Griffith UNIVERSITY

EcoAdapt Research Project

The Benefits of Ecosystem-based Approaches for Climate Change in Least Developed Countries

2016-2017 Annual Report

Griffith Climate Change Response Program
Griffith University

Table of Contents

Director's Overview

During the first year of our 5-year project we have made significant progress in advancing our research agenda in line with the schedule of milestones.

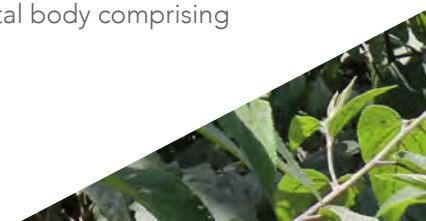
The EcoAdapt project is designed to address three primary research questions:

1. What constitutes an ecosystem-based approach to climate change adaptation?
2. In the Pacific context, under what circumstances are ecosystem based approaches an appropriate climate change adaptation response?
3. What information and decision making processes are required by stakeholders to evaluate adaptation options?

To address these questions, our research is organised around five themes each of which has a set of secondary research questions they are exploring (Appendix 1). The five themes are: *Coastal Process; Risk Assessment of Adaptation Options; Micro-economic Benefit-cost Analysis; Policy & Social Analysis; and Project Integration, Ecosystems and Climate Change Analysis.*

During the first year of our 5-year project we have made significant progress in advancing our research agenda in line with the schedule of milestones. Our activities this past year have focussed geographically on Vanuatu and in particular Tanna Island. Vanuatu is one of the world's poorest countries, ranking 155 by GDP per capita in 2015 by the World Bank, and is exposed to many natural hazards as well as threats arising from human-forced climate change. Undertaking research in Vanuatu requires a partnership approach with governments at all levels, which in Vanuatu comprises national, provincial, and local customary land and sea owners. Building these partner relationships takes time but is an essential step in terms of gaining both the formal approvals needed as well as the social licence that allows foreign researchers to operate in the field on customary land and sea. To this end, we have reached agreement on the terms of an MOU with the Tafae Provincial Government which, among other things, recognizes that Griffith University is undertaking research that will provide the government with data and knowledge to inform policy and planning for climate change and environmental problems, to the benefit of the local customary communities.

We are also collaborating with the Secretariat for the Pacific Regional Environment Program (SPREP), an intergovernmental body comprising



Director's Overview

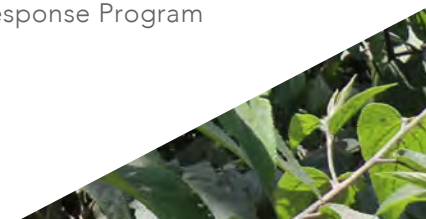
all the Pacific island states plus the so-called 'cosmopolitan' countries such as Australia. Fortuitously, SPREP have a major project funded by the German Government aimed at implementing ecosystem-based adaptation (EbA) projects in three countries, including Vanuatu where the focus is on Tanna Island. We have signed a contract with SPREP to help identify potential EbA projects. This research draws upon and complements our primary EcoAdapt research agenda to everyone's benefit.

In addition to our work on Tanna we are planning to undertake further case studies elsewhere in Vanuatu and in Samoa. Our proposed second Vanuatu case study is Melé Bay which is adjacent to Port Villa. The Melé Bay area is the site of the airport, along with expanding human settlements and tourist infrastructure. The Bay faces multiple natural and human-forced risks including flood, storm surges, sea level rise, and liquefaction following earthquake. We have lodged a research permit with the National Adaptation Board, whose approval is a pre-requisite to undertaking adaptation research in Vanuatu, and we are also developing a partnership agreement with the Climate Change Department who are interested in our research and in using the data and knowledge to information policy and planning.

Regarding Samoa, we have organised a meeting in May with the Ministry of Natural Resources and Environment to discuss our research proposal and identify the appropriate local partners and case study location.

While the benefits of a multidisciplinary approach to adaptation research to climate change adaptation problems is widely recognized, implementing them in practice is difficult due to the range of disciplinary expertise needed and the simple fact that our universities are still organised around disciplinary silos. We are fortunate therefore that Griffith University acknowledges the important of multidisciplinary approaches and actively supports such research through its programs, centres and institutes including the Griffith Climate Change Response Program.

Prof Brendan Mackey
Director,
Griffith Climate Change Response Program



Milestones & Research Progress

As noted, EcoAdapt's research is organised around five themes. As per our contractual arrangements, there is an agreed set of milestones for each theme. Table 1 presents a summary of the milestones for each theme and the evidence that the milestone has been in fact achieved. Where the milestone deliverable is a publication, a digital or hard copy of this is available and will be gladly forwarded.

Task I.D	Description	Evidence that milestone has been completed
1. COASTAL PROCESS		
1.1	Literature review report of existing modelling frameworks and calibration data availability in the region	**Completed**—Literature review paper for submission to Journal of Coastal Research by end of April 2017 - see document 1.1
1.2	Implementation of coastal and regional models in the high performance computing platform.	**Completed**—Multiple coastal process models are running for the region within Griffith University's High performance computing environment - see document 1.2 for details
2. RISK ASSESSMENT OF ADAPTATION RESPONSES		
2.1	Complete: (a) literature review; (b) stakeholder identification and engagement strategy; and (c) initial systems model formulation	**Completed**—(a) Literature review paper in review see document 2.1 submitted to the Journal Science of the Total Environment; (b) see document 4.2 which was produced for our SPREP collaboration and involves the partnerships we have developed with the Tafea Provincial Government and the local customary communities for our Tanna Island case studies; (c) see document 2.2
2.2	Literature and preliminary findings documented in a conference paper.	**Completed**—see document 2.2 submitted and presented at the Asia Pacific Systems Dynamics Conference
3. MICRO-ECONOMIC BENEFIT-COSTS ANALYSIS		
3.1	Existing adaptation projects reviewed and summarised into a database for subsequent meta-analysis	**Completed**—see document 3.1 which describes the database of some 228 Pacific Climate Change Adaptation Projects

Milestones & Research Progress

Many of the milestones reported in Table 1 relate to literature reviews on key topics. These were established as milestones for the first year because it is important that our research is based on a thorough understanding of the current state of knowledge as documented in the published academic literature to ensure that we do not unnecessarily 're-invent the wheel' and that we are addressing data, methodological and knowledge gaps. The following sections provide some insight into the additional activities and outcomes for the five research themes.

Task I.D	Description	Evidence that milestone has been completed
4. POLICY AND SOCIAL ANALYSIS		
4.1	Completed review of all relevant literature and synthesis report for stakeholders provided	**Completed**— see document 4.1
4.2	First multi stakeholder workshop held to gather input, obtain support, identify key issues and build partnerships for the project.	**Completed**—see document 4.2 which shows in Appendix 3 of the document the Tanna Island Stakeholder workshop conducted on 7 November 2016
5. PROJECT INTEGRATION, ECOSYSTEM & CLIMATE ANALYSIS		
5.1	Project management framework is produced that details the linkages between subprojects activities outputs and establishes common data and information management system.	**Completed**—see document 6.1 which is the agenda from the EcoAdapt project meeting presenting the project management framework to the project team
5.2	Year 1 project research symposium conducted	**Completed**—see document 6.2 which is the agenda for the project research symposium conduced on 15 December - Gold Coast Campus Griffith University
5.3	Year 1 Project management report that reviews the year's activities, outcomes and issues arising.	**Completed**—see document 6.3 Year 1 Annual Report
5.4	Completed review of all documented climate change adaptation projects in the region	**Completed**—see document 5.1 draft review for submission to a journal in April 2017
5.5	Regional GIS database completed of selected coastal and terrestrial ecosystems	**Completed**—see folder 5.2 as well as document 5.2 which shows maps derived from GIS Database in section 3

Milestones & Research Progress

Coastal Processes

Theme leader

Prof Rodger Tomlinson (Director, Griffith Centre for Coastal Management)

Theme members

Dr Fernando Andutta, Dr Serena Lee (Griffith Centre for Coastal Management), Prof Charles Lemckert (University of Canberra)

PhD researcher

Gaëlle Faivre

Our approach to understanding coastal processes involves use of a nested set of models that account for key biophysical processes at a range of spatial and temporal scales. Development of these models is proceeding in parallel.

Underpinning the coastal processes research is the development of a *regional ocean circulation model* for the southern pacific. This model enables simulation of all key aspects of ocean currents including; the direction and velocity of currents, along with water temperature, chemistry and sediment transport.

The regional ocean circulation model provides the 'boundary conditions' for the calibration of a *coastal dynamics model.*

As a first step, this model is undergoing calibration for Port Resolution, our Tanna Island case study location. The coastal dynamics model takes into account local physical conditions including bathymetry and enables simulation of waves and storm surges, among other things. These models in turn provide the tool needed to examine fine scaled conditions including water quality and coastal accretion and erosion. Together, we are able to simulate the impacts on coastal ecosystems of different climate change and development scenarios and the potential impacts on ecosystem health of engineered adaptation interventions.

Milestones & Research Progress

Risk Assessment of Adaptation Responses

Theme leader

Prof Rodney Stewart

Theme members

Dr Oz Sahin

The approach we are using to risk assessment draws upon system dynamics modelling, Bayesian statistics and computer-based decision support tools. We use so-called 'Bayesian Belief Models' (BBM) to integrate the influence of a range of key factors, spanning both socio-economic and bio-physical considerations. The advantages of BBMs include that they can combine data from a wide range of sources both qualitative and quantitative, are readily coupled to GIS when a factor needs to be mapped, and provide the basis for developing tools to aid decision makers.

BBMs are ideal for multi-disciplinary projects such as EcoAdapt where the outputs from five themes that must be brought together in a systematic way to address the shared research questions. The first step in developing our BBMs was to produce an 'influence diagram' that shows the main system components and their interactions including feedback processes that are most important when examining adaptation options in the coastal zone in the Pacific. This was a novel exercise for most of the researchers and has proven to be a valuable platform for assisting with the difficult task of getting researchers from different disciplines to communicate and share their expertise in ways that facilitate the project's goals.

Milestones & Research Progress

Micro-economic Benefit-cost Analyses

Theme leader

Assoc Prof Chris Fleming (School of Business), Dr Jim Smart (School of Environment)

Theme members

Dr Syezlin Hasan (Australian Rivers Institute), Andrew Buckwell (Australian Rivers Institute)

The micro-economic analysis in the EcoAdapt project will consist of two components: (i) a meta-analysis of existing completed climate change adaptation projects in the South Pacific (February 2016 – February 2018), and (ii) in-depth benefit-cost analysis of specific adaptation case studies (March 2018 – February 2019). The first year of the meta-analysis component was assigned to reviewing existing published literature and accessible reports on completed climate change adaptation projects in the Pacific, and cataloguing implementation details and outcomes for these projects into a database for subsequent meta-analysis.

A total of 228 projects have been reviewed, collated and catalogued into a database. The projects cover a range of sectors and draw on funding from a range of climate change-related programs. The biggest source of funding projects was the Global Environment Facility (GEF) under the United Nations Development Program. In addition to the GEF, other funding sources include the governments of Australia, New Zealand, Germany, United States, Japan and Canada, as well as funding from the European Union.

The availability and completeness of information dictated which projects could be included in the dataset. As a minimum, key information on project aims and objectives, start and finish dates, project funding and some description of project outcomes were required for a project to be included in the database.

Table 2 in Appendix 2 summarises the number of projects which will be included in the meta-analysis, by program.

Milestones & Research Progress

Policy & Social Analysis

Theme leader

Prof Susanne Becken (Director, Griffith Institute for Tourism)

Theme members

Dr Johanna Nalau

PhD researcher

Johanna Schliephack

The Social and Policy constraints component of the project focuses on understanding the current and potential future constraints in using and choosing EbA. The component specifically seeks to engage with a range of stakeholder groups to examine stakeholder-specific knowledge and attitudes regarding adaptation options and the decision-making processes that are in use when choosing adaptation options. It will also investigate the opportunities that could emerge when implementing EbA and governance arrangements. The component works across scales and aims to identify constraints in multi-level governance of adaptation in the context of small island developing states, ranging from community to provincial to national to regional levels.

One hundred journal articles have been identified and analysed to provide a baseline for the analysis of social and policy related constraints and enablers to EbA. The report 'Ecosystem-based Adaptation to Climate Change: Benefits and Constraints' is published through the Griffith Institute for Tourism Research Report Series, and it is available online and through the library system (Deliverable 4.1.). It is a quotable academic output, yet easily accessible to the public. We are also drafting a journal paper based on the main findings of the report, with submission April 2017. The stakeholder workshop was held on Tanna Island in Vanuatu in November 2016, which has given important insights into some of the issues surrounding EbA in Small Island Developing States (Deliverable 4.2.)

We have also undertaken a preliminary assessment of the policy landscape in Vanuatu to understand how some of the main policies treat ecosystems and EbA, following ecosystem service analysis by Pramova et al., 2012. This assessment has revealed that many of the policies in Vanuatu do not necessarily recognise climate adaptation or ecosystems except where these issues are the direct focus of the policy. We have also led the Griffith Human Ethics process for the project, with successful completion (GU Ref No: 2017/108), and developed a Fieldwork Reporting Template to collect data internally within the project team to better understand the information gaps and needs, which might arise in a multi-disciplinary project.

Milestones & Research Progress

Project Integration, Ecosystem & Climate Analysis

Theme leader

Prof Brendan Mackey (Director, Griffith Climate Change Response Program)

Theme members

Dan Ware (Griffith Centre for Coastal Management), Dr Willow Hallgren, Prof Rod Connolly.

The condition of an ecosystem is a measure of its ecological integrity and health. An ecosystem in good condition has the full complement of its characteristic species and has not been degraded by human impacts. A healthy ecosystem is therefore more resilient to external perturbations including climate change impacts. Furthermore, the condition of an ecosystem also determines the quality and value of its ecosystem service flows and the benefits for people, which is the focus of the micro-economic analyses.

The main coastal ecosystem type on Tanna Island is fringing coral reef. Each of these reefs is influenced by the water quality flowing from the adjacent catchment which in turn is a function of the catchment's vegetation cover and land use impacts. If the catchment is over-cleared and over-used, this can cause soil erosion which increases the sediment and nutrient load to the reef. Sediment smothers coral while nutrients stimulate algae growth at the expense of coral.

We undertook a reconnaissance survey of the condition of fringing coral reefs at three locations around Tanna Island using a reliable methodology developed by Griffith University's Prof Rod Connolly. The results showed that on a regional scale, Tanna's reefs are in a relatively good condition with the reefs to the north west and south east being in the better condition.

We also developed a GIS based map of the condition of Tanna's land ecosystems based upon an existing map of Vanuatu's vegetation cover updated with high resolution RapidEye satellite imagery. Our analysis revealed that the reefs with the best condition also appeared to be at the bottom of water catchments that were in relatively good condition.

Interestingly, our community level stakeholder interviews revealed that while there has been a noticeable decline in the number and size of fish on the fringing coral reefs since the 1970's. When asked, these communities believed this decline was the result of over-fishing due an increasing human population and the use of modern diving and fishing equipment, particularly nets.

Appendix 1 EcoAdapt Research Questions

Overall

1. What constitutes an ecosystem based approach to adaptation in the coastal zone?
2. In the Pacific context, under what circumstances are ecosystem based approaches an appropriate climate change adaptation response in the coastal zone?
3. When are soft engineering and capital works appropriate adaptations intervention in the coastal zone?
4. What information and decision support processes are required by stakeholders to evaluate adaptation intervention options?

Coastal Process

1. How can coastal processes be usefully characterized given obtainable data and process understanding?
2. What is the general ocean circulation in the region and how will this change under future climate?
3. What is the extent of coastal flooding currently and how will this change under a range of adaptation options and future climate?

Risk Assessment of Adaptation Options

1. Develop an integrated assessment model to answer the primary research questions for the research program
2. Key initial steps are to develop (a) a systems conceptual model and (b) scenarios to help identify adaptation interventions that are appropriate under a range of plausible futures

Micro-economic Benefit-cost Analysis

1. Which factors have historically influenced the kinds of climate change adaptation projects and the efficacy of their outcomes in the region?
2. Which factors affect local preferences for adaptation options and local valuations of adaptation outcomes from ecosystem based and engineered approaches?
3. What is the extent and distribution of the benefits and costs of an adaptation project?

Policy and Social Analysis

1. What knowledge and attitudes do different stakeholder groups hold about various types of adaptation options and how might these change under future climate?
2. How are decisions made about adaptation options at present and how might they change under future climate?
3. What are the commercial and livelihood opportunities arising from ecosystem based approaches?
4. How could current policy regimes be changed to enable appropriate use of ecosystem based adaptation and prevent maladaptation?

Project Integration, Ecosystems and Climate Change

1. How will ecosystems and biodiversity in the region be impacted by future climate?
2. From a biophysical perspective, what are the limits to ecosystem based adaptation?
3. Which ecosystems and biodiversity are at threat from hard engineered adaptation responses?

Appendix 2 Number of projects to be included in the meta-analysis

PROJECT GROUP OR PROGRAM	BRIEF DESCRIPTION	NO. OF PROJECTS RECORDED
Global Environment Facility - Small Grants Programme (SGP)	Small projects up to US$50,000 funded under UNDP's Trust Fund	190
Pacific Adaptation to Climate Change (PACC)	The largest climate change adaptation initiative in the Pacific region, with projects in 14 countries and territories	14
Global Environment Facility – medium to long-term projects	Projects exceeding US$50,000, funded under UNDP's Trust Fund	13
Assessments of Impacts and Adaptation to Climate Change (AIACC)	Projects on Fiji and Cook Islands funded by GEF, CIDA, USAID, US EPA, and the Rockefeller Foundation	1
Mangrove ecosystem for climate change adaptation and livelihoods (MESCAL)	Pilot projects in each of the five countries: Solomon Islands, Vanuatu, Fiji, Tonga and Samoa, funded by German Ministry for the Environment, Nature Conservation and Nuclear Safety	1
Kiribati Adaptation Program	Phase 1 and Phase 2	2
Pacific Hycos	Pilot projects in each of the 14 Pacific countries, funded by European Union Water Facility and SOPAC	1
Other completed programs or projects	Implemented by NGOs, regional agencies and Asian Development Bank	6
TOTAL		**228**

Contact

Griffith Climate Change Response Program

Climateresponse@griffith.edu.au

+61 (0) 7 55527263

griffith.edu.au