Community Vulnerability, Resilience and Adaptation to Climate Change: Progress Report

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Abstract

This is a progress report summarising the status of a research programme, funded by the Foundation for Research, Science and Technology. It covers work being carried out by collaboration across four research organisations as well as private consultants, in order to develop an integrated perspective on adaptation to climate change in New Zealand. We are following the rapid development of this area of research internationally and the growing recognition of a need to identify areas where there can be resilience to environmental changes as well as areas where there can be structural vulnerability.

Introduction

The ability to adapt to future climate change is now rapidly becoming recognised as a major issue for research in many countries. The aim of this FRST programme is to carry out research in a New Zealand context that produces a integrated perspective on the many different forms of adaptation, our ability to develop resilience to adverse changes, and the degree of vulnerability that may remain.

We are carrying out a series of specific studies on different aspects of climate change and using these to establish a framework for considering adaptation across New Zealand sectors: Māori communities, local government and health perspectives. This is also looking at the different time scales over which future impacts will occur. It is building on results from other research including NIWA's calibrated TopNet model of the Hutt River; contours for the Manukau, Waitemata/Hauraki and Waiheke coasts based on LIDAR datasets and model-derived extreme water levels for the present day and future sea-level rise scenarios; and climate change modelled data for 2040 and 2090 based on four emission scenarios.

Because adaptation is based on community responses, our programme is creating closer links between research groups and local and national government stakeholders, including Māori community leaders. So far, much of the interaction with end users has been focused on the design and operation of specific case studies. However, meetings with both the National Council and Technical Group in Local Government New Zealand (LGNZ) over the last year have focused on frameworks for approaching adaptation in their decision making contexts and these will be developed further over the next year.

While the effects of climate change can vary significantly from one region to another, there are structural similarities and our research is showing that some developments in other countries are relevant to New Zealand. Discussions between our research team and Prof Barry Smit, from the University of Guelph, Canada, have confirmed the importance of researchers working directly with communities and decision makers.

Maori community vulnerability, resilience and adaptation to climate change

Research Managers: Darren N King & Charlotte Severne

The principal aim of this objective is (i) to determine the processes that contribute to Māori community vulnerability and adaptive capacity to climate change as well as those that lead to adaptation, and (ii) to explore a range of climate change scenarios to ascertain how the present vulnerabilities and adaptive capacities of two Māori communities may change under altered environmental conditions. Once relevant conditions have been identified, information from other scientists, policy analysts, and decision-makers, will be integrated into the analysis to identify what conditions or risks the community may be facing, and in what ways the community may potentially plan for or respond to these conditions or risks. From a practical point of view, this exercise will provide a point to determine the most effective means of promoting actions to limit future impacts, support future coping strategies and facilitate future adaptation. Importantly, the coordinating team does not seek to presume the variables that represent exposure, sensitivity or adaptive capacity, but rather seeks to identify these empirically with participating iwi. Although the lessons from this analysis will ultimately reflect the issues being faced at the local level – and hence lead to the identification of specific adaptive measures or practises, there are also likely to be some common-ground issues and opportunities that will help to provide broad lessons on the vulnerability and adaptation options facing Māori individuals, whanau, hapu and iwi at other locations. Based on collaborative approaches that are underpinned by Māori values and aspirations, the work is coordinated by NIWA's Māori Environmental Research Centre (Te Kuwaha o Taihoro Nukurangi) and the National Climate Centre.

Progress during 2009/10:

Published in January 2010, "The climate change matrix facing Māori society", reviews the latest science; explores how Māori society is likely to be impacted by climate change this century; and considers the vulnerability, risks, coping capacity, and adaptation options available to Māori across key sectors, systems and groups. Importantly, this research contribution also highlights gaps in knowledge and therein identifies many required next steps for research, planning, policy and development.

Numerous speaking opportunities in association with this work presented themselves during 2009/10. Noteworthy, Darren King presented an overview of the projected impacts and adaptation options of climate change facing Maori society at the Australia New Zealand Society for Ecological Economics Conference (ANZSEE) in Darwin, Australia in late 2009. This invited opportunity included discussions about the identification of appropriate response and adaptation strategies for particular economies, industries and socio-cultural groups as well as how ecological economics can help provide both economic and sustainability based solutions.

Other outputs include a working paper that explores key concepts and definitions of 'community' and considers how best we examine, and deal with, diverse Māori social-political-economic realities. A second working paper reviews the brief history of climate change policy and planning in New Zealand.

Finally, a review of international adaptation research and planning on climate sensitive indigenous groups has been drafted for publication. This work examines how adaptation research, planning and actions for climate variability and change have been developed internationally for climate sensitive indigenous groups and communities (including businesses).

Community Vulnerability: The Local Government Perspective

Work in this area covers three case studies that explore exposure, sensitivity and adaptive capacity in three different locations for three different climatic pressures. In addition the Mapua Structure Plan case study described in the public health perspective below is carried out in the context of local government policies and programs to adapt to climate change.

Case study 1 investigates the potential impacts from sea level rise on existing settlements in the Auckland region, taking into account the potential for sea level rise to exceed IPCC projections in its 4th Assessment Report and continuing sea level rise beyond 2100. This explores how managed retreat could be integrated into the current suite of response options used by local government, and how community perceptions, environmental, social and cultural values, and socio-economic status of communities determine the potential outcomes. The case study is being conducted in close collaboration and with support from Auckland Regional Council, Auckland City Council, and Manukau City Council.

Case study 2 investigates the potential impacts of changes in rainfall patterns and intensity on flood risk in the Hutt valley. This uses downscaled climate scenarios based on different climate models to explore the full range of projections of future flood risk. It will combine this with indicators of socio-economic vulnerability (census data and the NZ Deprivation Index) to highlight areas of particular vulnerability. Results will be discussed in workshops with staff from Greater Wellington Regional Council and Hutt City Council to ascertain possible response options to the change in flood risk, including limits and barriers to particular responses. A survey of community attitudes in the Hutt valley towards flood risk and flood risk management options is underway and will support those discussions and further highlight any community views that may reduce or increase vulnerability to flooding in developed areas.

Case study 3 investigates the vulnerability and resilience of Wellington's reticulated water supply system to climate change (Wellington City, Hutt Valley and Porirua inclusive), in the context of a growing population and changing demand patterns. Modelling of climate change impacts on water demand and supply, together with more detailed demand modelling provided by MWH, is being used to construct alternative scenarios of future water security depending on alternative response options. Workshops with Wellington's water managers, and social and environmental sector representatives (iwi, public health etc.) are envisaged in order to explore the extent to which key response options may reduce vulnerability and increase resilience of water security in a climate change context.

Community vulnerability: The Public Health Perspective

This work involves four case studies:

A case study in the Nelson-Tasman region using the Mapua Structure Plan as a way to integrate climate change resilience building and adaptation into local government planning has progressed well. The Tasman District Council published the final draft Plan in June and we are in the process of finalizing a research report which will highlight the experiences of this process. The FRST project public health branch in Mapua has also drafted a conceptual document on the frameworks and indicators that can be of particular use in assessing public health impacts of climate change and the local government responses to such future health threats. An additional case study in the Nelson-Tasman region is being developed to study adaptation needs for outdoor workers in key industries where occupational heat stress is an increasing threat to health and productivity.

Another case study is assessing household water security and adaptation options to decrease vulnerability. A customised build of “SimClim” software to enable modelling of household rainwater supplies has been obtained and software training undertaken. Planning for the case study is continuing and it is anticipated that there will be linkages developed with other components of the project. We will use empirical results (Britton et al, 2010) along with projections of temperature and rainfall to forecast potential impacts of climate change on diarrhoeal illness and estimate the protective effect of improved water infrastructure. Climate data are ready and we are updating the data on geographic boundaries and public health gradings of community water supplies.

Household energy security and the potential effect of climate change on heat related health outcomes are being assessed. This case study involves a questionnaire survey of energy affordability and time series modelling of electricity consumption, climate and health outcome data. The survey has been designed and will be sent out in the next month. Data on electricity consumption and climate are being analysed; the health outcome data has been requested from the Ministry of Health. Use of the NZDep index of social deprivation as an empirical predictor of heat related mortality in cities will be investigated.

Separately funded projects on the global burden of disease attributable to climate change, and the effect of adaptation options, will produce estimates of the potential global distribution of vector borne diseases and occupational health impacts. A summary of the results of these models for New Zealand will be provided.

Frameworks and Indicators

In the last decade there has been very rapid growth of research on frameworks for identifying vulnerability, resilience and adaptive capacity for climate change effects. We have reviewed many of these and are now merging them into a New Zealand context. This is taking account of specific aspects of our country's structure, such as the high proportion of our population and industry that is close to the coastline. It is also raising questions such as whether New Zealand's future warming being lower than the global average will have advantages for us, or whether that is offset by a built-in dependence on having a rather mild climate by global standards.

Our reviews of what has been done elsewhere have involved direct communication with leading international researchers (e.g. G Yohe, USA, B. Smit, Canada, and T. Smith, Australia) in order to provide a basis for setting up a world class framework for considering vulnerability in New Zealand. We have also taken advantage of the frameworks for environmental health (the DPSEEA frameworks) developed by members of our team for the World Health Organization and integrated relevant ideas into the analysis of public health adaptation needs and approaches.

Analyses of the studies of adaptive capacity in other developed countries have shown the need to consider inertia in the social and institutional responses and even some social opposition to minimising the impacts in areas such as living on eroding coastlines. We are also starting to specifically cover new issues such as uncertainty in climate change projections which makes it quite clear that there is a growing need to relate adaptation to risk management so that the full ranges for projected climate change can be covered.

Because of the very long term implications of climate change it is also necessary to go beyond considering economic costs and to cover social values that are quite fundamental to our national heritage and policy and to consider the respective values of present and future generations. We now have a clear basis for a considering these issues and the second half of our three-year programme will develop this into a useful approach for future district, regional and national planning.

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Outputs so far

Peer-reviewed journal articles and book chapters

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Conference presentations and posters

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King, D.N., 2009: *The climate change matrix facing Māori society*. Invited Speaker: Australia New Zealand Society for Ecological Economics Conference (ANZSEE): 'Green Mileage in the Global Meltdown: An Ecological Economics Way Forward'. Darwin, Australia. 29 October 2009.

Khan, S., 2010: *Changing Hazardscapes and Rigid Mitigation: A Few Lessons Across Nations*. In GMSTEC 2010: International Conference for a Sustainable Greater Mekong Subregion, Bangkok, Thailand.

Kjellstrom T., 2009: *Climate change, occupational health and productivity*. Presentation at round table discussion at Institute of Medicine, USA, annual general meeting, Washington DC, October 2009.

Kjellstrom T., 2009: *Climate change: likely impacts on occupational health and productivity*. Seminar at US National Institute of Occupational Health and Safety, Washington DC, October 2009.

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Reisinger, A., 2010: *Climate Change Scenarios and Risk Management*. Presentation to Greater Wellington Regional Councillors and Executive Leadership Team, 8 March 2010, Wellington.

Reisinger, A., D. Wratt, and B. Mullan, 2010: *Scenarios vs probabilistic futures: towards a risk-based understandiing of climate change impacts and adaptation priorities.* In: 2010 Climate Adaptation Futures Conference, Australia's National Climate Change Adaptation Research Facility and the CSIRO Climate Adaptation Flagship, Gold Coast Convention & Exhibition Centre. (Poster presentation)