement with some of the RC Special Interest Groups (e.g. Biosecurity Managers, Coastal Special Interest Group).
BH NSC	In the development of the BH Strategy (2019–2024) the Regional RUAs Bio-Managers group had significant input to informing BH NSC priorities and in co-designing a better process for deeper engagement with RUAs. In 2018, a bioscience working group (a sub-group of the Regional RUA Bio-Managers' group) had significant input to informing BH priorities and in co-designing better processes for deeper engagement with RUAs. In particular, RUAs provided BH with a 'co-design' model that will eventually ensure commitment of key staff from their organisations at critical points along the innovation pathways during development of the 7 Strategic Outcomes from November 2018. This will ensure strong alignment with their priority science and research needs.
OLW NSC	In the context of the OLW original scope, biodiversity/biosecurity matters were considered peripheral to its mission. However, it has become apparent through the course of the first phase of research that there are strong links between the outcomes OLW is seeking for soil, water and NZ agricultural performance, and biodiversity. OLW will be working closely with other challenges, including BH NSC to make these connections stronger through joint work programmes. For example, future research will include creating a biosphere data commons for NZ where data are held across multiple institutions with common objectives and interests (in collaboration with the Biological Heritage NSC).

Appendix 7 – Responses of RUAs to Question (2) – Assessment of research against the Roadmap which identifies how RUAs, Manaaki Whenua and other research providers and are using the roadmap to direct research

a Description of process for identifying and prioritising research (both internal and external/collaborative), and allocating funding

Responses
Until recently there has been limited prioritisation of research needs by WRC. Instead, research has been undertaken on an 'as required' basis. Often this research will be based on the needs of the Long Term Plan (www.waikatoregion.govt.nz/RUA/policy-and-plans/long-term-RUA-community-plan-annual-plan-and-annual-report/long-term-plan-2018-2028/), regional planning document requirements, or when there are contentious issue (e.g. the spread/clearance of mangroves). The two exceptions would be the Healthy Rivers project and research undertaken as part of the dama wallaby management plan where research needs have been prioritised.
Decided through Long Term Plan process and alignment with RUA strategic direction and outcomes. Decisions made as required by our 'Chief Science Advisor' (i.e. Director of Science and Information).
This varies across departments. In biosecurity, we have a research section in our regional pest management plan, which sets out priority areas. Under the legacy RPMS this was just a list of species of interest. In the plan we've just recently adopted it's more about themes rather than species. We also used to have a biosecurity research implementation plan. This latter document is now out of date and no longer actively used. The process is quite undeveloped at the moment and, to be honest, rather dependent on the individuals involved. Having recently adopted a new RPMP it's a good time for us to reinvigorate a more systematic approach to what research we solicit or support, including alignment to the RPMP plus external strategic frameworks such as the RC research roadmap etc. Regardless, the research that is generated out of our biodiversity/biosecurity teams is by nature intended to be applied operational work that will assist us in overcoming critical knowledge/tool gaps that impede our effective management. There's also the state of the environment monitoring / reporting element, where we're moving slowly to improve alignment with national indicators.
The process for identifying and prioritising research for each new contract (each contract lasts 12 months 1 July – 30 June) starts with a comprehensive review of the existing and completed research programmes from the previous 12 months. This is usually in the form of a 2–3 day meeting with researchers and the project team. Once the review has taken place the team discusses new opportunities and needs. This list is compiled, and then the costings and allocated budget is incorporated. Final decisions are made by the project team (consisting of staff from all organisations involved) on the research topics for the coming year.

b Description of how and to what extent Roadmap priorities influence decision making and budget allocations

Responses
Generally, Roadmap research priorities have had little influence decision making and budget allocations.
Since the creation of the Roadmap in 2015, it has not been directly used by either the Biosecurity and Biodiversity Division or the Science Division at Environment Southland.
The roadmap has had limited explicit influence of late. Having said that, the priorities in the roadmap are largely fairly well aligned to our operational priorities.
The roadmap is not specifically discussed in our research selection process, however many of the identified roadmap priorities are closely aligned with our projects, needs.

c List of biodiversity and biosecurity research priorities during the July 15 to December 18 period

Responses
WRC research is intended to support the WRC strategic directions (p. 178 of the current Long Term Plan) and Directorate activities (pp. 47–52 and p. 182 for Integrated Catchment Management Directorate, and pp. 61–65 and p. 183 for Science and Strategy Directorate).
Listed in Biodiversity Strategy (in prep) and Biosecurity Strategy.
These are project-specific and are established annual in consultation with research providers. For current year: • Optimise configuration of control devices to maximise the probability of possum eradication and to prevent reinvasion in zone 1 of the Mahia Peninsula based on modelling of possum densities, dispersal, capture probabilities and habitat preferences. Report by Mar 31, 2019. • Design detection network required to demonstrate possum eradication in zone 1 of the Mahia Peninsula. Report by May 31, 2019. • Measure home range size and mobility of possums in three habitat types on the Mahia Peninsula. Report by June 30, 2019. • Spatial analysis of trap catch data from Poutiri Ao ō Tāne to reconfigure and optimise the trapping programme. Report by Dec 21, 2018. • Undertake a power analysis of predator and biodiversity response data collected to date from the Cape-to-City footprint to ensure the monitoring design going forward is sufficiently robust to detect given changes in abundance or presence. Report by Dec 30, 2018. • Undertake predator and biodiversity response monitoring at Poutiri Ao ō Tāne and C2C, including 100 ha of new mānuka plantings on Taurapa station to establish baseline of habitat value. Report on pest and biodiversity responses by May 30, 2019. • Conduct baseline eDNA and carbon surveys of invertebrates in young mānuka plantings, old growth mānuka, and rank pasture with no mānuka. Select sites and report sampling protocols by Nov 30, 2018. (sampling will be conducted from early Dec to early Jan) • Submit a paper on connectivity between sanctuaries and surrounding landscapes. This includes Cape Sanctuary as one of several national case-study landscapes. Submission by Feb 28, 2019. • Write a review paper entitled 'HABITAT: semantics, attributes and importance for bird studies in NZ' which explores how habitat fits with predators and other pests as a factor potentially limiting NZ birds, especially in fragmented and pastoral landscapes like C2C. Review completed by June 30, 2019. • Modify education impacts report to allow wider dissemination. Report by Dec 30, 2018. • Finalise case study of C2C programme. Conduct third round of interviews with core management team members, including new people recently involved in the project, and run a reflective conversation workshop with members. Report by May 30, 2019. • Kaupapa Maori. Provide advice on how best to support Māori engagement through the research programme. Report by Oct 31, 2018. • Repeat rural survey to measure changes in rural understanding and participation in programme. Report by June 30, 2019.

d Evidence of consultation, planning, etc. (internal, and with external research providers)

Responses
When the research plan for the dama wallaby management team (a joint WRC/BOPRC/DOC group) was prepared, consultation occurred with a range of stakeholders. WRC works with universities to identify MSc and PhD projects that are mutually beneficial.
The Southland Science and Monitoring Strategy development has been done with a real effort to include all relevant parties in a collaborative space. We have an internal Biodiversity working group, and a multi-agency working group. We conduct public consultation on things such as the Biosecurity Strategy. Also through Regional Planning processes, e.g. Regional Pest Management Plan.
We have a strong network of relationships particularly with tertiary institutions but also CRIs and other organisations. Active engagement being signalled with tertiary institutions to promote new research section of RPMP to improve alignment of student projects with AC priorities. Common for Ac to co-supervise students on applied topics of interest to us. Alignment to BHNSC, etc. as well. I maintain Honorary Research Associate status at University of Auckland, and advisory board capacity for some tertiary bodies, which helps.
Consultation and planning occur through our decision making process (see Appendix 7a)

e Evidence of collaboration across RUAs/UAs to address Roadmap research priorities of common concern

Response
Examples of collaboration occurring include: • Discussions on research needs at the Biomanagers Special Interest Group (SIG) Network and the Biodiversity and Biosecurity Working Groups meetings • A research plan for the dama wallaby management team (a joint WRC/BOPRC/DOC group) • The National Biocontrol of Weeds Collective.
No evidence of this in relation to Roadmap.
Potential for us to do much better in this space.
Our major project (Te Matau A Māui or Predator Free Hawke's Bay) is a collaboration between multiple organisations, and all are a part of the decision-making process. For our upcoming contract (2019–20) we are aligning with Taranaki Regional RUA and Towards a Predator Free Taranaki Project who will be a part of our planning hui.

Appendix 8 – Alignment of RUA projects with SRBBR Strategic Research Priorities

For each RUA, the percentage of projects (internal and collaborative) aligned with the various SRBBR SRPs. Some projects aligned with more than one SRP.

	ES (n=38)	AC (n=20)	WRC (n=55)	NCC (n=20)	MDC (n=17)	HBRC (n=70)	GW (n=42)	TRC (n=10)	No. of RUAs
1. Scaling up: landscapes and seascapes	3	5				21			3
2. Ecological monitoring and reporting	55		65	80	59	14	81	40	7
3. Surveillance and detection	8	15	4			17		10	5
4. Novel and improved tools, tactics and strategies for threat management	8	20	11	20	35	24	9	30	8
5. Pathway analysis		5	2						2
6. Data management									0
7. Social and citizen science	3	55	2			14	3	10	6
8. Risk analysis and prioritisation			4		6	3	12	10	5
9. Ecosystem services and valuation of natural assets	5		15			6			3
10. Modelling to predict future scenarios and risks	18								1

Appendix 9 – Responses of RUAs to Question (3b) – Accepting that RUAs/TAs also need to address problems/issues that arise unexpectedly, please provide your views of the nature of and extent to which research should be aligned to Roadmap?

Responses
Ideally, research should align with the Roadmap, However, the Roadmap is not particularly balanced. It appears to have a primary focus on biosecurity and has ignored (or downplayed) some of the other key biodiversity issues where we have knowledge gaps – e.g. degradation of freshwater habitats, conflicting community and commercial 'wants' in relation to marine environments (e.g. mangroves) and changes in land use. Many of these other issues are having a significant impact on biodiversity in the Waikato Region. If the WRC is to meet its commitment to the local environment and community it cannot focus solely on the Roadmap research needs. Other research undertaken by WRC has been to improve our monitoring tools, so that we can cost effectively report on the 'state of the environment', and changes in biodiversity in the region.
Despite Environment Southland not having used the Roadmap to direct research thus far, it does still provide a good grounding for prioritizing research in the future. The recommended research areas in the Roadmap are wide ranging but relevant.
It covers a range of issues that are of broad importance to the sector and alignment therefore useful.
Research should be aligned to the research road map where possible. From our perspective we would expect to see 50–75% of research at our RUA funded from the biosecurity space to be aligned. In reality, this is not that difficult as much of the research road map is about the major strategic or operation issues facing RCs in biosecurity and biodiversity.

Appendix 10 – Examples of adoption of research findings by RUAs and the changes in policy and practice resulting from the research

The quality of the research and whether it will provide useful information	
a. Adoption	**b. Change**
Outcomes directly utilised in the product registration process. Further knowledge on efficacy directly adopted by RUA and occupiers and how control operations were delivered.	A change in the way control operations were delivered as more was learnt about the product.
Outcomes fed directly into landholders farming systems that aim to, in tandem, improve productivity and also manage Chilean needle grass	Led to a substantial change in management approaches on a number of properties
If a successful control agent is found, will certainly adopt ways to augment population management	Has the potential to change the nature of managing the pest immensely
This report was important in understanding that non-participation of a few smaller properties within a project would not be cause for project failure which fed directly into the implementation of Cape to City.	Less emphasis on signing lifestyle blocks into the Cape to City project.
While not being able to directly feed into the project management, this report was important to identify that the level of predator control needed is determined by outcomes sought. Therefore, clear outcomes need to be identified from the beginning.	While no policies specifically have been developed from this, it has had influence on the thinking behind implementing projects for species specific protection.
Proof of concept that investment in predator control is reaping expected benefits.	Strengthened case for investing in large scale predator control across farmland.
This report has informed policy makers and practitioners in the difficulty of using measures of predators for compliance and that any compliance should be measured in inputs (i.e. if traps are checked by x date).	This report was critical in framing the technical protocol for the creation of Predator Control Areas that was implemented as part of the recent Hawke's Bay Regional Pest Management Plan.
This report highlighted the strong need to have consistent data collection nationally in order to answer these landscape scale questions.	May have influenced the strong emphasis on using Trap.NZ for data collection in Predator Free projects nationally.
This report confirmed the use of ferret lure in traps. This lure has been a critical component of our trapping programmes.	Change in practice to adding ferret pheromone as a lure alongside conventional baits.
Recommendations for monitoring adopted into Cape to City.	Techniques recommended are typically conventional so nothing new to incorporate.
This report has been hugely useful when talking with farmers about their concerns regarding the influence of predator control on rabbit abundance. There is still a prevailing view that predator control causes an increase in rabbit population.	More needs to be done to dispel the view of predators driving rabbit numbers. It also meant that we put in place a specific night count monitoring programme for rabbits to assist with building the picture discussed by the research.
Reconnecting the landscape for bird species is important to any landscape restoration project and bird movement is fundamental. This report has helped align thinking for habitat restoration however no specific outcomes for this project.	Supports ongoing restoration strategy and programme

The quality of the research and whether it will provide useful information	
a. Adoption	**b. Change**
eDNA as a sampling method is being used in the project as a result of this research project.	Potential new widespread practice using eDNA as opposed to conventional techniques for invertebrate monitoring, however still early days as more complete databases are required.
Methodology for monitoring possums assessed	Methodology for monitoring possums with chew cards pre/post control adopted
Results of this report drove the decision to deploy bait stations across the entire Poutiri Ao ō Tāne footprint (9000ha) of PAPP control. Annual pulses of the toxin is planned for feral cats.	Connovation's application to the EPA to reduce the notification boundary for PAPP was unfortunately unsuccessful as the 3km buffer limits its use. Feral cat policy changes needs to be driven at a national level.
This report resulting in optimising the Poutiri Ao ō Tāne network. A portion of the network was removed based on these recommendations.	The principle of reviewing a trapping network for efficiency at regular intervals has been adopted into our programmes.
This report informed trap spacings required when planning Whakatipu Mahia and was influential in the development of the operation plan.	Designing networks based on a first cut use of this decision-support tool will continue.
Results of this report triggered a mop up operation in Cape to City. This highlighted the importance of reinvasion and predator movement through the landscape.	Aided to refine our targeted trapping/live capture operations.
The project continues to use camera traps as standard operating procedure.	Important to understand tool costings when making monitoring decisions.
With the current costs of wireless monitoring relatively high, this report was critical in assessing the wide-scale use of wireless in the project.	Project has helped to inform where wireless is cost effective and beneficial.
Only horizontal camera traps have been implemented in the projects.	Horizontal camera trapping is current best practice.
This report has helped inform the team how regularly the lure needs to be changed.	When final report is complete will inform best practice and refresh times optimum.
Again, this report was useful to inform use of wireless in our trapping networks and current limitations for maximising savings, e.g. life of bait and layout/scale of networks.	Inform implementation of wireless use.
This report was of limited use when produced as wireless technology was not yet reliable enough for live capture. However now is becoming more relevant in informing our trapping operations as the technology progresses.	Will be important in the future as wireless becomes more widespread and reliable. Important to highlight the non-monetary benefits of wireless.
The Cape to City planting programme ceased in winter 2017 so the timing of this report meant we could not act on the findings. However, the report will be beneficial for HBRC's catchment management team and their erosion control scheme which will see large scale plantings.	Findings can help inform HBRC's erosion control scheme planting.
While our projects do not sit in the urban environment yet, this report is important in articulating the biodiversity benefits in urban environments from possum control only and will aid further urban project planning.	This report supports HBRCs ongoing PCA and HuB programmes and justifications in addition to TB benefits.

The quality of the research and whether it will provide useful information	
a. Adoption	**b. Change**
Report fed directly into identified outcomes for further research.	Information in this report would have aided justification of increased resourcing to predator control and the Predator Free Hawke's Bay project.
This report led to the adoption of Manaaki Whenua's annual Garden Bird Survey data into the projects bird monitoring.	Project data now enhancing Garden Bird database.
This research has helped clarify areas of improvement in project management which has been acted on by the management team.	Management team operations modified.
Results will directly inform species specific work programmes in Cape to City and Poutiri Ao ō Tāne.	This report should also be considered by HBRC's ecosystem prioritisation programme and wider biodiversity work.
Exploiting interspecific olfactory communication to monitor predators.	Ferret lure is now used extensively across our projects and once a synthesised version is available will be used.
Modelling results fed directly into the operation plan and implementation of the Whakatipu Mahia possum eradication.	Will be used to inform best practice for regional rollout of possum eradication across Hawke's Bay.
This report was used to inform the optimisation of the Poutiri Ao ō Tāne trapping network.	Optimised network now in place.
Implementation of our most recent 9000ha PAPP operation (2018).	Report used to ensure best practice application of control method
Review of current hornwort control methods.	No change in practice as research supported current hornwort control methods.
Koi carp digestor no longer operational.	Recommendations unable to be adopted.
Duneland community monitoring method developed.	This protocol will be used by community. Coastcare/Beachcare groups – community groups still require training in how to use it.
Used to support decision making by RUA staff when allocating funding for biodiversity management.	Improved funding allocation.
Information will be used in discussions around mangrove removal and in review of the Regional Coastal Plan	Future decisions about mangroves and Regional Coastal Plan.
Freshwater ecosystem services review completed	Information will be used in review of the Regional Coastal Plan.
Recommendations from National Weed Biocontrol collective on weed biocontrol agents	Has led to a number of biocontrol agents been released in NZ and the region.
Outcomes directly utilised in the product registration process. Further knowledge on efficacy directly adopted by RUA and occupiers.	A change in the way control operations were delivered as more was learnt about the product. Results shared widely with all agencies and communities that use this herbicide as a tool.
Outcomes fed directly into landholders farming systems that aim to, in tandem, improve productivity and also manage Chilean needle grass.	Led to a substantial change in management approaches on a number of properties. Outcomes shared widely across both RUAs and also industry channels.

The quality of the research and whether it will provide useful information	
a. Adoption	**b. Change**
Implemented and facilitated the release of new RHDV strain across the region	Had only moderate impact that did not result in substantial change to RUA's management approach.
Used in proposed Southland Water and Land Plan.	Supported proposals in management plans.
Pest monitoring results communicated to community groups.	Community groups alter pest control methods based on results
Possum monitoring results communicated to interested parties.	Interested parties action further control as appropriate.
Used to inform feral pig management as a component of kauri dieback management.	Incorporated into pig and kauri dieback sections of newly developed RPMP.
Project on-going to refine operational applicability with view to use in detecting kauri dieback (e.g. in nurseries or on waterfront).	Still on-going, anticipated that if successful it will result in introduction of scent detection dog as operational tool.
Used to inform cat management in new RPMP.	Contributed to informing new approach.
Used to inform design of feral pig control programmes.	Contributed to informing new approach.
Contributes to general improvement in understanding of complex multi-species pest control.	No specific changes in practice or policy.
Provided RUA with confidence to recommend that moth plant pods can be safely disposed of into commercial greenwaste collection services.	Has informed advice given to public.
Used to inform weed management practices.	Results generated slightly too late to inform development of new RPMP. Potential to be used in next iteration.
Informed bait delivery and discontinuation of use of Vespex due to limitations in Auckland context.	Results generated slightly too late to inform development of new RPMP. Potential to be used in next iteration.
Recommendations from programme evaluation.	Used to shape future direction of project.
Recommendations from review of fish control and water clarity control.	Discontinued programme of pest control at Lake Wainamu. Replaced by new programmes aligned better to biodiversity and community outcomes