Science to inform Climate Change Planning in North Queensland

Workshop Report
4 June 2013
Cairns Regional Library

Crowley, G.M., Dale, A., Turton, S. and Bennett, D.
Science to inform Climate Change Planning in North Queensland

Workshop Report – 4 June 2013 – Cairns Regional Library

Gabriel Crowley¹, Allan Dale¹ Steve Turton² and Dale Bennett²

¹ The Cairns Institute, James Cook University
² Environmental Science, Geography & Sustainability, School of Earth & Environmental Sciences, James Cook University

Supported by the Australian Government’s National Environmental Research Program
Project CF2 Project Title
# Contents

List of Figures ............................................................................................................................ ii  
List of Tables ............................................................................................................................. ii  
Acronyms and Abbreviations Used In This Report ................................................................. iii  
Acknowledgements ................................................................................................................... iv  

## 1 Purpose of meeting

NRM planners to: ...................................................................................................................... 1  
Researchers to: .......................................................................................................................... 1  
Regional Development planners to: ....................................................................................... 1  

## 2 Summary of NRM Climate Change planning

2.1 Monsoon North Cluster – Southern Gulf region – Southern Gulf Catchments (SGC) 2  
2.2 Monsoon North Cluster – Burdekin Dry Tropics region – NQ Dry Tropics (NQDT) .... 3  
2.3 Monsoon North Cluster – Northern Gulf region – Northern Gulf Resource Management Group ........................................................... 3  
2.4 Wet Tropics Cluster – Cape York region – Cape York NRM ......................................... 4  
2.5 Wet Tropics Cluster – Wet Tropics region – Terrain NRM ........................................... 4  
2.6 Wet Tropics Cluster – Mackay-Whitsundays region – Reef Catchments ...................... 5  

## 3 Presentations

3.1 Climate Change Research and Development ........................................................... 6  
3.2 Stream 2 Climate change program .......................................................................... 6  
3.3 NERP TE CF2 - Integration of science into regional planning ..................................... 7  

## 4 Cross-regional collaboration and science intergration

.................................................................................................................................................. 7  

## 5 Breakout sessions

5.1 Governance and Engagement ............................................................................... 11  
5.2 Scenario Development .......................................................................................... 12  
5.3 Information synthesis and access ........................................................................... 13  
5.4 Prioritisation and planning ..................................................................................... 14  

## 6 Wrap up and next steps

.................................................................................................................................................. 14  

### Appendix 1. List of attendees

.................................................................................................................................................. 16  

### Appendix 2 R&D Program – Climate Change research

.................................................................................................................................................. 17  

### Appendix 3. Wet Tropics Cluster – Stream 2 Overview

.................................................................................................................................................. 31  

### Appendix 4 NERP CF2 – Integrating Science into Regional Planning

.................................................................................................................................................. 38
List of Figures

Figure 1: NRM regions represented in workshop
Figure 2: Map of common planning elements identified across NRM regions
Figure 3: Map of common planning elements from Figure 2, identifying planning themes and contributing NERP and Stream 2 projects
Figure 4: Interaction between governance, engagement and resilience planning elements

List of Tables

Table 1: Contributing projects
Table 2: Identified next steps
Acronyms and Abbreviations Used In This Report

CFI ................ Carbon Farming Initiative
CSIRO .......... Commonwealth Scientific and Industrial Research Organisation
CYNRM .......... Cape York NRM
GBR ............ Great Barrier Reef
GIS ............... Geographic Information Systems
JCU ............... James Cook University
KB ................ Knowledge-Brokering hub
NCCIS .......... National Climate Change Information Service
NCCP .......... National Climate Change Projections
NERP TE .......... NERP Tropical Ecosystems
NERP ............ National Environmental Research Program
NQDT .......... North Queensland Dry Tropics
NRM .......... Natural Resource Management
QCSSI .......... Queensland Centre for Social Science Innovation
R&D .......... Research and Development
RC ............ Reef Catchments
RDA .......... Regional Development Australia
Res ............ Research institution
RGC .......... Regional Groups Collective (Queensland NRM groups)
SGC .......... Southern Gulf Catchments
WT ............ Wet Tropics
Acknowledgements

We thank all those that contributed to making this workshop a success: Peta-Marie Standley, Cape York NRM; David Hinchley, Gavin Kay and Sharlene Blakeney, Terrain NRM; Robyn Bell, Alice Spencer and Shirley Zheng, Reef Catchments; Sarah Connor, Northern Gulf Resource Management Group; Alistair Buchan and Lea Scherl, NQ Dry Tropics; Peter Jacklyn and Brendan Edgard, Charles Darwin University, Don Pollock, attending on behalf of Southern Gulf Catchments; Sonya Johnson and Jann Crase, Regional Development Australia, Far North Queensland and Torres Strait; Bob Pressey, James Cook University; David Hilbert, Iris Bohnet, Nadine Marshall, Matt Curnock, Petina Pert and Chris Cvitanovic, CSIRO and Richard Musgrove, Reef and Rainforest Research Centre. Special thanks go to Jennifer McHugh, James Cook University, for her support throughout this project.
1 Purpose of meeting

This meeting was held to bring together those undertaking Climate Change planning for Natural Resource Management (NRM) bodies and Regional Development Australia (RDA) in North Queensland with the researchers contributing scientific information and support for these plans. This meeting was a collaborative arrangement between the National Environment Research Tropical Ecosystems Hub Project CF2 *Science integration into regional planning* and the Stream 2 Climate Change *Wet Tropics Cluster Research Program*, and forms part of the Knowledge Brokering activities of both these organisations. A list of attendees is included in Appendix 1.

The aim of the meeting was to provide opportunities for collaboration and relationship building, specifically for:

**NRM planners to:**

- Discuss approaches to the Stream 1 Climate Change planning with other NRM groups, and explore ideas on how to address significant issues
- Articulate science needs to the researchers working on the Stream 2 and NERP programs
- Explore options for accessing the evidence base needed for Climate Change planning
- Identify research gaps to address future NRM needs (both planning and day-to-day business)
- Map out a process for science integration into NRM business into the future

**Researchers to:**

- Build strong research partnerships for current and future NRM research programs
- Clarify the information needed for current Climate Change planning activities, and the timeframe needed for delivery
- Get a better appreciation of how NRM groups work and the issues they face, and how best to engage with them in a meaningful way

**Regional Development planners to:**

- Build linkages with NRM groups and researchers
- Integration NRM activities into the development and delivery of RDA Roadmaps
2 Summary of NRM Climate Change planning

Facilitated by Allan Dale

Each of the NRM bodies described the processes they are currently undertaking to incorporate climate change mitigation and adaptation, including their planning processes: their governance and engagement processes; and their development and use of an evidence base. While each group was using a process that was tail-make to their own region’s characteristics and needs, many similarities were identified along with areas where their efforts could be aligned. The regions represented in this discussion are shown in Figure 1. Planning elements that were shared across one or more regions are presented graphically in Figure 2.

2.1 Monsoon North Cluster – Southern Gulf region – Southern Gulf Catchments (SGC)

Don Pollock

SGC is developing a process rather than a fixed plan. This process will have four key components

- Access to Climate Change science
- Developing a monitoring and assessment process to measure Climate Change impact
- Developing a framework for information sharing and dissemination to facilitate an informed regional view (knowledge management and information retrieval are key aspects)
- Increasing capacity for mapping and spatial analysis to support decision-support tools
2.2 Monsoon North Cluster – Burdekin Dry Tropics region – NQ Dry Tropics (NQDT)

Alistair Buchan, Lea Scherl

NQDT is substantially changing the NRM planning approach to incorporate a continuous rather than a cyclical process for engagement and information and content update. We will be using a dynamic process which reviews learning, capacity and context on an ongoing basis with only broader strategy, vision and objectives remaining fixed over the longer long-term (5-10 years). Climate Change will be fully incorporated into this process. The planning process will have five elements:

- Establishment of context for decision making through an information and context library.
- Governance.
- A short strategy document, with visions and goals,
- An investment strategy (investment exchange), which will facilitate the funding local and cross-regional/organisational projects and will include investment in research.
- A learning tool kit – which will capture the perceptions of different stakeholder groups about what is and isn’t working with the investment strategy and include other decision support tools (e.g. around scenario planning process).

NQ Dry Tropics considers such a process will ensure outcomes that extend beyond individual funded projects. It also intends to improve mechanisms for participation and partnerships. Most important is that the planning process will be structured for easy access buy in and update so that it is attractive space for collaborative work and is resilient in the face of rapid and unpredictable change to the socio-ecological systems in the region. The need for a plan of this nature is being driven by the need to address the complex issue of regional climate change adaptation.

2.3 Monsoon North Cluster – Northern Gulf region – Northern Gulf Resource Management Group

Sarah Connor

The Northern Gulf community and board are satisfied with their existing NRM plan. So rather than develop a new plan, the current one will be updated, including by incorporating Climate Change. More information is needed about likely Climate Change impacts, particularly on the grazing industry, Indigenous communities and special places, so there is a strong interest in scenario modelling. The updating of the plan will be a collaborative process, using a socio-ecological approach, applying resilience thinking. As the community has been well-consulted in previous planning processes, stakeholder engagement will be more streamlined and targeted around specific issues.

The updated plan will be more dynamic plan and strongly based on spatial information. Targets and actions will also be dynamic so they can be changed depending on changing circumstance and opportunities.

NGRMG is very keen on collaborative projects and alignment of effort and resources. They are working with neighbouring region and liaising with Terrain NRM and NQ Dry Tropics to identify opportunities to collaborate, especially with regard to identifying and managing significant features.
2.4 Wet Tropics Cluster – Cape York region – Cape York NRM

Peta-Marie Standley

The Cape York region does not have an NRM plan, only a draft plan that was never endorsed by State or Federal Government or the Cape York community. The reference to Climate Change was small and, although it was mentioned as an issue, did not indicate what actions community could take to affect or adapt to impacts. The 2004 Draft plan was developed through consultation with the community rather than involving the community in its development and therefore lacked ownership. Cape York communities are already experiencing the effects of Climate variability.

CYNRM has not committed itself to producing a plan, although this might be an outcome of the project. Rather, it is taking a multi-pronged approach, which will include:

- Communicating Climate Change and its impacts to the community through an Atlas (DVD, online or printable outputs), which will allow access to scientific information and literature, but also allow communities to input their own information
- Action development plan – based on social-ecological-cultural systems, and linked to a regional investment strategy
- Action learning
- Environmental accounts assessment – for which a framework has already been developed
- Developing a framework for engagement for the planning process including the development of a multi-media atlas

As the emphasis will be on communication, the engagement of communication designers and socio-ecological systems experts is being explored to both share information with the community and get feedback from the community about what they already know (e.g. longer dry seasons, eroding of turtle nesting sites, inundation) and what they are already doing, as well as how they have responded in previous periods of Climate Change. This information will be incorporated into the atlas.

Case studies will be developed that illustrate Climate Change issues and how communities are responding to them.

CYNRM has undertaken a number of project evaluations and synthesis of previous planning including the identification of priorities and gaps. CYNRM has also initiated a number of community engagement workshops and meetings to identify community priorities with regards to actions that can contribute to improving and maintaining sustainable communities and environments in Cape York.

2.5 Wet Tropics Cluster – Wet Tropics region – Terrain NRM

David Hinchley, Gavin Kay, Sharlene Blakeney

The Wet Tropics region has an NRM plan and Aboriginal (Bama) plan. Terrain NRM will be building on these current plans but also looking at other relevant plans from within the region and across neighbouring regions (such as water quality improvement plans). Terrain NRM is not yet sure what format the plan will take – possibly a short document, or even a poster. However, it will be an adaptive plan that is modular, an interactive system that communicates with and informs all stakeholders. Issues that will be addressed in the planning process include:

- Broad institutional/governance arrangements – determining how the plan fits within the region considering that NRM groups are not statutory bodies
• Making sure that the plan is useful and relevant to the land managers
• Having a resilience focus
• Having an ecological basis

The plan will include
• An investment portfolio
• An action plan
• Monitoring and evaluation, focusing on condition and impacts
• Opportunities for collaboration – tools, information libraries

As Terrain NRM will be using an adaptive process, timing of information coming from the Stream 2 projects is not an issue.

2.6 Wet Tropics Cluster – Mackay-Whitsundays region – Reef Catchments

Robyn Bell (NRM Planning for Climate Change contact), Alice Spencer (NRM plan contact), Shirley Zheng (GIS officer)

Updating of the NRM plan has commenced with the Climate Change elements yet to be determined pending funding delivery to trigger related activities, i.e. project plan. The broader planning process, which will include Climate Change considerations, will cover:

• Context setting – State of the region reports are being updated, and a ‘knowledge database’ created, to include scientific knowledge, stakeholder analysis, literature, and policy reviews
• Scenario planning to be used to inform potential future realities
• Trade-offs consideration
• Spatial prioritisation a central theme, proportioning the region into planning units and considering where the best return on investment in NRM may occur. RC will engage a research institution to support the development of this work
• In line with RGC guidelines, taking a systems approach
• Adaptive management approach, a living plan, monitoring and evaluation
• Governance – clear line of sight connectivity between NRM issues and priority implementation issues;
• Conservation entrepreneurship/investment portfolio to fill ample gaps left by funding
• Innovation in communication, potential web tools for plan delivery.

Particular concerns are the changing policy environment (e.g. vegetation management) and lack of applicability of current methodologies under the CFI for the region.
3 Presentations

3.1 Climate Change Research and Development

Gabriel Crowley

This presentation provided a background to the Stream 2 Climate Change research by mapping out the investment of Research and Development organisations into climate change research (Appendix 2 R&D Program – Climate Change research). Also provided was a directory of current and recent projects relevant to Climate Change (available on request).

3.2 Stream 2 Climate change program

Steve Turton
This presentation described the Stream 2 Climate Change research program, including nationwide initiatives. It then described in detail the focus of the Stream 2 Wet Tropics Cluster research program (Appendix 3. Wet Tropics Cluster – Stream 2 Overview).

### 3.3 NERP TE CF2 - Integration of science into regional planning

*Gabriel Crowley*

This presentation summarised the findings of the NERP Tropical Ecosystems Hub project CF2 - Integration of science into regional planning (Appendix 4 NERP CF2 – Integrating Science into Regional Planning). It described the process of identifying the relevance of each NERP Tropical Ecosystems Hub projects to Climate Change planning and developing portfolios of projects relevant to each NRM region (available at http://www.nerptropical.edu.au/publication/climate-change-relevance-hub-projects-nrmcairns-institute).

### 4 Cross-regional collaboration and science integration

*Facilitated by Allan Dale*

Six thematic areas (Figure 3) were identified where NRM groups could collaborate in Climate Change planning, either through sharing of information and experience, or through establishing processes for science integration with contributing research organisations. A number of NERP TE projects and Stream 2 Climate Change were identified as contributing to these thematic areas, and this list has subsequently been extended to include all relevant activities from both programs (Table 1).

#### 1. Governance and engagement

The Governance and engagement theme includes mechanisms for managing the planning process and engaging with stakeholders to ensure the plans reflect community concerns. Identification of socio-ecological networks and their resilience was considered essential to understanding how communities interacted with each other and their environment. Collaborative opportunities under this theme were discussed in Breakout Session 5.1.
Figure 3. Map of common planning elements from Figure 2, identifying planning themes and contributing NERP and Stream 2 projects

See Table 1 for key to contributing projects.
### Table 1. Contributing projects

<table>
<thead>
<tr>
<th><strong>Climate Change Stream 2 Projects</strong></th>
<th><strong>Element 2 - Wet Tropics Cluster activities</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Element 1 – National activities</strong></td>
<td><strong>Element 2 - Wet Tropics Cluster activities</strong></td>
</tr>
<tr>
<td>National – themes Decision making; Invasive species; Biodiversity; Monitoring &amp; Evaluation</td>
<td>WT-A</td>
</tr>
<tr>
<td>WT-A</td>
<td>Participatory scenarios node</td>
</tr>
<tr>
<td>NCCP</td>
<td>National Climate Change Projections</td>
</tr>
<tr>
<td>NCCP</td>
<td>National Climate Change Information Service</td>
</tr>
</tbody>
</table>

### NERP TE Hub Projects

| NERP 1.1 | NERP 1.2 | NERP 1.3 | NERP 2.1 | NERP 2.2 | NERP 2.3 | NERP 3.1 | NERP 3.2 | NERP 3.3 | NERP 3.4 | NERP 4.1 | NERP 4.2 | NERP 4.3 | NERP 4.4 | NERP 5.1 | NERP 5.2 | NERP 5.3 | NERP 6.1 | NERP 6.2 | NERP 6.3 |
|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Monitoring status and trends of coral reefs of the GBR | Marine wildlife management in the GBR World Heritage Area | Characterising the cumulative impacts of global, regional and local stressors on the present and past biodiversity of the GBR | Marine turtles and dugongs of the Torres Strait | Mangrove and freshwater habitat status of Torres Strait Islands | Monitoring the health of Torres Strait coral reefs | Rainforest Biodiversity | Rainforest refugia and hotspots of plant genetic diversity in the Wet Tropics and Cape York Peninsula | Targeted surveys for missing and critically endangered rainforest frogs in ecotonal areas, and assessment of whether populations are recovering from disease | Monitoring of key vertebrate species | Tracking coastal turbidity over time and demonstrating the effects of river discharge events on regional turbidity | The chronic effects of pesticides and their persistence in tropical waters | Ecological risk assessment for water quality of the GBR | Hazard assessment for water quality threats to Torres Strait marine waters, ecosystems and public health | Understanding GBR diversity: spatial and temporal dynamics and environmental drivers | Combined water quality–climate effects on coral and other reef organisms | Vulnerability of seagrass habitats in the GBR to changing coastal environments | Maximising the benefits of mobile predators to GBR ecosystems: the importance of movement, habitat and environment | Drivers of juvenile shark biodiversity and abundance in inshore ecosystems of the GBR | Critical seabird foraging locations and trophic relationships for the GBR | Fire & rainforests | Invasive species risks and responses in the Wet Tropics | Climate change and the impacts of extreme events on Australia's Wet Tropics biodiversity | Monitoring the ecological effects of GBR zonning plan on mid and outer shelf reefs | Assessing the long–term effects of management zoning on inshore reef of the GBR | Significance of no–take marine protected areas to regional recruitment and population persistence on the GBR | Dynamic vulnerability maps and decision support tools for the GBR | Design and implementation of management strategy evaluation for the GBR | Prioritising management actions for GBR islands | Conservation planning for a changing coastal zone | Social and economic long–term monitoring program | Socio-economic system and reef resilience | Building resilient communities for Torres Strait futures | Improved approaches for the detection and prevention of wildlife diseases in the Torres Strait | Indigenous peoples and protected areas | Harnessing natural regeneration for cost-effective rainforest restoration | Relative social and economic values of residents and tourists in the WTWHA | Governance, planning and the effective application of emerging ecosystem service markets: climate change adaptation and landscape resilience | e-Atlas |
2. **Science synthesis**

The Science synthesis theme addressed the core information needed on which to base Climate Change planning. This need is being addressed by the Stream 2 Wet Tropics Cluster Science Synthesis Node as well as by the Stream 2 National project and National Climate Projections project, and similar activities being undertaken by the Monsoon North Cluster research program. Numerous NERP TE projects also involve synthesis of scientific evidence about the extent and condition of terrestrial and marine resources, the pressures and drivers affecting them, and – to some extent – how these will be affected by Climate Change. However, as current NRM planning activities and daily business extend beyond considerations of Climate Change, other on-going mechanisms for synthesising relevant scientific evidence may also be required. Further collaborative opportunities under this theme were discussed in Breakout Session 5.3.

3. **Scenario development**

The Scenario development theme includes mechanisms for visualising and engaging with changes likely to be experienced in each region and their implications for NRM in order to identify appropriate planning and management responses. This need is being addressed by the Stream 2 Wet Tropics Cluster Scenario Development Node, and similar activities being undertaken by the Monsoon North Cluster Research Program. Several NERP projects also involve scenario development in relation to both Climate Change and other pressures and drivers. However, as current NRM planning activities and daily business extend beyond considerations of Climate Change, other on-going mechanisms for scenario development may also be required. Collaborative opportunities under this theme were discussed in Breakout Session 5.2.

4. **Information storage and retrieval**

The Information storage and retrieval theme includes mechanisms for ensuring that data, information and synthesised information are made accessible to NRM groups in useable formats that can be incorporated in both planning and day-to-day business, and that knowledge of both this evidence and the systems for accessing it is maintained to ensure NRM activities are informed by a stable evidence base. Collaborative opportunities under this theme were discussed in Breakout Session 5.3.

5. **Prioritisation and planning**

This includes mechanisms for marrying scientific evidence with stakeholder concerns to prioritise where NRM efforts are invested. This need is being addressed by the Stream 2 Wet Tropics Cluster Planning and Prioritisation Node, and similar activities being undertaken by the Monsoon North Cluster Research Program. Several NERP projects also involve prioritisation and planning to address both Climate Change and other stakeholder concerns. However, as current NRM planning activities and daily business extend beyond considerations of Climate Change, other on-going mechanisms for prioritisation and planning may be required. Collaborative opportunities under this theme were discussed in Breakout Session 5.4.

6. **Monitoring and evaluation**

This includes mechanisms for managing the planning process and engaging with stakeholders to ensure the plans reflect community concerns. Identification of socio-ecological networks was considered essential to understanding how communities interacted with each other and their environment. Further discussion of collaborative opportunities across this theme was postponed to a further meeting.
5 Breakout sessions

Breakout sessions explored each of the above themes, except Monitoring and evaluation. Discussions were broadly organised around the following topics

- Current situation – where we are now
- Alignment opportunities – what NRM groups and/or researchers should be doing together
- Collaborative efforts required – how can efforts be aligned to achieve these alignments?
- Next steps

5.1 Governance and Engagement

Current situation

- Wanting to ensure our plans are highly influential (See Figure 4)
- Need to keep the story about improving governance simple.
- Need to know who are the key players that we to influence/involve.
- What are the mandates of the various players?
- Where are their synergies and conflicts?
- How can we best position the plans to be influential?
- Collectively need analytical tools to support these considerations.

Alignment opportunities

- New Governance Risk analysis framework developed by JCU (NERP).
- New sub-regional social resilience analysis emerging via JCU (QCSSI).
- Emerging work on Social Network Analysis could be of value (Pressey/NERP).

Collaborative efforts required

- Collaborative risk assessment of the governance systems.
- Collaboration on finding tools for social network analysis.
- Collaborative opportunities to explore social resilience.

Next steps

- Work across the regions to support Social Network Analysis approaches.
- Progress a whole of region (systemic) Governance Risk Analysis as a basis for higher level collective and strategic decision making among the Wet Tropics Regions.
- Continue to progress current JCU Social Resilience Benchmarking work across the regions as a basis for integration into the Wet Tropics cluster and adaptation planning.
5.2 Scenario Development

Current situation

- Some climate projections are available, but there is a lot of uncertainty
- Stories from Indigenous people and other sectors (local knowledge) need to be captured
- No mechanisms for incorporating science into planning
- Poor understanding of scenario planning
- Climate Change information is already available, but it is difficult to engage stakeholders when there are long time periods, as they feel it doesn’t apply to them

Alignment opportunities

- Spatial biophysical information coming from the national Stream 2 initiative is needed before any scenario planning can be done for the region
- Scenario planning needs to be undertaken separately for each region, as they are all different
- Bring spatial information together across the region for scenario planning
- Provide links to the scientists

Collaborative efforts required

- Alignment through the Wet Tropics cluster knowledge hub

Next steps

- Bring spatial information together for individual regions and across regions
- Each NRM group to work out delivery of scenario planning engagement activities
Science to inform Climate Change Planning in North Queensland

- Run two types of scenario planning
  - climate scenarios
  - social-ecological system
- Scientists to compose a local compendium of science information

5.3 Information synthesis and access

Current situation
- Wet Tropics Cluster has identified issues and knowledge gaps affecting Climate Change planning to inform the Science Synthesis Node activities
- The Science Synthesis Node activities will include workshops on the impacts of Climate Change and Climate Change adaption in relation to Biodiversity, Socioeconomics, Communities (cultural/social aspects). It will also identify major Climate Change threats, and identification of where and how soon change is likely to occur. There will be a chapter on Climate Change adaptation science. A bibliography will be provided.
- These workshops will be held after the knowledge broker is appointed
- The Science Synthesis Node activities will draw on datasets provide by the Stream 2 National project as well as material provided by the NRM groups.
- The Stream 2 Wet Tropics Cluster Knowledge Brokering Node will help formulate products from the science synthesis that will be useful to the NRM groups.
- Data and information systems that are available for accessing scientific information, and could be expanded to meet growing NRM needs, include
  - North Australian Fire Information www.firenorth.org.au
  - North Australian Land Manager www.landmanger.org.au

Alignment opportunities
- Improve communication between researchers and NRM groups about suitable formats for outputs

Collaborative efforts required
- Alignment through the Wet Tropics cluster knowledge hub

Next steps
- Discuss examples of good science synthesis and swap them between the NRM groups and the science synthesis team
- Arrange for draft formats for Science Synthesis Node products to be circulated to NRM groups for feedback before completion
- Define the role of the Wet Tropics Cluster Knowledge Broker, to be appointed soon
- Knowledge gathering/synthesis needs to be an iterative process
- Develop information storage and access systems that leave a legacy beyond current project funding
- Make sure information is available in a spatially detailed and relevant basis
5.4 Prioritisation and planning

Current situation

- Both the Monsoon North Cluster and Wet Tropics Cluster Stream 2 programs include prioritisation and planning projects.
- A postdoctoral fellow will be appointed soon by the Wet Tropics Cluster Stream 2 program’s Prioritisation and planning node.
- This node’s activities will include information about trade-offs in decision making as well as and understanding spatial information.
- Most NRM plans in the Wet Tropics cluster include little spatial information in it, which makes it difficult to prioritise efforts (e.g. wildlife corridors).
- Southern Gulf Catchments has little mapping and spatial analysis capacity.
- Information is required at both the regional and local scale.
- Specific gaps include springs of Cape York, water assets in the Wenlock catchment, coal seam gas information.
- CYNRM has developed an online tool that allows people to upload information on what they are seeing, e.g. Videos. This will be used as a community monitoring tool.

Alignment opportunities

- Develop consistent landscape objectives.
- Develop consistent information and approaches to trade-offs.
- Ask the right questions for the planning and prioritisation tools to answer.
- Design of tools.
- Bioregional planning.
- Identifying and filling spatial gaps (e.g. water resources).
- Consistent communication of data layers.

Collaborative efforts required

- Spatial staff network.
- Keep link to state approach to supporting NRM planning.

Next steps

- Formalise planners’ alliance.
- Network among NRM GIS staff, NRM Planners and Wet Tropics Cluster Prioritisation and planning node staff (Bob Pressey and Petina Pert).

6 Wrap up and next steps

The meeting confirmed the usefulness of bringing together NRM planners with each other and with contributing researchers, and that the objectives of the meeting to enhance collaboration were achieved. Next steps identified in the breakout sessions are listed in Table 1.

It was resolved to organise a follow-up meeting in approximately six months’ time to be organised around an identification information need or process development.

| Table 1. Identified next steps |
### Governance and engagement

Work across the regions to support Social Network Analysis approaches

Progress a whole of region (systemic) Governance Risk Analysis as a basis for higher level collective and strategic decision making among the Wet Tropics Regions

Continue to progress current JCU Social Resilience Benchmarking work across the regions as a basis for integration into the Wet Tropics cluster and adaptation planning

### Scenario development

Bring spatial information together for individual regions and across regions

Each NRM group to work out delivery of scenario planning engagement activities

Run two types of scenario planning
- climate scenarios
- social-ecological system

### Information synthesis and access

Discuss examples of good science synthesis and swap them between the NRM groups and the science synthesis team

Arrange for draft formats for Science Synthesis Node products to be circulated to NRM groups for feedback before completion

Define the role of the Wet Tropics Cluster Knowledge Broker, to be appointed soon

Knowledge gathering/synthesis needs to be an iterative process

Develop information storage and access systems that leave a legacy beyond current project funding

Make sure information is available in a spatially detailed and relevant basis

### Prioritisation and planning

Formalise planners’ alliance

Network among NRM GIS staff, NRM Planners and Wet Tropics Cluster Prioritisation and planning node staff (Bob Pressey and Petina Pert)
## Appendix 1. List of attendees

<table>
<thead>
<tr>
<th>Sector</th>
<th>Person</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRM</td>
<td>Peta-Marie Standley</td>
<td>Cape York NRM</td>
</tr>
<tr>
<td>NRM</td>
<td>Sarah Connor</td>
<td>Northern Gulf Resource Management Group</td>
</tr>
<tr>
<td>NRM</td>
<td>Alastair Buchan</td>
<td>NQ Dry Tropics</td>
</tr>
<tr>
<td>NRM</td>
<td>Lea Scherl</td>
<td>NQ Dry Tropics</td>
</tr>
<tr>
<td>NRM</td>
<td>Alice Spencer</td>
<td>Reef Catchments</td>
</tr>
<tr>
<td>NRM</td>
<td>Robyn Bell</td>
<td>Reef Catchments</td>
</tr>
<tr>
<td>NRM</td>
<td>Shirley Zheng</td>
<td>Reef Catchments</td>
</tr>
<tr>
<td>NRM</td>
<td>Don Pollock</td>
<td>Southern Gulf Catchments</td>
</tr>
<tr>
<td>NRM</td>
<td>David Hinchley</td>
<td>Terrain NRM</td>
</tr>
<tr>
<td>NRM</td>
<td>Gavin Kay</td>
<td>Terrain NRM</td>
</tr>
<tr>
<td>NRM</td>
<td>Sharlene Blakeney</td>
<td>Terrain NRM</td>
</tr>
<tr>
<td>RDA</td>
<td>Jann Crase</td>
<td>Regional Development Australia FNQTS</td>
</tr>
<tr>
<td>RDA</td>
<td>Sonja Johnson</td>
<td>Regional Development Australia FNQTS</td>
</tr>
<tr>
<td>Res</td>
<td>Chris Cvitanovic</td>
<td>CSIRO / Stream 2 National Project</td>
</tr>
<tr>
<td>Res</td>
<td>Dave Hilbert</td>
<td>CSIRO / Stream 2 Wet Tropics Cluster</td>
</tr>
<tr>
<td>Res</td>
<td>Iris Bohnet</td>
<td>CSIRO / Stream 2 Wet Tropics Cluster</td>
</tr>
<tr>
<td>Res</td>
<td>Matt Curnock</td>
<td>CSIRO / Stream 2 Wet Tropics Cluster</td>
</tr>
<tr>
<td>Res</td>
<td>Petina Pert</td>
<td>CSIRO / Stream 2 Wet Tropics Cluster</td>
</tr>
<tr>
<td>Res</td>
<td>Nadine Marshall</td>
<td>CSIRO / Stream 2 Wet Tropics Cluster / NERP Tropical Ecosystems Hub</td>
</tr>
<tr>
<td>Res</td>
<td>Steve Turton</td>
<td>James Cook University / Stream 2 Wet Tropics Cluster</td>
</tr>
<tr>
<td>Res</td>
<td>Bob Pressey</td>
<td>James Cook University / Stream 2 Wet Tropics Cluster / NERP Tropical Ecosystems Hub</td>
</tr>
<tr>
<td>Res</td>
<td>Allan Dale</td>
<td>James Cook University / Stream 2 / NERP</td>
</tr>
<tr>
<td>Res</td>
<td>Brendan Edgar</td>
<td>NERP Northern Australia Hub / Stream 2 Monsoon North</td>
</tr>
<tr>
<td>KB</td>
<td>Gabriel Crowley</td>
<td>James Cook University / NERP Tropical Ecosystems Hub</td>
</tr>
<tr>
<td>KB</td>
<td>Richard Musgrove</td>
<td>NERP Tropical Ecosystems Hub</td>
</tr>
<tr>
<td>KB</td>
<td>Peter Jacklyn</td>
<td>Charles Darwin University</td>
</tr>
<tr>
<td>Minutes</td>
<td>Dale Bennett</td>
<td>James Cook University</td>
</tr>
</tbody>
</table>

1 NRM: Natural Resource Management body; RDA: Regional Development Australia; Res: Research institution; KB: Knowledge Brokering role.
Appendix 2 R&D Program – Climate Change research

Gabriel Crowley

R&D Programs - Climate Change research

Gabriel Crowley – The Cairns Institute JCU

Session Aims

1. Familiarise NRM planners with the range of R&D programs contributing to Climate Change science
2. Identify science projects that will inform Climate Change planning
3. Identify outputs that will be useful from research projects
4. Provide background for session on knowledge brokering / science integration
5. Provide context for research being undertaken in NERP and Stream 2 Climate Change programs
<table>
<thead>
<tr>
<th>R&amp;D Program</th>
<th>CC Research Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate Change Research Strategy for Primary Industries</td>
<td>Primary Industries</td>
</tr>
<tr>
<td>National Climate Change Adaptation Research Facility</td>
<td>Adaptation planning</td>
</tr>
<tr>
<td>Managing Climate Variability</td>
<td>Building farmer capacity</td>
</tr>
<tr>
<td>Sugar Research and Development Corporation</td>
<td></td>
</tr>
<tr>
<td>Meat and Livestock Australia</td>
<td>Building farmer capacity through improving productivity,</td>
</tr>
<tr>
<td></td>
<td>profitability, innovation &amp; sustainability</td>
</tr>
<tr>
<td>Grains Research &amp; Development Corporation</td>
<td></td>
</tr>
<tr>
<td>Fisheries Research &amp; Development Corporation</td>
<td></td>
</tr>
<tr>
<td>Horticulture Australia</td>
<td></td>
</tr>
<tr>
<td>CSIRO Climate Adaptation Flagship</td>
<td>Adaptation; Cities &amp; coasts; biodiversity; Primary industries</td>
</tr>
<tr>
<td>Australian Research Council Centre of Excellence for Climate System Science</td>
<td>Climate and its drivers</td>
</tr>
<tr>
<td>Australian Centre of Excellence for Local Government</td>
<td>Governance &amp; capacity</td>
</tr>
<tr>
<td>Rural Industries Research &amp; Development Corporation</td>
<td>Innovation, adaptation, policy</td>
</tr>
<tr>
<td>Productivity Commission</td>
<td>Policy development</td>
</tr>
<tr>
<td>National Health and Medical Research Council</td>
<td>Health implications</td>
</tr>
</tbody>
</table>

**CCRSPI**

CLIMATE CHANGE RESEARCH STRATEGY FOR PRIMARY INDUSTRIES

**AIMS:**
Towards more efficient and effective research, development and extension to address the challenges and opportunities of climate change for primary industries in Australia

**Activities:**
Leading national collaboration, coordination and communication of climate change research, development and extension activity for Australia’s primary industries

[www.ccrspi.org.au](http://www.ccrspi.org.au)
National Climate Change Adaptation Research Facility

Role:
Harness and coordinate the capabilities of Australia’s researchers, to generate and communicate the knowledge decision-makers need for successful adaptation to climate change

Objectives:
• Identify knowledge needs of end users
• Build and harness the capacity of the research and end user community
• Generate the knowledge to meet end user needs
• Make knowledge available to end-users

www.managingclimate.gov.au

News
- CLIMAG issue 24, May 2013
- New free CLIMATE app for farmers
- Climate Analyst decision-support system tools

Managing Climate Variability
We have been helping Australian farmers to manage climate risk on-farm for over a decade, providing them with practical tools to incorporate climate information into farm business decisions.

Our goals are to:
• improve seasonal forecasting – its accuracy, lead-time and ease of use
• provide farmers with tools and information for managing climate risk
• get more farmers and natural resource managers managing their climate risk

Last updated: Friday, August 6, 2010

www.managingclimate.gov.au
Managing Climate Variability

Aims:

- improve seasonal forecasting – its accuracy, lead-time & ease of use
- provide farmers with tools & information for managing climate risk
- get more farmers & natural resource managers managing their climate risk

www.managingclimate.gov.au
2012 Marine Climate Change Report

The 2012 Report Card demonstrates that climate change is having significant impacts on Australia’s oceans and marine ecosystems. Many new changes have been documented since the 2009 Report Card. There is now strong evidence of extensive widespread movements of tropical fish and pandanus species in southwestern Australia, declines in abundance of temperate species, and the first signs of the effect of ocean acidification on marine species with shells. The report card highlights that the Australian scientific community is widely engaged in research, monitoring and observing programs to increase our understanding of climate-related impacts, and storm management. The comprehensive information shows that climate-friendly actions are already underway, and that seasonal forecasts for fisheries and aquaculture are being used by researchers in situ to inform policy and management responses to climate change.

86% of Australia’s marine scientists from 37 universities and research organisations contributed to the 2012 Report Card. Each section contains information on what is already happening, what may happen if nothing is done, and describes the actions underway to prepare for and adapt to changes.

Download the 2012 Marine Climate Change Report Card (PDF).

To read more about the 2012 Marine Climate Change Report Card visit: http://www.oceansexchange.org.au/content/index.php/2012/report_cord
Barriers to Effective Climate Change Adaptation

Inquiry report

The inquiry report was released on 31 March 2005.

See also

- Brief about Barriers to Effective Climate Change Adaptation

Download the report

- Barriers to Effective Climate Change Adaptation Inquiry report (PDF - 2.94 MB)
- Barriers to Effective Climate Change Adaptation Inquiry report (Word - 1.94 MB)

Download the report by chapters

- Preface, Introduction, Appendices, Explanatory Notes and Glossary
- Chapter 1: Introduction (PDF - 1.42 MB)
  - 1.2 The Committee's approach to identifying, reviewing and prioritising the issues
  - 1.3 The structure of the inquiry
- Chapter 2: The challenges of climate change (PDF - 1.17 MB)
  - 2.1 Australia's variable and changing climate
  - 2.2 Projected climate change for Australia

www.climatechange.org.au
Adapting to climate change

Between 2007 and 2013 the Australian Government invested $129 million in the National Climate Change Adaptation Program, which is helping Australians to better understand and manage risks linked to the carbon pollution already in our atmosphere and to take advantage of potential opportunities.

The Australian Government is:

- Investing $12.9 billion to secure Australia’s water supply in the single largest investment in climate change adaptation. *Water for the Future*. Scientists predict climate change will reduce the amount of rainfall in parts of Australia—particularly in southern areas. Water for the Future focuses on four national priorities: taking action on climate change, using water wisely, securing our water supplies, and supporting healthy rivers and wetlands. Part of the funding is being provided for alternative water supplies in our major cities to improve irrigation efficiency in areas which will improve the ability of primary producers to respond to climate change and manage their emissions.

The Australian Government’s position paper, *Adapting to Climate Change in Australia*, sets out the government’s vision for adapting to the impacts of climate change and proposes practical steps to realise that vision.

It outlines the Australian Government’s role in adaptation, which includes building community resilience and encouraging the right conditions for people to adapt; taking climate change into account in the management of Commonwealth assets and programs; providing sound scientific information; and leading national reform.

The position paper identifies six national priority areas for action: water, coasts, infrastructure, natural ecosystems, natural disaster management, and agriculture.

It is important that Australia reduces its carbon pollution to minimise the severity of climate change. However, because some greenhouse gases stay in the atmosphere for about 100 years after they are first emitted, there will be some changes that cannot be avoided due to past and inevitable future global emissions.

---

R&D Projects

<table>
<thead>
<tr>
<th>Category</th>
<th>ACELG</th>
<th>ARC</th>
<th>CCSRPI</th>
<th>DAFF</th>
<th>DCCEE</th>
<th>DRDC</th>
<th>HAL</th>
<th>MCV</th>
<th>MLA</th>
<th>NCCARF</th>
<th>NERP</th>
<th>OMA</th>
<th>PC</th>
<th>RRDC</th>
<th>SRDC</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climatic &amp; environmental conditions</td>
<td>25</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>2</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>3</td>
<td></td>
<td>44</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>45</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td>101</td>
</tr>
<tr>
<td>Communities &amp; organisational arrangements</td>
<td>2</td>
<td>28</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>54</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>101</td>
</tr>
<tr>
<td>Industries &amp; livelihoods</td>
<td>15</td>
<td>1</td>
<td>61</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>7</td>
<td>3</td>
<td>9</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>8</td>
<td></td>
<td>130</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17</td>
</tr>
<tr>
<td>Resource access &amp; cost</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Data, resources &amp; tools</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2 124</td>
<td>1</td>
<td>62</td>
<td>2</td>
<td>6</td>
<td>4</td>
<td>7</td>
<td>5</td>
<td>100</td>
<td>54</td>
<td>8</td>
<td>4</td>
<td>17</td>
<td>11</td>
<td></td>
<td>413</td>
</tr>
<tr>
<td>Topic</td>
<td>NHM relevance score (Region + Threat + Planning relevance)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------</td>
<td>------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate and environmental conditions (20)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All risk areas (20)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forecasting &amp; risk assessment – general (20)</td>
<td>3</td>
<td>5</td>
<td>11</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural fire, temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate variability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extreme events (10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sea level rise (10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrological cycle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water quality (10)</td>
<td>1</td>
<td>4</td>
<td>8</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>10</td>
<td>25</td>
<td>101</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biodiversity</td>
<td>7</td>
<td>3</td>
<td>7</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All-risk areas/ecosystems (13)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biodiversity</td>
<td>7</td>
<td>3</td>
<td>7</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate variability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extreme events (10)</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sea level rise (10)</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water quality (10)</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>9</td>
<td>21</td>
<td>34</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communities &amp; organisations (20)</td>
<td>4</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biodiversity</td>
<td>4</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate variability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extreme events (10)</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sea level rise (10)</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water quality (10)</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>9</td>
<td>2</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industries &amp; livelihoods (100)</td>
<td>7</td>
<td>14</td>
<td>12</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural &amp; primary industries (67)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cashew &amp; ecosystem services (100) (31)</td>
<td>3</td>
<td>17</td>
<td>10</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indigenous land &amp; sea management (100)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tourism (100)</td>
<td>3</td>
<td>17</td>
<td>10</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other industries (100)</td>
<td>3</td>
<td>17</td>
<td>10</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>94</td>
<td>23</td>
<td>130</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infrastructure</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General (100)</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban centres (110)</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population growth &amp; distribution (110)</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>98</td>
<td>26</td>
<td>130</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resource access &amp; cost (130)</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General resources (130)</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land (tenure &amp; use)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water (130)</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>96</td>
<td>26</td>
<td>130</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mapping &amp; regional planning (150)</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>98</td>
<td>26</td>
<td>130</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R&D publications
Appendix 3. Wet Tropics Cluster – Stream 2 Overview

Steve Turton

Stream 2 Program Objectives

- To improve the quality and accessibility of regionally relevant information on climate change impacts and potential adaptation responses available to regional NRM organisations;
- To provide regional NRM organisations with access to expert advice on how to apply climate change information in their planning;
- To encourage local knowledge and experience to be integrated into understanding of climate change impacts, opportunities and potential adaptation responses; and
- To assist regional NRM organisations to plan for the biodiversity impacts of climate change and capitalise on the opportunities provided by the Carbon Farming Initiative and the Biodiversity Fund to improve the long term resilience of the landscape, communities and agricultural economies.
Element 1: Delivery of Climate Change Projections (CSIRO and BOM)

Element 2: Impacts and Adaptation Grants Program
8 clusters from the 56 NRM regions

Plus a National Project (CSIRO)
National Project (Chris Cvitanovic, CSIRO)

- Aim is to deliver ‘tailored’ information to each of the NRM groups to use for climate change planning. Science team provides information on 4 key issues: 1) Decision making, 2) Invasive species, 3) Biodiversity, and 4) Some form of M & E.
- Science team will feed this information and this information will be used to pass along to NRM groups for their planning. Specifically high-level cluster based. If data is available it will be used – no new data will be collected. If no data available will have to look at extrapolating what data you do have across regions.
- Will be rolled out by January 2014.

Wet Tropics Cluster Objectives

- To undertake research to synthesise and model climate change impacts and adaptation responses for priority issues identified by the Wet Tropics Cluster, including: biodiversity shifts, rural and Indigenous community responses, extreme events (in particular cyclones), coastal development, weeds, feral animals and fire.
- To identify best ‘no regrets’ solutions for the Wet Tropics Cluster and the most effective and influential mechanisms for integrating these into the NRM planning and investment strategy development process.
Wet Tropics Cluster Objectives

- To provide **targeted new knowledge generation** for identified **priority information gaps**.
- To develop **user-friendly decision making tools** that support stakeholder engagement and education.
- To support workshops and other **participatory processes** for training, information sharing and advice.
- To use information to **develop a framework** for the ongoing incorporation of knowledge for **adaptive management** of terrestrial and marine environments as **socio-ecological systems** beyond the time-frame of this project.

Wet Tropics Cluster Activities

- An **exploratory analysis** of the social-ecological system (multi-scalar), including a **science gap analysis and synthesis**, data collection for **spatial prioritisation** and the identification of **focal issues, drivers and measures for participatory scenarios**.
- **Vulnerability** and **risk identification**, including **participatory processes** to collect and incorporate **local knowledge** and experiences and the development of data and models for **prioritisation** and **spatial scenarios**.
- **Participatory scenario generation**, including the synthesis of science on **adaptation pathways** and **opportunities**, and the identification of **potential optimal solutions** for biodiversity and carbon sequestration.
**Wet Tropics Cluster Activities**

- Co-identification of *priority adaptation pathways* and landscapes with *triggers & thresholds*, and the participatory *prioritisation* of adaptation pathways for building *system well-being*, including prioritised opportunities and locations.
- Providing *expert support* for the implementation of *adaptation pathways & landscapes* in NRM groups planning.
- Undertake *Monitoring and Evaluation* (M&E) at the project level and provide input into Stream 2 Program M&E.

---

**Co-research approach that promotes long-term system well-being and social learning**

- **Element 1:** Kathy McInnes (CSIRO)
- **Ro Hill (CSIRO)**
- **Science synthesis node**
- **Participatory scenarios node**
- **Steve Turton (JCU)**
- **Brokering Hub Co-research Team**
  - **Broker/s**
  - **NRM GIS & Planning Tools Team**
  - **Cape York RPM**
  - **NRM Planning Priority: Stream 1**
- **Reef Catchments RPM**
- **Science Priority: Stream 2**
- **Bob Pressey (JCU)**
- **Prioritisation & opportunities node**
- **Peta-Marie Standley**
- **Science synthesis node**
- **Robyn Bell**
- **David Hinchley**
- **John Rainbird**
Wet Tropics Cluster Deliverables

- Syntheses of *regionally relevant* ecosystems and landscape impact and adaptation responses to climate change, that include information from the scientific literature and incorporates work that the NRM organisations are championing (e.g. resilience and adaptation planning, carbon and ecosystem services, no regrets solutions, marine and terrestrial corridors).

- *Regionally specific case studies* that encapsulate key issues.

- *Participatory scenario analysis* to build on existing work and integrate local knowledge and experience.

- *Planning tools.*
Achievements to date

- Establishment of a Knowledge Brokering Hub, comprising of key researchers from JCU and CSIRO and representatives from the four NRM regions in the Wet Tropics Cluster, together with developing our Terms of Reference and agreeing on a co-research framework for the Hub.
- Completion of three meetings of the Brokering Hub.
- Workshop to discuss knowledge gaps and to identify focal issues, drivers and measures for participatory scenarios.
- Completion of a Stakeholder Engagement Plan (living document).
- Completion of our Project M & E Plan in consultation with Clear Horizons.
- Preparation for a Stream 2/NERP TE Workshop (Science to inform climate change planning in north Queensland) to be held on June 4 (Today).
Appendix 4 NERP CF2 – Integrating Science into Regional Planning

Gabriel Crowley

Integrating Science into Regional Planning
NERP Project CF2
Gabriel Crowley & Allan Dale – The Cairns Institute JCU

NATIONAL ENVIRONMENT RESEARCH PROGRAM

SCIENCE TO INFORM ENVIRONMENTAL POLICY
Improving our capacity to understand, manage and conserve Australia’s unique biodiversity and ecosystems through the generation of world-class research and its delivery to Australian environmental decision makers and other stakeholders
NATIONAL ENVIRONMENT RESEARCH PROGRAM

NERP Tropical Ecosystems Hub
GBR, Rainforest, Torres Strait

NERP Northern Australia Hub
Savannas – Terrestrial, Freshwater, Estuaries

NERP Environmental Decisions Hub

NERP Landscapes & Policy Hub

NERP Marine Biodiversity Hub

NERP emerging priorities

<table>
<thead>
<tr>
<th>Theme</th>
<th>Program</th>
<th>No. Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessing Ecosystem Condition and Trend</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Historical and current condition of the Great Barrier Reef</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>Natural Resources of the Torres Strait land and sea</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>Condition and trends of North Queensland rainforests</td>
<td>4</td>
</tr>
<tr>
<td><strong>Understanding Ecosystem Function and Cumulative Pressures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Water quality of the Great Barrier Reef and Torres Strait</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>Cumulative impacts on benthic biodiversity</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>Movements and habitat use by marine apex predators</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>Threats to rainforest health</td>
<td></td>
</tr>
<tr>
<td><strong>Managing for Resilient Tropical Systems</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Effectiveness of spatial management on the Great Barrier Reef</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>Decision support systems for Great Barrier Reef managers</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>Socio-economic value of Great Barrier Reef goods and services</td>
<td>4</td>
</tr>
<tr>
<td>11.</td>
<td>Resilient Torres Strait communities</td>
<td>2</td>
</tr>
<tr>
<td>12.</td>
<td>Managing for resilience in rainforests</td>
<td>4</td>
</tr>
<tr>
<td>13.</td>
<td>e-atlas</td>
<td>1</td>
</tr>
</tbody>
</table>
CF2 - Integrating Science into Regional Planning

- Identify NRM & RDA scientific info needs
- Understand how and when NRM & RDA use scientific info
  - Planning
  - Delivery
- Identify best scales for info delivery
  - NRM region / NRM clusters / Northern Australia / State / National
- Make sure research programs meet NRM planning and delivery needs
Example CC profile

1.1 Monitoring status and trends of coral reefs of the Great Barrier Reef
Project Leader(s)
Dr Hugh Sweatman, Australian Institute of Marine Science

<table>
<thead>
<tr>
<th>NRM Region</th>
<th>TS</th>
<th>CYP</th>
<th>NG</th>
<th>WT</th>
<th>BDT</th>
<th>MV</th>
<th>FB</th>
<th>BM</th>
<th>Terrestrial impacts on marine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental domain</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Mainland</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Islands</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Coastal/inshore marine</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Terrestrial impacts on marine</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Total</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Relevance of project for Climate Change (CC) planning & management
This project will provide baseline condition assessment of the GBR, and analysis of trends and threats. It will provide information on the impacts of climate change factors (coral bleaching, cyclonic damage), and their interaction other stressors (crown-of-thorns).
### PROJECT FOCUS

<table>
<thead>
<tr>
<th></th>
<th>Baseline info</th>
<th>CC impacts</th>
<th>Planning</th>
<th>Management</th>
<th>CC interactions</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climatic &amp; environmental conditions</td>
<td>8</td>
<td>10</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>27</td>
<td>14</td>
<td>7</td>
<td>12</td>
<td>3</td>
<td>34</td>
</tr>
<tr>
<td>Communities &amp; organisational arrangements</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Industries &amp; livelihoods</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td></td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Resource access &amp; cost</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

### KNOWLEDGE SOURCES & SYSTEMS

<table>
<thead>
<tr>
<th>KNOWLEDGE SOURCES &amp; SYSTEMS</th>
<th>NO. PROJECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>KNOWLEDGE SOURCES</td>
<td></td>
</tr>
<tr>
<td>Indigenous knowledge</td>
<td>5</td>
</tr>
<tr>
<td>Other community knowledge &amp; experience (e.g. pastoral)</td>
<td>4</td>
</tr>
<tr>
<td>Science &amp; social science</td>
<td>39</td>
</tr>
<tr>
<td>DATA, RESOURCES &amp; TOOLS</td>
<td></td>
</tr>
<tr>
<td>Bibliographic search &amp; display</td>
<td>3</td>
</tr>
<tr>
<td>Mapping &amp; regional planning</td>
<td>26</td>
</tr>
<tr>
<td>Scenario modelling</td>
<td>8</td>
</tr>
<tr>
<td>Prioritisation</td>
<td>11</td>
</tr>
<tr>
<td>Monitoring &amp; evaluation</td>
<td>15</td>
</tr>
<tr>
<td>SYNTHESIS &amp; ASSESSMENT</td>
<td></td>
</tr>
<tr>
<td>Knowledge synthesis</td>
<td>12</td>
</tr>
<tr>
<td>Availability &amp; access</td>
<td>7</td>
</tr>
<tr>
<td>Adequacy &amp; gap analysis</td>
<td>7</td>
</tr>
</tbody>
</table>