

Environment Research Fund - 2015 Science Investment Round Successful Proposals

Short title	Organisation	Term (yr)	Total funding (excl GST)	Summary
Coastal acidification: rate, impacts and management	National Institute of Water and Atmospheric Research Ltd	4	\$4,900,000	The increase in atmospheric carbon dioxide from burning fossil fuels is altering the chemistry and lowering the pH of the ocean, with potential detrimental effects on marine ecosystems. This is particularly concerning in coastal regions where declines in pH are greater due to riverine input and land run-off. Global research has shown this may impact coastal productivity and foodwebs, and impair the growth of organisms with carbonate shells such as shellfish. Consequently it is imperative we establish the scale of acidification, and if, when and how this will affect New Zealand coastal ecosystems. To do this we will monitor the variation in pH at three different locations, and use this information to determine the impacts on Greenshell mussels, paua, and snapper—species that are ecologically, economically and culturally important in New Zealand. We will determine the sensitivity of their different life stages, and whether changes in food quality, availability and habitat will affect their survival under lower pH in the future. We will also examine the potential for shellfish to adapt to acidification. Combining this information will provide population forecasts for these iconic species, and an indication of future prospects for aquaculture, wild harvest, customary and recreational fisheries. Our research will also consider potential approaches to reducing acidification of coastal water, such as in the Firth of Thames, by identifying sources of acidification that can be managed. We will communicate the information on coastal acidification, using a variety of media including a website, and a final report and workshop synthesising results and recommendations. Our programme will provide new and fundamental knowledge for enhancing protection and management of New Zealand coastal ecosystems.
What's at stake? - Enabling decision-making through better measurement, forecasting and evaluation of the impacts of non-native organisms in NZ's changing ocean	National Institute of Water and Atmospheric Research Ltd	4	\$3,033,760	The transport of marine plants and animals by humans to areas outside their natural range is a global environmental and food production problem that has increased as world trade and travel have expanded and diversified. New Zealand's unique indigenous marine biodiversity—our native marine species, natural habitats, and ecosystems—is particularly vulnerable to introduced non-indigenous species (NIS) as it has evolved in relative isolation from other coastal regions of the world. The impacts of NIS on New Zealand's iconic birds and land-based organisms are well documented, but in our coastal seas, the threat is less visible and more difficult to study. The number and distribution of NIS in our waters is increasing, but our ability to manage threats from them is limited by our understanding of how they behave in New Zealand and the impacts they have on native species, fisheries and aquaculture and other features of our marine environments that are integral to the lifestyle, culture and future prosperity of New Zealanders. Well-targeted measures to reduce the establishment and spread of NIS in our waters may have significant long term benefits for New Zealand, but it is difficult to justify expenditure on management when these benefits are uncertain. This project aims to enhance protection of New Zealand's marine ecosystems and industries through better understanding of the impacts that harmful NIS have on indigenous marine biodiversity and the long-term benefits we derive from it. The research will develop novel methods to describe and measure the current impacts of NIS in New Zealand and to forecast future threats associated with changes to our climate, coastal environments and the arrival and spread of new species. The research team includes ecologists, economists, social scientists and risk modellers in partnership with central and regional government, university, Maori and international collaborators. A key goal is that the environmental, economic, social and cultural values at risk from NIS are better protected by effective management of harmful NIS. The research will develop the required new knowledge and approaches needed to prioritise public investment in biosecurity that gives due consideration to the benefits of marine biodiversity protection for future generations of New Zealanders.
Smart models for aquifer management	Institute of Geological & Nuclear Sciences Limited - Trading as GNS Science	3	\$3,000,000	<p>New Zealand's freshwater resources underpin our nation's health and wellbeing. Freshwater is also vital for the success of primary productivity, tourism and other sectors of New Zealand's economy. The past two decades have seen a high demand for both groundwater and surface water resources. Over the same time period, degradation of water quality has become a more pervasive issue for the nation.</p> <p>This research programme has a focus on aquifer management, specifically on improving the utility of models of groundwater-surface water systems. Why models? Models are essential tools in the effective management of the nation's water resources. Groundwater models are by necessity becoming increasingly complex in order to allow predictions that cover large areas and long time frames with fine spatial and temporal resolution. Hence groundwater models are rapidly becoming too data-hungry and computationally burdensome to run quickly. This is a critical deficiency that significantly undermines current integrated aquifer management.</p> <p>We propose to develop, test and validate a suite of methods for simplifying large-scale groundwater models so that they can run quickly,</p>

				<p>but without introducing biases or inaccuracies. Our approach will be based on innovative mathematical techniques for model simplification. We will apply these techniques to simplify existing complex models from the Mataura (Southland), Hauraki Plains (Waikato) and Ruamahanga (Wellington) catchments. In all cases, these models will include groundwater and surface water components and address water flow and the transport of key contaminants such as nitrate. Development of these simple yet accurate models will make a major contribution to effective water allocation and limit setting.</p> <p>The assembled project team includes experts from GNS Science, NIWA, ESR, Victoria University of Wellington, Market Economics, Earth in Mind and Land Water People Ltd.</p> <p>End-user partners in the programme will include regional councils, Central Government, industry and iwi. These partners will provide crucial input to the programme to define what type of model predictions are important, where these predictions should apply, over what time scales, and how the predictions link to economic, ecosystem and socio-cultural outcomes. Several end-user partners will also be directly involved in the production of the research outputs. This will ensure that the simplified models we aim to develop will be as simple as possible, so as to run most efficiently, but without losing the ability to accurately make the type of predictions that are important for the nation.</p>
Understanding the groundwater conduits between land and receiving waters - the key to effective aquifer management.	Lincoln Agritech Limited	3	\$3,000,000	<p>New Zealand's freshwater resources are at a critical point; we cannot currently define acceptable values for water quality and quantity or ensure they are achieved in a defined time frame with any certainty. In particular, defining acceptable water quality (limit setting), and measures to achieve them (manage to limits), is the responsibility of regional councils. The councils are embarking on collaborative processes to carry out 'limit setting' and 'manage to limits', operated through committees established for each catchment or sub-catchment (Freshwater Management Unit). The committees are comprised of a wide range of community-based representatives, including iwi. However, to make good decisions these committees need robust data and processes; this programme will provide new understanding and enhanced quantification of contaminant transfer from land (source) to freshwater receiving bodies (receptor), taking lag times and assimilative capacity into account. This is key information that committees, regional authorities and the Government require to make good decisions.</p> <p>This research will apply a Measure-Model-Manage (M3) framework to three case study areas, in Canterbury, the Waikato and Marlborough, and will model flows of nitrogen and phosphorus, both in terms of quantity and time. The targeted research in these case study areas will be used to create three types of model as well as methodologies and characteristics of catchment areas, which will allow the findings to be applied broadly across New Zealand. An important type of model produced will be simplified management models, which will convey understanding of contaminant transfers through relevant pathways, and the uncertainty level of this understanding, in a way that is useful for decision making by all stakeholders, including regulatory authorities.</p> <p>This programme will benefit all New Zealanders: the public, iwi, Government and the agricultural and tourism sectors.</p> <p>These stakeholders will benefit from:</p> <ul style="list-style-type: none"> • improved long-term freshwater quality, • water quality that specifically meets the kaitiaki needs of Maori, • quicker and less expensive decision making by regional councils in developing regional plans and decisions on resource consents, • maximised productive value from land balanced with sustainable freshwater for the community.
Enhancing the health and resilience of New Zealand lakes	University of Waikato	4	\$5,136,708	<p>The aim of this research is to increase the capability of decision makers and managers to achieve favourable outcomes for lake health and resilience at a national scale, and to raise the level of knowledge about how lakes respond to environmental pressures and management solutions. The research direction has been guided by the National Policy Statement for Freshwater Management (NPS-FM) which involves managing lakes to limits set out in the National Objectives Framework. The research will contribute to the Government's proposal for improved national environmental reporting outlined in the Environmental Reporting Bill currently before Parliament. Healthy, resilient lakes will deliver important environmental, social, cultural and economic benefits to New Zealand and will reflect well-managed land use in catchments, supporting prosperous, sustainable communities.</p> <p>The research will help to optimise return on the major investments currently being made in freshwater management in New Zealand. It will create a transparent prioritisation process for selecting lakes and regions where major restoration actions can be targeted and effective.</p>

				<p>The research will also provide effective tools to help organisations, iwi and local communities to manage lakes to achieve limits.</p> <p>The research has three main focal areas:</p> <p>Firstly we aim to effectively communicate future scenarios of lake health and resilience to decision makers, iwi and local communities. This research task will be achieved with well-validated in-lake models coupled with new visualisation tools, enabling prioritisation of sites for management. These technologies will demonstrate how actions by these groups affect lake health and resilience, the lag times for responses to occur within lakes, and provide pathways to sustainable futures.</p> <p>Secondly, we will develop better, more cost-effective ways to monitor lake water quality and biodiversity. New initiatives in reporting the pressure on and state of freshwater across New Zealand and the regions will demand smarter, more focused approaches to monitoring. The monitoring needs to take advantage of the opportunities provided by new tools such as in-situ sensors which can continuously record different water quality variables in lakes, and remote sensors on satellites that can provide historical records of changes in lake water quality at scales ranging from an individual lake up to whole of New Zealand.</p> <p>The third area of research involves the development, application and prioritisation of cost-effective in-lake interventions required to achieve management goals for lake ecosystems. There is a pressing need for long-term, sustainable intervention approaches to complement the range of short term interventions, and for understanding how these should be sequenced in priority lakes; those most in need and most responsive to intervention. Long-term interventions that will be tested include manipulating undesirable changes in lake food webs, manipulating habitats to enhance the abundance of taonga (treasured) species, and actions to deal with contaminant legacies in lakes.</p> <p>The outcome of this research will be widespread improvements in knowledge and capability of stakeholders to prioritise actions (ranging from policies to direct management interventions) aimed at achieving environmental limits.</p>
Oranga Taiao, Oranga Tangāta - Knowledge and toolsets to support co-management of estuaries	Massey University	4	\$4,400,000	<p>The central objective of the research is to empower iwi/hapu to be strong partners in the co-management of estuaries, by providing improved knowledge/tools/processes. This four-year programme has the following phases: Phase 1 – Matauranga Maori focusing on an enhanced web-enabled Estuarine Cultural Health Index (ECHI), with an oral history critical enquiry of local iwi/hapu knowledge and how this can be integrated into contemporary coastal co-management; Phase 2 – Ecological Knowledge, Modelling and Indicators of estuarine ecosystem health, resilience and functioning; Phase 3 – Integrative Spatial Planning Tool (ISPT). A hybrid GIS-modelling system will integrate spatially-explicit environmental, economic, cultural, land use and estuarine ecology information. The development of this planning tool will be a world first. Tauranga Harbour will be our test-bed, with tools/knowledge/processes readily transferred to other regions, other hapu/iwi and other ecosystem types, particularly coastal, through our deliberate benefit-transfer strategy. Research partners of this programme are: Manaaki Te Awanui Trust, Cawthron Institute, Massey University, University of Waikato, WakaDigital Ltd and Market Economics Ltd. Bremen University will provide sophisticated ecological monitoring tools.</p> <p>The outcome benefits to NZ are, firstly, improved estuarine ecosystem health, resilience and functioning by the provisioning of improved understanding, knowledge, analysis and indicators for estuarine ecosystems. As an example, plausible estuarine seagrass restoration, catalysed by our research, will deliver an estimated ecosystem service value of \$135 million/pa after 10yrs. Benefit-transfer will be enhanced by generic ecological modelling templates/standard values and by developing nationally-relevant indicators for all NZ estuaries using the Cawthron-administered Estuarine Monitoring Protocol database. Secondly, enhanced mana for participating iwi/hapu. These outcomes are beyond quantification, but incredibly important to cultural survival and well-being of iwi/hapu. Reclaiming hapu Maori Kaupapa will enable transformative strategies for restoring the wellbeing of Tauranga iwi/hapu, a process that can inform the integrative cultural-ecological resilience of iwi/hapu around NZ. Third, empowered iwi/hapu co-management of estuaries/other ecosystem types. This is important for establishing a practical role-model of how iwi/hapu can become a strong co-management partner by using an appropriate mix of both Matauranga Maori and Western science/academic approaches and tools developed in our research. Fourth, better plans and policies for estuaries. The evidence base for integrated planning of estuaries will be greatly improved using our Integrated Spatial Planning Tool to rigorously evaluate future development options. No such tool exists in NZ, resulting in piecemeal planning with sub-optimal outcomes. Better legal evidence in RMA Section 32 analysis. The tool will significantly improve quantitative analyses, such as cost benefit analysis, for legal evidence required by changes to RMA Section 32.</p>

Making SENZS: richer decisions for engaged communities	AgResearch Limited	3	\$2,400,000	<p>This programme addresses the issue of making sound environmental decisions when faced with a multitude of environmental, economic, cultural and social demands. This issue is becoming more common as society's expectations for, and demands on, New Zealand's natural resources increase.</p> <p>The programme will develop a menu of success factors that environmental decision makers can use to enable behaviours for improved outcomes from addressing different environmental challenges at the local, regional and national levels. In short, what decision-making approaches work where, when and how?</p> <p>These success factors will enable decision makers to create a shift from compliance-driven to fully engaged resource user participation in more robust, inclusive and informed decision-making. Our research will address a number of existing key issues that environmental decision makers are facing. These include how to support change beyond those directly involved in decision-making processes and make robust decisions in environments where resources are rapidly approaching use limits.</p> <p>This programme is an initiative of the recently created Lincoln Hub that will contribute to greater primary sector sustainability through improved collaboration across five research, education and industry partners (AgResearch, DairyNZ, Landcare Research, Lincoln University, Plant & Food Research). The Lincoln Hub aims to become a globally significant centre for research, technology transfer and adoption.</p> <p>A multidisciplinary team has been formed from the Lincoln Hub partners and NIWA to collaborate with environmental decision-makers from industry, central and local Government, NGOs and Maori entities. This team has experience in environmental decision-making, behaviour change and governance across matauranga Maori, economics, and social and environmental science, as well as expertise in systems and qualitative analysis. Together they will:</p> <ul style="list-style-type: none"> • develop an evaluation framework for analysis of decision-making approaches addressing a range of environmental challenges • characterise success factors for decision-making based on analysis of at least eight examples of decision-making • identify the 'what, when, where and how' of success factors which enable behaviours that will achieve enhanced outcomes. <p>Matauranga and kaupapa Maori with respect to environmental management is essential to understanding how to successfully enable behaviours that enhance outcomes from decision-making. This will be embedded in the programme by developing the evaluation framework with Maori, and studying iwi specific examples of decision-making, such as co-governance.</p> <p>The quality of research is enabled by the use of an existing international framework to help identify barriers and enablers for robust environmental decision-making. New knowledge will be delivered in both this identification of barriers and enablers but also the development of key success factors and fundamental approaches to motivating behaviour change. The relevance and credibility of our research is ensured by the already established links with key environmental decision-makers who have been involved in co-design of the research as well as part of the network that will guide the research throughout the three years.</p>
Remote sensing, classification and management guidelines for surf breaks of national and regional significance	University of Waikato	3	\$1,206,390	<p>New Zealand has many high quality and socioeconomically important surf breaks frequented by a large wave riding community of both domestic and tourist origin. The realisation that surf breaks are coastal resources and that the integrity of some surf breaks can be threatened by coastal activities led to the classification of 17 surf breaks as "Surf Breaks of National Significance" in the New Zealand Coastal Policy Statement 2010 (NZCPS). The purpose of Policy 16 of the NZCPS is to:</p> <p>"Protect the surf breaks of national significance [...], by:</p> <p>(a) Ensuring that activities in the coastal environment do not adversely affect the surf breaks, and;</p> <p>(b) Avoiding adverse effects of other activities on access to, and use and enjoyment of the surf breaks"</p> <p>At present there is little to no data pertaining to the existing wave quality, breaking patterns, physical drivers, and the socioeconomic importance of New Zealand's surf breaks. This lack of knowledge makes it difficult for councils to assess the effects of coastal activities on surf breaks and effectively uphold the intent of the NZCPS.</p>

				<p>The aims of this research are to build a knowledge base and develop a detailed understanding of the physical and oceanographic characteristics of seven selected surf breaks in New Zealand, namely, Aramoana, Lyall Bay, Piha (south), Wainui Beach (“Pines”), Manu Bay, Whangamata Bar, and Whareakeake. Data collection will be primarily through the use of remote camera stations. Images are captured 7 days a week, 365 days a year, and highly automated systems process the data to extract important physical and social parameters such as wave breaking patterns, the numbers of surfers and the formation of rip currents.</p> <p>The knowledge gained from this research will aid in the development of guidelines for the sustainable management of surf breaks. The data collected in this research will be made publically available through an online portal providing the opportunity for other organisations, including universities and crown research institutes, district and regional councils, port and harbour authorities, iwi, marine resource prospectors and coastal developers to use the data for their own research, consent applications and/or planning purposes.</p> <p>The Principal Investigators for this project are the University of Waikato’s Associate Professor Karin Bryan, Dr Shaw Mead and Mr Edward Atkin of eCoast Marine Consulting and Research, and Dr Terry Hume, former Principal Scientist and National Projects Manager of the National Institute of Water and Atmospheric Research. The team hold expertise in surf science, estuarine and coastal processes, hydrodynamics, surf zone physics, sediment dynamics, marine geology, remote sensing, community engagement, and project management.</p> <p>A project steering committee containing representation from the Department of Conservation, Maori, the Surf Break Protection Society, and Surf Life Saving New Zealand will ensure the project achieves its goals and that relevant stakeholders are genuinely involved. Workshops will be undertaken at each of the seven study sites to engage with stakeholders and access local knowledge, document real and perceived threats, and gauge where added value can be incorporated into the project to meet the public’s needs.</p> <p>Contact: Karin Bryan, University of Waikato, email: k.bryan@waikato.ac.nz, phone: 07 838-4123</p>
Weaving the korowai of Papatūānuku - adaptive governance and supported environmental decision making	New Zealand Forest Research Institute Ltd Trading as Scion	3	\$2,391,408	<p>If New Zealand is to overcome the many environmental challenges it faces, then agencies must learn to adapt to complexity and create new governance ‘landscapes’ that reflect local aspirations, livelihoods and resources. The aim of this research programme is to develop a systems and adaptive governance approach to decision making. This approach will be applicable to any context in New Zealand where multiple agencies and communities are wrestling with complexity, especially where there are limited resources or a lack of clarity over desired outcomes. The Waiapu Catchment, on the East Coast of the North Island, will be used as an exemplar of an adaptive governance approach. The extreme nature of the challenge facing those engaged in the restoration of the Catchment and the complexity of the issues it faces makes this case study an ideal testing ground for radical and transformational approaches to enhanced and accelerated decision making.</p>
Total over 3-4 years			\$29,468,266	