Final Progress Report
The South East Queensland Climate Change Adaptation Research Initiative

Ryan R. J. McAllister, Cath E. Lovelock, Tim F. Smith, and Darryl Low Choy

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1 Introduction

SEQCARI was a three year research initiative examining South East Queensland’s (SEQ) vulnerability to climate change and informing the development of practical and cost-effective adaptation strategies to assist decision-makers in government, industry and the community.

The SEQCARI involved over 30 scientists from:

- The CSIRO Climate Adaptation National Research Flagship;
- Griffith University;
- The University of the Sunshine Coast;
- The University of Queensland;

This initiative was supported by funding from all four research organisations, the Queensland Government Smart State Fund, and the Australian Department of Climate Change and Energy Efficiency. It was guided by an Advisory Committee representing major stakeholders in the region. The primary model of achieving impact from SEQCARI was through engagement with stakeholders.

Research activities were structured into sectors: climate projections; adaptive capacity; human settlements; agriculture; ecosystems and biodiversity; energy; and cross sectoral synthesis. Each of the research foci ran their own engagement activities. However, both interactions throughout the project and whole-of-project synthesis were conducted in order to bring the various sciences together.

1.1 Scope of this report

This report does not seek to present any science findings as such. The scientific findings of the report are presented in a DRAFT edition of the international journal *Regional Environmental Change*. Instead this report is about the administration of SEQCARI.
2 Governance

The nature of the funding model was an important element of how SEQCARI was governed. While SEQCARI was communicated as a holistic, single project, in fact SEQCARI was made up of six contracts. The proposal that was presented to the Queensland Government was for $2m in order to build $13.5m worth of investment in climate adaptation research in SEQ. This proposal was in response to the "ROUND 3 NATIONAL AND INTERNATIONAL RESEARCH ALLIANCES PROGRAM". The proposal included a commitment to achieve $850,000 of co-investment from the Australian Greenhouse Office (now the Department of Climate Change and Energy Efficiency), $3m from the Flagship Collaboration Research Fund (CSIRO administered Australian Government funding for Publicly Funded Research Agencies) and partner co-investment. Three small contracts were also signed relating to university partnership in the whole-of-project synthesis activities.

- The contract with the Queensland Government was signed 5 December 2008
- The Australian Government contract was signed on 26 February 2009
- The Flagship Collaboration Research contract was signed 15 May 2009 (and note the Queensland Government contract became active only once this Flagship contract was signed)

2.1 Cluster management meetings

The Cluster contract stipulated regular meetings between the three university partners and either the Cluster leader (Andrew Ash) or a representative. These generally occurred every 2 months (last Thursday of each second month). Ryan McAllister represented CSIRO in these meetings and chaired the vast majority, while Amy Warnick from CSIRO recorded meeting minutes and actions. Since start 2012, Cluster meetings were held at, and minuted by, Griffith University, with Darryl Low Choy as chair.

2.2 Science interaction meetings

Every two months, on alternative months to the cluster management meeting, a phone hook up was held with researchers from across the project to communicate progress and discuss various opportunities for synthesis and integration. On average about 6-8 people participated per meeting. Ryan McAllister attended and chaired every meeting. We retained this meeting date on the last Thursday of the month throughout the project.

2.3 Advisory steering committee meetings

An advisory steering committee was established to provide input and advice. The committee was ‘advisory’ because with so many interacting contracts it was not feasible to provide the committee with the power to re-define scope. Representatives came from

- Department of Climate Change and Energy Efficiency
- South East Queensland Council of Mayors
- Department of Infrastructure and Planning (now Department of State Development, Infrastructure and Planning), and the
- South East Queensland Healthy Waterways Partnership
The committee met six monthly. On each occasion Andrew Ash chaired the meeting and Ryan McAllister and Amy Warnick attended from CSIRO. The meetings included a guest presenter to provide a summary of exemplar activities from within SEQCARI. The main value of the committee proved to be in providing advice in terms of engaging with stakeholders, and for example, the quarterly newsletter was one of the early recommendations of the committee (see attachments).

2.4 Science workshops

For a period of about 2 years the project funded and organized half-day science based workshops where postdoctoral and PhD students could meet to discuss, in depth, various aspects of science development within the project. The majority of project personnel were based within SEQ, so this was feasible for this project. Attendance at the science workshops was high in the early stages of the project. However, participation diminished towards the end of the project as staff were focused on delivery. Participation fell to a point where this was no longer feasible. Topics included science communication, biodiversity management, and climate science, in addition to workshops that facilitated wide-ranging discussions on adaptation science.

2.5 Communication plan and newsletters

The project developed a communications plan. The aim of the document was to guide presentation of SEQCARI to external stakeholders as a coordinated, holistic body of research being undertaken by a partnership of six organisations; and also to facilitate cooperation among the partner groups in relation to external media engagement, public awareness raising and promotions in regard to the Initiative.

It’s worth noting that at the start of the project, staff members were very active in the media. The aim was to build some form of a profile from which to help build good stakeholder engagement.

Newsletters have been instrumental in communicating the progress of the project to internal team members, and externally to stakeholders and specifically funders. These have been attached as an Appendix for reference.

CSIRO will produce two additional newsletters - one before 30-June as the last official SEQCARI newsletter, and another later in the year. SEQCARI will have an ongoing research portfolio beyond the end of the project due to the timing of PhD and postdoctoral recruitment. Hence we will have new material to communicate beyond 30-June. Ongoing activities are summarised in Section 3.

2.6 Engagement plan

SEQCARI also developed an engagement plan at the start of the project. A core commitment of the SEQCARI was engagement with key stakeholder and end users. This is critical for several reasons. First, much of the information needed to understand vulnerability and scope and test adaptive responses in the region is held by individuals, organizations and institutions working in various sectors. Their involvement is therefore necessary as a critical source of basic data and qualitative input. Second, participatory research has been shown to maximise the creative development of responses and increase the likelihood of adoption of the research findings. Third, climate change research is an area of high complexity and uncertainty and participatory approaches enable stakeholders to both manage and respond to this complexity and uncertainty. The plan listed principles and started to outline the activities at the forefront of stakeholder engagement across the project.

2.7 Review of Governance

For a project of the size of SEQCARI, the governance model could be described as “light”. This means that management and administration has been achieved by a relatively small group. The
focus has been on minimising internal transaction costs, and instead building interdependencies through collaborative science meetings (rather than administration). There have been both benefits and costs in this approach. It provided the opportunity for most of the leadership to focus on science. However, it also left the majority of administrative duties and power in the hands of CSIRO. Once the project has been completed CSIRO’s Climate Adaptation Flagship will review the governance of the project.

2.8 Review of Science impact

In our original proposal we undertook to evaluate the science impact post-completion. We have now formulated a framework, which in summary, seeks not just to analyse usage of SEQCARI research, but seeks to do so in the context of science usage in SEQ climate change planning more broadly.

This project involves a quantitative and a qualitative component. Network theory is used to map how organisations have participated in climate change forums. In depth semi-structured surveys will then be used to examine the impact and usage of science (both SEQCARI and otherwise).

The data for the quantitative component has been collected and is graphically represented below (see Figure 1). The semi-structured survey has been drafted and has been approved by the CSIRO ethics committee (REF#006/12).

Planning for climate change is a particularly challenging space. The impacts of climate change are not felt consistently across sectors or across communities. The nature of the impacts is also diverse. What this means is that there is both a strong rationale for coordination in policy response, while at the same time introducing real challenges in the ability to coordinate policy in the context of many competing agendas. This review will help facilitate coordination of policy networks, and the ability to build in adaptive capacity.

Both the formal review of the science impact, and SEQCARI governance, are expected to be completed end Jan-2013, with CSIRO undertaking to continue to track longer-term impacts of SEQCARI.
Figure 1. Stylised representation of network data collection. The circles show key climate change forums in SEQ over the past 3 years – the squares indicate which organisations participated in those forums.
3 Research and Engagement activities

3.1 CSIRO (Energy, Agriculture, Climate projections, Synthesis, Infrastructure)

Main impacts

CSIRO was responsible for leading three sectors of SEQCARI research: agriculture (horticulture, and beef), energy and climate projections science. In addition CSIRO governed the project overall including running the synthesis activities. CSIRO also conducted research into critical infrastructure.

- Downscaled climate projections – SEQCARI’s downscaled climate projections have been completed. SEQCARI downscaled three global climate models (general circulation models - GCMs) to 14km square grid over SEQ. These projections were combined with the efforts of the SEQ Urban Water Research Alliance, who downscaled nine global models. In terms of science impact, SEQCARI’s data now contributes to water supply planning under climate change via the contribution of the water alliance. The downscaled data has also been used within SEQCARI in order to inform adaptation science in beef production, energy demand modelling, and road infrastructure maintenance. We are also in the process of supplying the data to some local councils.

- Coastal Inundation research – storm surge risk is a significant issue for SEQ. SEQCARI research has comprehensively established a value proposition for adapting to coastal inundation. Various aspects of this work have been published as a working paper, book chapter and journal papers. An external review of CSIRO Climate Adaptation Flagship indentifies that this research stands to contribute enormous benefits to the community. For SEQ, modifications to planning regimes alone stand to save $470 million (net present value) in avoided future damages.

- Agriculture is a major land use in SEQ with a wide range of enterprise types and sizes. Studies have been undertaken with practitioners and advisors for two very different farming systems (beef and horticulture) to understand the likely threats, and opportunities, and to understand the adaptive capacity of these agricultural industries. Studies used a rural livelihood framework to determine how agriculture is underpinned by human, social, natural, physical and financial capital. These have highlighted that agriculture in the region generally benefits from good natural, physical and social capital but that pressures from urbanisation and demographic change have left many farms exposed in terms of their financial and human (skills) capacity. Impact from these findings has been fostered by involvement of various government, industry, environmental and farmer groups in the discussions, and ensuing on-farm case studies.

- Energy demand modelling – Rising peak and average electricity demand in the region of SEQ represents a major issue in relation to reliability of electricity supply, capital investment for network infrastructure, price of electricity and climate adaptation. We explored both the technical and socio-political feasibility of various adaptation options. Energy efficiency measures, such as insulation, and remote control of air conditioning are effective options. One behavioural adaptation option is to increase the awareness of the role of peak electricity demand and educate consumers not to use concurrently (or at all) electric appliances (except AC) during the afternoon of hot and humid days. To underpin these adaptation options, we analysed electricity demands at regional and sub-station levels based on the data recorded for the last 10 years by Energex. Average and peak electricity demands, as well as their relationships to temperature, population and economic growth,
have been studied. A new decomposition, statistical method for regional electricity demand forecasting was published in a technical journal, *Energy*. The research team also investigated the historical and likely future trends in electricity use for cooling purpose in residential housing in this region, considering air temperature, number of households, cooling system penetration rate, energy efficiency of air conditioners and building insulation. Residential cooling energy consumption in SEQ is projected up to 2030 based on three household growth scenarios (low, medium, and high). A set of climate change response actions for alleviating peak electricity demand has been suggested and analysed. The proposed models are capable of revealing the electricity consumption patterns and the related research findings are fundamental for demand forecasting, planning of electricity supply, and adaptation of the distribution network infrastructure to climate change. The research team has had about a dozen meetings with Energex, Gold Coast City Council, Brisbane City Council and other stakeholders, in which the research findings were presented and constructive opinions expounded by the participants were taken into account in subsequent research.

**What continues to happen**

CSIRO are committed to continue four keys aspects of the project. We will (1) conduct reviews of SEQCARI, (2) finalise the production of the SEQCARI special edition of an international journal to communicate the science content of SEQCARI (see Section 4), (3) run future communications activities (produce booklet/ run communication activities), and (4) continue to research and disseminate climate projections for the SEQ region. It is also worth noting that CSIRO and our partners have an ongoing commitment to communicate our science and to improve its uptake. Such a commitment will see continued stakeholder engagement to support the research conducted under SEQCARI.

**Synthesis**

The special edition and the various internal and external communication forums have been the focus of the synthesis activities. It is important to note, however, that this whole-of-project synthesis is only a base level of cross sectoral integration. The sectors themselves conducted activities that constituted in some cases a greater degree of synthesis. The human settlements component of research in particular had a high degree of cross sectoral research (see below, Section 3.4). The adaptive capacity likewise worked across sectors. Here, though, we present only the whole-of-project activities.

The timing of various activities were as shown in Figure 2, In the special edition the whole-of-project synthesis methodology is be laid out such to inform future projects. The key lines of inquiry in the whole-of-project synthesis are as follows.

- Are their different sectoral ‘models’ or conceptualisations of adaptation / risk implicit in the options and strategies proposed by sectors that may inhibit an integrated response (i.e. anticipatory or reactive assumptions; incremental or transformative);
- **Impacts**: are there likely to be impacts (positive or negative) on other sectors’ economic, environmental or social performance, or on their capacity to adapt, or on the effectiveness of other sectors strategies? By for instance creating new problems that draw resources away from planned activities or provide synergies that result in co-benefits across sectors
- **Interdependence**: does the option require preconditions to be met outside the scope of a given sector; would the option increase / decrease sectoral interdependence (is interdependence a desirable trait in adaptation or a risk)?
  - **Political acceptability**: is there sufficient consensus between sectors to support cooperative implementation if required?
  - **Equity**: how are costs, risks and responsibility to be allocated or shared between sectors?
  - Is there sufficient flexibility in the value chain to accommodate proposed options, or do sufficient market signals exist for proposed changes? Are there split incentives on implementation of a given adaptation option?
- **What adaptive capacity strategies / investments are required / able to be leveraged from or co-invested with other sectors?**
- **Institutional fit:** is it within the parameters of existing regulations and policies? [Here the link implied is the connection to public sector capacity to for example design, implement and monitor/compliance on new regulations, and/or the ease with which a proposed option might be implemented under existing public rules and practices]? What are the prospects or likelihood of re-design if required?

**Figure 2.** Timeline of the SEQCARI synthesis activities
Publications To-date

Journal Publications

Printed

- Taylor BM, Harman BP, Heyenga S, McAllister RRJ. The property development industry and urban adaptation: empirical and conceptual perspectives on governance. Urban Policy and Research, 30(1) 5-24

Under review

- Brown PR, Hochman Z, Bridle K and Huth NI. Issues affecting adaptation to climate change for the grazing industry in SEQ. Agricultural Systems
- Stewart M, Wang X. Risk assessment of climate adaptation strategies for Australian housing subject to extreme wind events. Climatic Change

Science Reports (including book chapters)

Released


Selected media

- “Flood & climate change”, ABC Radio (live-on-air, Spencer Howson) 24-Apr-09 (McAllister)
- “The winners & losers of climate change”, CSIRO Podcast, 19-Jun-09 (McAllister)
- “Adaptation pressures”, Australian R&D Review, 1-Jul-09 (McAllister, McDonald, Smith)
- “The Heat is on us”, The Courier Mail (by Graham Readfearn), 24-Jul-09 (Lovelock, McAllister, McDonald)
- “SEQ air-conditioning on overload” ABC Radio (live-on-air) 16 Dec 2009
- “SEQCARI feature article”, Q-science, in press (McAllister, Smith)
- “Huge rise in sea levels forecast if global warming ignored” Sydney Morning Herald 12 Aug 10, (McAllister)
- “Coastal inundation under climate change” ABC Gold Coast (live-on-air) 1-Jul-10 (McAllister)
- “Summer of fury exposes planning failures” The Weekend Australian 12-Feb-11 (McAllister)

3.2 The University of Queensland (Biodiversity)

Main impacts
The biodiversity group focussed on a subset of critical ecosystems within the SEQ region, investigating adaptation to climate change for rainforests, intertidal wetlands and marine habitats in Moreton Bay. They have supported a detailed data gathering program to develop adaptation options for biodiversity and to provide the basis on which to assess the effectiveness of different adaptation options. The team used a landscape conservation planning framework to synthesise experimental field work activities within the development of climate adaptation strategies. Key recommendations relate to protecting current and predicted refugia, providing room for landward migration of tidal wetlands and reducing the impact of non-climatic risks to biodiversity.

Over the duration of the project a range of young investigators at different stages in their careers were trained. The biodiversity team engaged 4 postdoctoral fellows over the duration of the project. Our postdoctoral fellows and Investigators worked on a wide range of subprojects that have provided immediate outputs but also developed tools and approaches that can be used in the future and in other regions. Dr Lochran Traill investigated how changes in wetland distribution with sea level rise (SLR) influenced a vulnerable species in the region (the false water rat, Xeromys myoides) and what strategies are likely to enhance its population numbers with sea level rise. Dr Karin Perhans investigated when we should invest in biodiversity reserves to get the best value for money. In conducting their work Traill and Perhans, in collaboration with CSIRO and with Dr Jonathan Rhodes, developed a predictive landscape model for SEQ in conjunction with an urban growth model, vegetation coverage (from the QLD Herbarium) and a tidal inundation model. This is the only location in Australia to have such a detailed analytical approach applied to adaptation to climate change. Dr Simon Walker looked at the risks associated with reduced connectivity of habitats in Moreton Bay and Dr Luke Shoo has used modelling tools to establish the most appropriate sites for restoration of rainforests. We also organised a forum for rainforest stakeholders to discuss adaptation to climate change for rainforests in the region and to identify what the most appropriate strategies might be given the ancillary pressure of weeds, feral animals and urban development and what baseline data sets might be available to quantify change.

Five undergraduates have worked as research assistants, fulfilling a range of roles from data collection to data management. Many of these research assistants are co-authors on research publications giving them an important boost in applying for further study or science related employment. We have trained 6 honours students and 4 PhD students within the project, all have provided presentations in public forums (e.g. stakeholder meeting on rainforests) and student sessions organized within the project. Publications from these student theses will mostly arise after the completion of the project. Four of our Honours students received awards to support their research from NCCARF. The students provided project descriptions and updates that were published within the NCCARF newsletters. Additional support has been provided by The Goodman Foundation. Our Honours students also engaged with DEEDI in assessing adaptation of landscapes for sustainable fisheries.

Within the broader project the Biodiversity team contributed to the University of the Sunshine Coasts workshops aimed at identifying adaptive capacity in the biodiversity sector. We have provided consistent input to overall project management and have provided support for student forums and stakeholder meetings. The Biodiversity team has strongly supported the overall synthesis among project components. We have co-authored a publication with CSIRO members of the project aimed at exploring how climate adaptation can be mainstreamed into all levels of governance.

The University of Queensland’s contribution to the overall project and more broadly in the provision of science to support the maintenance of biodiversity in SEQ with changing climate is made largely through the activities and publications of our students. Students often cannot publish within the time frame of the project and thus many benefits of the project remain to be acknowledged but will be forthcoming in the coming years.
What continues to happen

The project will not close with the completion of funding but instead the project provides a legacy that will continue to provide information for climate adaptation in the region. Monitoring of how intertidal wetland habitats are keeping pace with sea level rise will continue, this data will be used to model distributional change in wetland biodiversity. Within this framework we will investigate the role of intertidal wetlands in mitigating CO2 emissions and in collaboration with others at The University of Queensland we will assess likely changes in seagrass distributions with SLR. Our conservation planning work will consider the optimal time for investment in new habitat reserves. The biodiversity team have initiated monitoring of rainforest regeneration using satellite data and this work will be extended to a field program into the future.

Publications To-date
Journal Publications

Printed


Under review

- Hagger V, Fisher D, Schmidt S, Blomberg S. Assessing the vulnerability of an assemblage of subtropical rainforest vertebrate species to climate change in south-east Queensland, Austral Ecology, accepted with changes
- Weber LC, Vanderwal J, Shoo LP, Schmidt S, McDonald BJF. Patterns of rainforest plant endemism relate to stable mesic refugia and species dispersal limitations. Journal of Biogeography

Science Reports (including book chapters)

Released


Forthcoming

3.3 The University of the Sunshine Coast (Adaptive Capacity)

Main impacts

The Adaptive Capacity team worked across the various sectors under investigation as part of the SEQCARI. The adaptive capacity research was broken into four phases: (i) understanding the socio-economic trends of the region; (ii) assessment of historical adaptation successes and failures; (iii) system conceptualisation workshops with SEQ stakeholders; and (iv) identification of adaptive capacity determinants including Bayesian Belief Network analysis. Synthesis of the four phases (in consultation with other sector researchers) led to the development of cost-effective recommendations to build adaptive capacity. Options include increasing scientific literacy, and financing to support vulnerable sectors. Another component also integrated into these recommendations was research led by Dr Tim Lynam (CSIRO) focused on climate change narratives – the findings from which are currently being compiled for a special issue of Ecology and Society to be submitted in July. The adaptive capacity team took a transdisciplinary approach and included researchers with expertise in human geography, natural and cultural heritage, public health, sociology, education, futures, history, modelling and planning. We also worked actively with the biodiversity, human settlements, and energy sector researchers (eg. joint workshops with SEQ stakeholders). This collaboration also resulted in joint publications with CSIRO researchers.

Over the duration of the project we have trained a range of PhD students and Early Career Researchers (ECRs). We have engaged 3 research fellows over the duration of the project. Dr Marcus Bussey (research fellow) led the historical assessment of adaptive capacity. Dr Marcello Sano (research fellow seconded from Griffith University) led the systems conceptualisation development. Dr Russell Richards (research fellow seconded from Griffith University) led the Bayesian Belief Network analysis. Noni Keys (who submitted her PhD in January 2012) was appointed as an associate lecturer at USC and contributed to the synthesis of adaptive capacity determinants and development of options to build adaptive capacity. Dr Robert Mangoyana (while completing his PhD on biofuel feasibility assessment) assisted at various stages of the projects such contributing to the analysis of socio-economic trends. Dr Mangoyana’s skills acquired through SEQCARI has contributed to his current role as a post-doctoral fellow working on the Multi-Criteria Analysis project in Sydney as part of the Coastal Adaptation Pathways program. An affiliated PhD student (Kate English with a scholarship jointly funded by CSIRO and USC – and jointly supervised by Dr Dana Thomsen, USC; Dr Tim Lynam CSIRO; Dr Iain Walker, CSIRO; and Dr Gail Maloney,
SCU) also contributed to SEQCARI through her research on social representations of climate change in Noosa.

Our PhD students and ECRs developed their capacity for research on climate change adaptation through active involvement in the project team and joint publication of research outputs (eg. journal articles). The PhD students and ECRs also participated in numerous national and international conferences and workshops (eg. Gold Coast Climate Adaptation Conference; as well as, several of the NCCARF ECR workshops such as through both the Marine Biodiversity and Resources, and the Settlements and Infrastructure Networks).

The adaptive capacity team also focused on a participatory approach to many of the research phases, including workshops with 66 sector stakeholders and 42 key informant interviews to inform the Bayesian Belief Network analysis. The team also participated in numerous media events and impact was also recognised through keynote speaker invitations at various international conferences (eg. International Coastal Zone Management Symposium in Norway, and the Integrated Coastal Area Management conference in Vietnam).

What continues to happen
Our PhD students are nearing completion (Keys has submitted for examination, while Corpe and Adams are due to submit in the next few months). Several meetings and presentations at national and international forums have been planned to disseminate the SEQCARI research findings, including discussions with the Stockholm Environment Institute in June. A key focus over the next few months will also involve the write-up of several publications for academic audiences and broader communities. A key partnership with the Noosa Biosphere Reserve will also be enhanced through continued research. Additional new projects and partnerships will also continue beyond SEQCARI. For example, a partnership with Oak Ridge National Laboratory (USA) has been established to focus on integrated assessments of climate change impacts and vulnerabilities – this has recently been operationalised through Australian Government funding via the Coastal Adaptation Pathways program. Similarly, related projects will also be enhanced through the lessons from SEQCARI (eg. coastal adaptation research through GIZ in Vietnam). Our work will continue to focus on research to provide the knowledge base for successful societal adaptation to environmental change.

Publications To-date
Journal Publications
Printed


Under review
• Thomsen, DC, Smith, TF, and Keys, N. Adaptation or Manipulation? Unpacking Climate Change Response Strategies. Ecology and Society

Science Reports (including book chapters)

Selected media
• “University of the Sunshine Coast in climate change role” Gympie Times, 20-Jun-09 (Smith)
• “Study to measure SE Qld climate change vulnerability”, ABC.net, 22-Jun-09 (Smith)
• “Tim Smith comments on climate change study” ABC News Sunshine & Cooloola Coasts, 22-Jun-09 (Smith)
• “Uni’s role in climate change research”, Sunshine Coast Daily, 23-Jun-09 (Smith)
• “University of the Sunshine Coast plays a critical role: Team tests strategies to adapt to climate change”, Caloundra Weekly, 1-Jul-09 (Smith)
• “Adaptation pressures”, Australian R&D Review, 1-Jul-09 (McAllister, McDonald, Smith)
• “Tim Smith comments on climate change plans”, Channel Seven News (Sunshine Coast) (compare Rob Brough, interviewee Smith) 26-Aug-09
• “Tim Smith comments on possible climate change scenarios”, ABC Radio News, Midwest Wheatbelt (Geraldton), 8-Oct-09 (Smith)
• “SEQCARI feature article”, Q-science, in press (McAllister, Smith)
• “Coast’s Future Flood Shock” The Sunshine Coast Daily 9-Apr-11 (Smith)
• “Climate a hot topic” The Sunshine Coast Daily, 1/Sept/2011 (Smith)
• “Forum discusses Coast climate” The Sunshine Coast Daily, 4 Sept 2011
• “Southeast's Queensland's ability to adapt to Climate Change”, 2 Sept 2011 ABC Gold and Tweed Coasts (Gold Coast)
• “Affects of man made climate change”, 23/May/2011 ABC Sunshine and Cooloola Coasts (Sunshine Coast) Drive (Smith)
• “Plant a tree and reverse the impact”, 17 July 2011 Buderim Weekly (Smith & Thomsen)
• “Blumel climate warning, Council's planning has to take rising sea levels into account” 10 Mar 2012 (Smith)

3.4 Griffith University (Human Settlements)

Main impacts
The Human Settlement component addressed the five sectors of: urban planning and management; coastal management; human health; emergency management; and physical infrastructure with respect to local government responsibilities. The Human Settlement study was completed in six phases comprising:

i. Social vulnerability assessment of human settlement types across all five sectors in the SEQ region;
ii. Sectoral assessment of a hypothetical case study based on SEQ and six human settlement types (a regional activity (town) centre, canal estate, beachfront high rise holiday destination, middle suburb, peri-urban community, and a master planned community);
iii. Scenario development through stakeholder engagement in a series of workshops;
iv. Development of adaptation options for human settlement types across all sectors and cross sectoral options for human settlements (including policies, programs, actions and monitoring, evaluation and reporting requirements);

v. Testing of adaptation options through a scenario planning approach involving key sector specific stakeholders, supported by interviews and surveys; and

vi. Development of a full suite of climate change adaptation options for each sector and cross sectoral options for human settlements.

Due to the political sensitivity of climate change research and the need to engage human settlements stakeholders for the three year duration of the project across state and local government elections, stakeholders, particularly from local government were initially cautious about participating. Their concerns were satisfied by an agreement to publicly study a hypothetical case study region and locations. Whilst based on data provided by the participating local governments, the hypothetical region and its locations were unidentified from their true SEQ locations.

Extensive stakeholder engagement was achieved by the human settlement’s team which involved local government briefings including to full councils, two series of workshops (6 regional and sub-regional workshops), interviews with individual stakeholders and surveys of key stakeholder groups. Such engagement reinforced the need to secure stronger leadership at all levels in government, the private sector and the community, such to improve the acceptability of adaptation options. A Project Reference Group (PRG) was established comprising fourteen representatives for local and state governments, non government organisations representing environmental and natural resource interests, land developers, social welfare and the five specific human settlement sectors. Participants over the project’s three year period included: Local Government (84); State Government (37); Industry Peak Bodies (7); and Non-government and community-based organisations (17).

The human settlement’s team also conducted a non-scheduled physical Infrastructure workshop which took advantage of the January 2011 SEQ floods to examine the recovery process associated with a major adverse weather event whilst at the same time investigating adaptation and recovery options at the local government level in regard to physical infrastructure provision.

During the project, a number of postdoctoral early career research fellows were employed and trained in the five human settlement sectors. The principal researchers were:

1. Urban planning and management - Dr Silvia Serrao-Neumann and Ben Harman (CSIRO);
2. Emergency management - Dr Florence Crick;
3. Human health - Dr Vigya Sharma (to June 2010), Gemma Schuch (from July 2010) and Professor Scott Baum;
4. Coastal management - Dr Marcello Sano; and
5. Physical infrastructure - Dr Rudi van Staden and Dr Oz Sahin (from July 2011)

Three postdoctoral students are associated with the human settlement’s component: Kara Rickson (the nature of environmental risk debates, exposures and responses in relation to a socially and physically vulnerable locality) - PhD candidate confirmed in July 2011; Tony Matthews (understanding how climate adaptation can be addressed as an immediate institutional issue within planning) - PhD candidate confirmed during 2011; and Johanna Mustelin (linking private and public perceptions for successful climate adaptation) – submission of thesis imminent. In association with the Griffith University Climate Change Response Program, we have also trained two honours students (i. climate change adaptation and transit orientated development design and ii. climate change and bush fire threats in peri-urban areas)

The PhD students, early career research fellows and senior researchers participated in numerous international and national conferences, forums and workshops. The team also participated in numerous media events throughout the three years of the project as well as making submissions to the Queensland Flood Commission of Inquiry. The impacts of the human settlement component
have also been recognised through keynote speaker invitations at various national and international conferences and workshops.

What continues to happen

Beyond the SEQCARI we will continue to draw on its lessons and legacies in a number of emerging international partnerships with potential research collaborators in China (the Urban and Regional Development Research Center, Nanjing Institute of Geography & Limnology, Chinese Academy of Sciences) and Brazil (Center for conflicts, disasters and global environmental changes, University of Campinas). National scale initiatives include a NCCARF study to examine climate change adaptation relevant to Indigenous peri-urban and urban communities; work with the Cardwell community Far North Queensland on a post-Yasi strategic Action Plan; and an ARC application to examine "Communities on the Edge: Understanding the thresholds to coastal communities' resilience and adaptation to natural hazards".

A number of meetings and presentations at national and international forums have been organised to disseminate the SEQCARI research findings over the next twelve months. A final PRG workshop is planned for August 2012 to disseminate the final human settlement outputs to SEQ stakeholders. Several papers are in preparation or planned for development during the balance of 2012.

Publications To-date

Journal Publications

Printed


Under review

- Sahin, O. and Mohamed, S. A Spatial Temporal Decision Framework for Adaptation to Sea Level Rise, Environmental Modelling & Software
• Chai, G., van Staden, R.C., Guan, H. and Loo, Y.C. Development of a Three-Dimensional Finite Element Model for Simulating the Performance of Joints in Concrete Pavements, Road and Transport Research: A Journal of Australian and New Zealand Research and Practice.
• Chai, G., Guan, H., van Staden, R.C., and Loo, Y.C. Numerical Analysis of Concrete Pavement with Dowel Bar and Sublayer Void, Materials & Design.
• Chai GW, van Staden RC, Chowdhury SH, Kelly G, Loo YC. Modelling of crack initiation and progression for thin bituminous sprayed seal and asphalt pavements. International Journal of Pavement Engineering
• Sano, M, Richards, R, Roiko, A, Carter, RW, Matthews, J, Bussey, M, Thomsen, DC, Smith, TF. A systems approach for identifying pathways towards effective climate change adaptation. Climatic Change
• Matthews, T. Institutional Perspectives on Operationalising Climate Adaptation through Planning, Planning Theory and Practice

Science Reports (including book chapters)

Released

**Under Review**

• Stewart, R., Guan, H., Chai, G., Sahin, O., van Staden, RC., Oh, E., Jenkins, G. "Physical Infrastructure in South East Queensland and Impacts of Climate Change", Responding to climate change: lessons from a hotspot, CSIRO publishing (Abstract Submitted).

**Selected media**

• “Adaptation pressures”, Australian R&D Review, 1-Jul-09 (McAllister, McDonald, Smith)
• “The Heat is on us”, The Courier Mail (by Graham Readfearn), 24-Jul-09 (Lovelock, McAllister, McDonald)
• “Let Nature Help”, Brisbane Times (then syndicated through Fairfax Media), 16 Feb 11, (Low Choy)
• “Plan and Design with Nature”, Opinion Piece, Brisbane Times (then syndicated through Fairfax Media), 17 Feb 11, (Low Choy)
• Darryl Low Choy interview ABC Radio 610 (by Kelly Higgins-Devine), 16 Feb 11
• “Plan and Design with Nature”, Opinion Piece, Brisbane Times (then syndicated through Fairfax Media), 17 Feb 11, (Low Choy)

**Submissions**

• Griffith University Response to the Draft SEQ Regional Plan (McDonald, Stadler)
• GCCRP Response to the Draft Climate Change management Plan (McDonald)
• GU URP Response to the Draft Climate Change management Plan (Burton)
• GCCM Response to Draft QLD Coastal Management Plan (Sano, Lazarow)

### 3.5 Contribution to the research capacity

Adaptation science in application to climate change is a relatively new domain of science. In this regard one of the most important legacies from the project will be to train scientists in climate adaptation. There are of course a range of expertises that are needed to underpin this capacity, but the project has taken scholars with various groundings and given them skills and focus on climate adaptation issues. Demonstrative of this is the backgrounds of our PhD and post-doctoral researchers, compared to the work they have focused on within SEQCARI (Tables 1 and 2).
<table>
<thead>
<tr>
<th>Student (supervisors)</th>
<th>Pre-SEQCARI expertise</th>
<th>Focus within SEQCARI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Johanna Mustelin, (GU, Burton &amp; Tomlinson)</td>
<td>Environmental sciences with specialisation in tropical environments; particularly adaptation measures to climate change</td>
<td>Examined which existing policies can support adaptation, who/what drives the choice of adaptation measures, and how public participation can produce tangible benefits to decision-makers</td>
</tr>
<tr>
<td>Noni Keys, (USC, Smith &amp; Thomsen)</td>
<td>Environmental studies</td>
<td>The role of opinion leaders in influencing climate change response</td>
</tr>
<tr>
<td>Cimarron Corpe, (USC, Carter &amp; Matthews)</td>
<td>Geography (coastal management)</td>
<td>Visual perceptions of the impacts of climate change on sense of place</td>
</tr>
<tr>
<td>Sarah Adams, (USC, Matthews &amp; Carter)</td>
<td>Geography, statistics, business management</td>
<td>Youth representations of climate change</td>
</tr>
<tr>
<td>David McNicoll, (USC, Roiko &amp; Smith, WITHDRAWN)</td>
<td>Science (public health), business management</td>
<td>Communities of practice and influences on climate change response</td>
</tr>
<tr>
<td>Kara Rickson, (GU, Baum, Woolcock &amp; Howes)</td>
<td>Masters Degree in Environmental Education</td>
<td>Examines environmental risk debates, 'exposures' and responses in relation to a locality identified as both socially and physically vulnerable</td>
</tr>
<tr>
<td>Sabrina Latansio-Aidar, PhD (1 year), University of Queensland (Schmidt)</td>
<td>MSc in physiology and ecology of plants of the Brazilian cerado</td>
<td>Ecophysiology of rainforest plants under climate change</td>
</tr>
<tr>
<td>Chrystal Mantyka-Pringle, PhD, University of Queensland (Rhodes)</td>
<td>Honours tropical marine ecology, (JCU) Technical assistant monitoring aquatic ecosystems, DERM</td>
<td>Interactions between habitat loss and climate change for biodiversity</td>
</tr>
<tr>
<td>Francesco Bancala, PhD (full time), University of Queensland (Skilleter)</td>
<td>MSc Conservation Biology (Italy)</td>
<td>Conservation of shorebirds with climate change</td>
</tr>
<tr>
<td>Tony Matthews, (GU, Gleeson &amp; Dodson)</td>
<td>Planning for climate adaptation at the district scale</td>
<td>Understand how climate adaptation can be addressed as an immediate institutional issue within planning</td>
</tr>
<tr>
<td>Angela Guerrero Gonzalez (UQ, Wilson)</td>
<td>MSc Conservation Biology (UQ)</td>
<td>Social and institutional factors that define opportunities and constraints for conservation</td>
</tr>
</tbody>
</table>
### Table 2. Postdoctoral fellows fully funded by SEQCARI

<table>
<thead>
<tr>
<th>Fellow</th>
<th>Pre-SEQCARI expertise</th>
<th>Focus within SEQCARI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Silvia Serrao-Neumann</td>
<td>Biological Scientist, specialized in environmental conservation with a Masters and Doctorate in Environmental Education, followed by a Masters in Urban and Environmental Planning</td>
<td>Investigated a policy frame and planning principles and processes for the sustainable adaptation of the different types of urban and regional form</td>
</tr>
<tr>
<td>Dr Marcello Sano</td>
<td>Coastal engineering, planning, conservation and management</td>
<td>Coastal planning and management, climate change adaptation, integration of engineering, policy and the community</td>
</tr>
<tr>
<td>Dr Öz Sahin</td>
<td>Explored and developed a dynamic model for forecasting supply and demand for construction skills</td>
<td>Understanding the impacts of climate change on both stormwater and road deterioration and its implications to the service life as well as design and maintenance</td>
</tr>
<tr>
<td>Dr Rudi van Staden</td>
<td>Finite Element Method modelling of dental implants</td>
<td>As directly above</td>
</tr>
<tr>
<td>Dr Simon Walker</td>
<td>PhD – Predicting effects of climate change on biodiversity of sessile invertebrates on a coral reef - 2009</td>
<td>Assessing the vulnerability and adaptive capacity of coastal habitats to climate change</td>
</tr>
<tr>
<td>Dr Marcus Bussey</td>
<td>Futures and education</td>
<td>Analysis of historical adaptation and determinants of adaptive capacity</td>
</tr>
<tr>
<td>Dr Russell Richards,</td>
<td>Ecological modelling</td>
<td>Bayesian Belief Network analysis, systems modelling, and determinants of adaptive capacity</td>
</tr>
<tr>
<td>(full-time, USC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr Lochran Traill</td>
<td>Ecology and conservation of tropical wetlands birds.</td>
<td>Modelling for setting conservation priorities for threatened species in SEQ</td>
</tr>
<tr>
<td>Dr Luke Shoo</td>
<td>Topical conservation: management of biodiversity under contemporary climate change and emerging market-based instruments to reduce tropical deforestation and restore degraded environments.</td>
<td>Prioritizing conservation investment (protection and restoration of habitat) to maximize retention of rainforest biodiversity under climate change</td>
</tr>
<tr>
<td>Gemma Schuch</td>
<td>Worked on issues of climate change advocacy in the community sector</td>
<td>Researched climate change adaptation and the Human Health sector, generating understandings of health needs and potential responses in SEQ in the context of climate change.</td>
</tr>
<tr>
<td>Dr Florence Crick</td>
<td>Investigated how rural communities in Africa adapt to drought</td>
<td>Investigation of the impacts of climate change on and potential adaptation options for the emergency management sector</td>
</tr>
</tbody>
</table>

#### 3.6 Contribution to stakeholder capacity

SEQCARI’s contribution to stakeholder capacity is the ultimate aim of an initiative like SEQCARI. While the true impact of SECARI will takes years to track, for an evidence-based scientific project, it has taken on an enormous amount of participation in two ways. What is clear from the activities
listed in Section 3 is that SEQCARI has sponsored and run a large number of workshops and forums in the region. These in themselves have provided a space where stakeholders have engaged and debated issues around climate adaptation at various scales across the region. As the project was beginning, SEQ was amidst the engagement process for the climate change management plan (as part of the SEQ Regional Plan). As this wound down, SEQCARI engagement activities served as the major vehicle for stakeholder capacity building over the past three years and this itself tells a compelling value proposition from the activities.

What is also important is that researchers, who developed expertise in the field of climate adaptation through SEQCARI, have actively participated in the climate change stakeholder forums not just in the region but also internationally. In addition to participation in science based communication activities, more than 70 presentations have been recorded as part of either a forum or a presentation to external stakeholders. SEQCARI staff also participated in formal responses to the:

- SEQ Climate Change Management Plan;
- SEQ Regional Plan 2009-2031;
- Queensland State Government’s Climate Adaptation Issues Paper;
- Australian Government’s Productivity Commission’s Adaptation Plan;
- State Planning Policy 1/03 Review; and
- Queensland Floods Commission of Inquiry

And SEQCARI had formal roles on various climate change panels

- SEQ Climate Change Management Plan Working Groups
- Regional Landscape & Open Space Advisory Committee
- SEQ CEOs Committee for NRM (Low Choy, 2008 ongoing)
- SEQ Water Research Alliance Climate & Hydrological Reference Group,
- Great Barrier Reef Marine Park Reef Advisory Committee
- Australian Coastal Alliance Steering Committee
- “Blue Carbon” International Scientific Working Group, UNESCO
- Queensland EnviroDevelopment Technical Standards Taskforce (UDIA)

Our role in the co-development of stakeholder capacity has been a major part of SEQCARI.
4 Reporting the science

This final progress report does not report the science. But it is important to outline how the science has been, and will be, reported.

- For the purpose of demonstrating the science outputs of SEQCARI, by the end of the project (as defined by CSIRO’s contract with Financial Incentive Agreement with the Queensland Government) we will deliver a collection of sectoral papers from across the sectors.
- We will also deliver a synthesis paper which looks across the sectors to guide future cross-cutting studies.
- The sectoral papers and cross-cutting synthesis will be edited and published in the form of a special edition for the international, peer reviewed journal Regional Environmental Change. Table 3 shows the table of contents, acknowledging that the final set of papers will depend on peer review, and that some papers are not under SEQCARI’s direct control.
- It is important to highlight the sectoral papers that will be submitted with the final report are themselves syntheses of underpinning research that has been conducted within SEQCARI. In Section 3 in list 51 reports and journal papers which constitute underpinning science against our milestones.

Finally, and very importantly, while reporting in the science literature is best for broad, long lived and more assessable impact, we will also produce a communication booklet which summarises the action plan for adaptation in SEQ. This booklet will be in plain language, but linked to evidence. This will be completed by end July.
Table 3: Special edition for Regional Environmental Change - “Climate adaptation at the regional scale: the case of South East Queensland”, Edited by Ryan R J McAllister, Darryl Low Choy, Cath E Lovelock, Tim F Smith

<table>
<thead>
<tr>
<th>Lead Institutions</th>
<th>Title/Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Editorial</td>
<td>Editorial – adapting to climate change in South East Queensland</td>
</tr>
<tr>
<td>Andrew Ash, Ryan McAllister, Darryl Low Choy, Tim Smith, Cath Lovelock</td>
<td></td>
</tr>
<tr>
<td>GU</td>
<td>Adaptation to climate change in a vulnerability hotspot: the case of South East Queensland</td>
</tr>
<tr>
<td>Florence Crick, Ben Harman, Silvia Serro-Neumann, Gemma Schuch, et al</td>
<td></td>
</tr>
<tr>
<td>UQ</td>
<td>Adaptation for the maintenance of biodiversity with climate change</td>
</tr>
<tr>
<td>DERM *</td>
<td>From drought and flood: Adapting to water shortages while preparing for floods</td>
</tr>
<tr>
<td>Don Begbie, Wenju Cai, Debbie Abbs, Matthew Goonda</td>
<td></td>
</tr>
<tr>
<td>CSIRO *</td>
<td>Managing the peak – adapting electricity demand to regional climate change and population growth</td>
</tr>
<tr>
<td>George Quezada, George Grozev, Chi-hsiang Wang, Seongwon Seo</td>
<td></td>
</tr>
<tr>
<td>CSIRO</td>
<td>Adapting agricultural landscapes</td>
</tr>
<tr>
<td>Zvi Hochman, Neil Huth</td>
<td></td>
</tr>
<tr>
<td>CSIRO</td>
<td>Adapting residential communities for sea level rise</td>
</tr>
<tr>
<td>Cameron Fletcher, Xiaoming Wang, Chi Hsiang Wang</td>
<td></td>
</tr>
<tr>
<td>CSIRO *</td>
<td>Community perceptions of the links between extreme events, climate change, and the responsibilities of local government</td>
</tr>
<tr>
<td>Erin Bohensky and Anne Leitch</td>
<td></td>
</tr>
<tr>
<td>GU</td>
<td>Improving cross-sectoral climate change adaptation for coastal settlements: lessons from South East Queensland, Australia</td>
</tr>
<tr>
<td>Silvia Serro-Neumann, Florence Crick, Harman, Marcello Sano, Oz Sahin et al</td>
<td></td>
</tr>
<tr>
<td>USC</td>
<td>Building adaptive capacity in South East Queensland</td>
</tr>
<tr>
<td>Marcus Bussey, Noni Keys, Dana Thomsen, Tim Smith,</td>
<td></td>
</tr>
<tr>
<td>CSIRO</td>
<td>Cross-scale adaptation at the regional scale</td>
</tr>
<tr>
<td>Bruce Taylor, Ryan McAllister,</td>
<td></td>
</tr>
</tbody>
</table>
5 Other

5.1 Facilitating collaboration between international and national partners

The outputs (as opposed to outcomes) from the project have been targeted towards scientific peer review. This has allowed our scholars to present their work are part of international forums, workshops and conferences. Examplar of this are involvements at:

- Upcoming Adaptation Futures Conference, Arizona, Jun 2012
- Resilient Cities Congress, Bonn, Jun 2011
- International Conference on Climate Change, Rio de Janeiro, Jun 2011
- Association of American Geographers Annual Meeting, Washington DC, Apr 2010
- Tropical Biology and Conservation (ATBC) Conference Indonesia, Jul 2010
- Impacts Of Climate Change On Future Urban Societies, Shanghai, Aug 2010
- International Climate Change Adaptation Conference, Gold Coast, Jun 2010

Examplar scholarly relationships have been built or strengthened with: Stockholm Resilience Institution, University of California, Arizona University, Arizona State University, and Tyndall Centre for Climate Change Research.

Also, many of our scholars are international, and they have maintained links to their country of origin.

5.2 Total expenditure by the Recipient on Eligible Project Costs;

Financial reports will be completely separately

5.3 Unspent Funds

Financial reports will be completely separately

5.4 Evidence of the amount and type of financial contribution made by the Recipient and each of the Participants to the Project

As detailed above, partners have been included in the project via a Flagship Collaboration Research Fund. This funding required the partners to provide financial reports to CSIRO, and we will make these available to the Queensland Government to demonstrate their financial contribution.
6 Certification by the Project Leader

I certify that this is an accurate final progress report for the whole period of the project.

Project Leader signature: Dr. Andrew Ash

15/05/2012
Date: _____________________________

Co-signatures

Project Manager: Dr Ryan McAllister

Cluster lead signature: Prof: Darryl Low Choy

Date: _____________________________ Date: _____________________________

**The content of this report is structured primarily to satisfy CSIRO’s reporting obligations to the Queensland and Australian Governments. The content of this report also satisfies the Collaborative Cluster reporting obligations to CSIRO.**
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