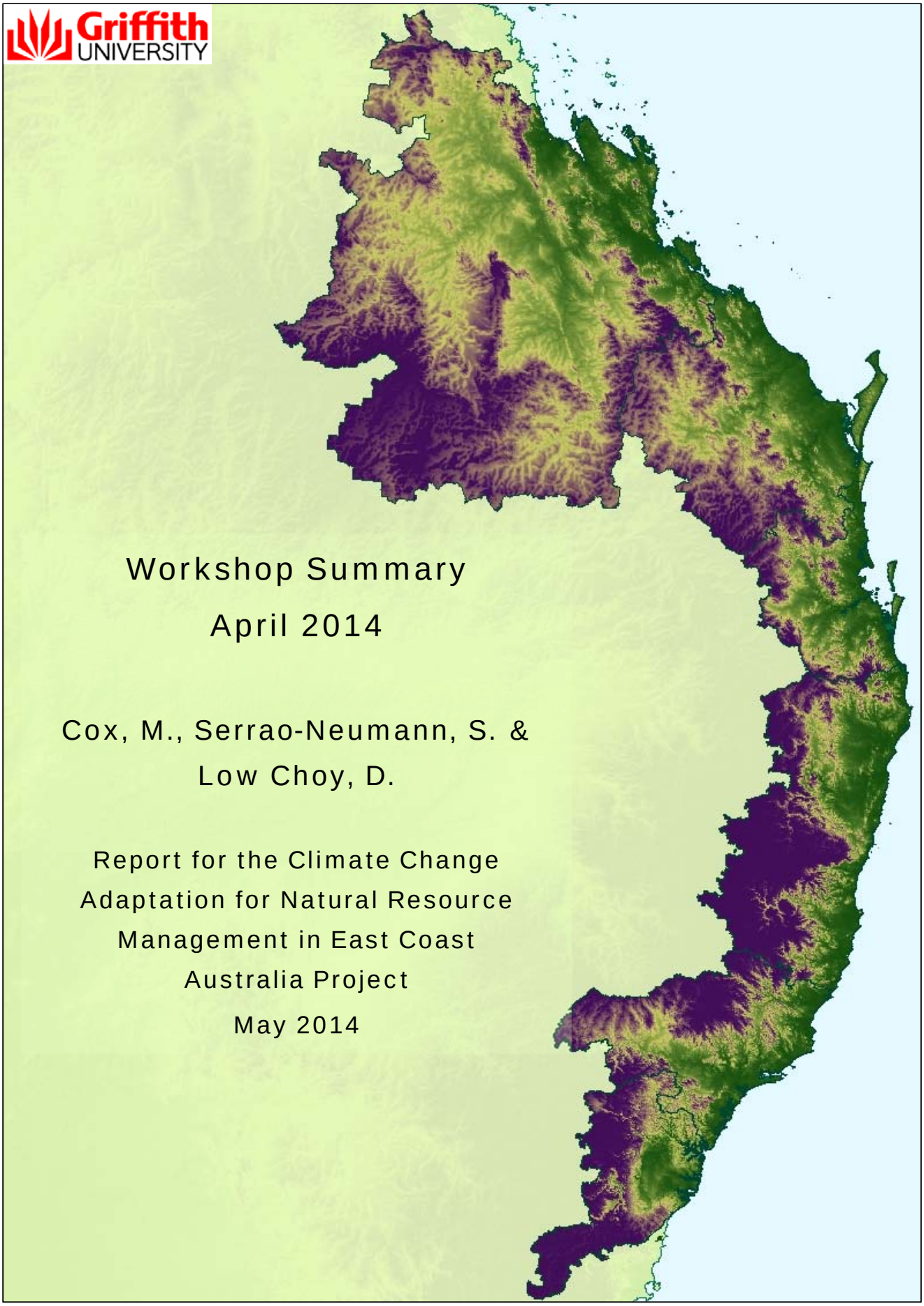

Workshop Summary

April 2014

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Report for the Climate Change Adaptation for Natural Resource Management in East Coast Australia Project

May 2014

This report, *Workshop Summary April 2014,* has been produced as part of the Climate Change Adaptation for Natural Resource Management in East Coast Australia project. The project is being delivered by six consortium partners: University of Queensland (Consortium leader); University of the Sunshine Coast; CSIRO; New South Wales Office of Environment and Heritage; and Queensland Department of Science, IT, Innovation and the Arts (Queensland Herbarium) to foster and support an effective "community of practice" for climate adaptation within the East Coast Cluster regions that will increase the capacity for adaptation to climate and ocean change through enhancements in knowledge and skills, and through the establishment of long term collaborations.

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Summary

This report is a summary of the East Coast Cluster Planners Working Group workshop held in April 2014. The objectives of this report are to:

- provide a summary of the workshop
- provide an opportunity for workshop participants to reflect on the content and processes for the workshop, and share those reflections with other participants
- provide ideas to improve future workshops and the wider project.

This was the third workshop for the Planners Working Group (PWG) for Climate Change Adaptation for Natural Resource Management in East Coast Australia Project. The theme of the workshop was '*A working workshop – developing, testing and progressing projects*'. The objectives for the workshop were to:

- provide updates on research projects
- provide updates on the NRM planning processes and institutional factors
- facilitate input to project development and progress
- facilitate discussion of the use of project outputs in NRM planning
- facilitate sharing and knowledge transfer.

Overall, the workshop was well received and the sessions were seen to be relevant and useful. Key discussion points included:

- The regional update sessions have been well received at each workshop held so far. In future workshops, this session should be held at the start of the workshop, with a longer time allocation, to enable the issues and context to be established for the rest of the workshop.
- The workshop sessions, reports and websites from the projections team are highly relevant to the work of the regional bodies. The information on OEH projects was also valued, although it is not clear to what extent this will be able to be used by Queensland regional bodies. The Integrated Regional Vulnerability Assessments (IRVAs) were of particular interest.
- The regional bodies expressed interest in receiving the first pass assessment of the coastal modelling work as soon as possible, as it would be useful for identifying areas requiring further work in each region. Applicability of the second pass work is dependent on the availability of good quality data, and will therefore be limited to specific areas. Further work to integrate the socio-economic vulnerability assessment being done by USC would be useful.
- The species distribution modelling approach to agricultural species may be useful, but needs to recognise that many other factors affect profitability and therefore sustainability of agricultural activities. From a regional perspective, it would be useful to model more species that are important in each region, and to be able to look at the whole range of species in a region to identify future options.
- The ready reckoner, regrowth benefits tool and common framework for revegetation are useful as they can be modified to be applicable to each region, but still provide commonality and demonstrate the value of regional bodies in complex regional decision making processes.
- There was significant interest in the socio-economic vulnerability assessments, but it would be useful to have information for grazing and tourism sectors. More information is also required to link climate change projections to impacts on specific sectors.
- The integrated assessment reports need further work to improve usability – they need to be focused at a regional scale (not cluster); and further work is required in relation to the audience for the reports and how they will be used. Reports for the first three themes proposed will be useful, but the other themes need further clarification. The reports should be aimed at supporting investment in climate change adaptation activities, and mainstreaming climate change adaptation.

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- The website under development for Stream 2 is potentially useful for sharing information with other clusters, which is a clear need. The Terranova website is also potentially useful for storing information longer term, as long as there is some quality assurance for material uploaded, and useful key words and tags (metadata) are included.
- The mismatch in timing between streams 1 and 2, and the lack of funds for regional bodies to continue planning work after June, is likely to significantly impact on the ability of the regional body planners to continue to participate in stream 2 activities, and to best incorporate information into planning responses.
- Taking the information back into the rest of the NRM organisation is important, and there is a need to develop internal processes to do this – a project officer is a good way to do this when funding is available.
- Mainstreaming climate change adaptation into the rest of the NRM organisation is essential; a good understanding of how the information relates to the work of the organisation is required.
- Processes that can help facilitate use of the information include providing a complete list of expected outputs and timing of delivery, and identifying the relevant people who might use the information, actions that might flow, and potential projects to be developed.
- The PWG and stream 2 activities have been very useful in terms of building networks and sharing information, and all involved are keen to continue. However, the limited availability of funds to the regional bodies after June, and the possible lack of a funded planning position, may limit attendance at future events.
- The process also provides a really good opportunity for knowledge sharing, as everyone is doing similar things at the same time, and more thought needs to be given to maximising the outcomes from this. It would be good to know more about what the other clusters are doing.

Actions to be progressed before the next PWG workshop include:

- There are opportunities for regional NRM bodies to contribute to the development of the Queensland state adaptation framework.
- Further discussions are required to scope the second phase of more detailed socio-economic vulnerability assessments.
- Melanie and Chris to trial adding reports to the Terranova website.
- Chris to circulate cluster branding and templates when available.
- Investigate possibilities for adding the socio-economic vulnerability assessment to the coastal vulnerability assessments.
- One page summaries need to be finalised and branded, with clear outputs and dates.
- A summary of outputs (directory/framework/table) and how they link together would be useful to enable planners to prepare for using the information in the next stage of planning.
- Logos of each of the partners to be circulated for use on presentations etc. (to provide credibility for information used).
- A Project Reference Group meeting with the new GMs soon to be held soon to regain support for climate change adaptation in the NRM plans.

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1 Introduction

1.1 Workshop overview

This report is a summary and discussion of the Planners Working Group workshop held on the 29-30 April 2014. This was the third workshop for the Planners Working Group (PWG) Climate Change Adaptation for Natural Resource Management in East Coast Australia Project. The theme of the workshop was '*A working workshop – developing, testing and progressing projects*'. The agenda for the workshop is provided in Appendix A and organisations attending listed in ***.

1.2 Workshop objectives

The objectives for the workshop were to:

- provide updates on research projects
- provide updates on the NRM planning processes and institutional factors
- facilitate input to project development and progress
- facilitate discussion of the use of project outputs in NRM planning
- facilitate sharing and knowledge transfer.

The evaluation criteria for meeting these objectives were:

- Participants have a greater understanding of research objectives and outputs after the workshop.
- Participants have a greater understanding of regional NRM planning and needs in relation to research outputs.
- Participants have sufficient opportunity to provide input to projects.
- Participants have a greater understanding of how project outputs may be used in NRM planning.
- Participants feel they have had useful discussions or gained useful information.

1.3 Workshop process

The workshop was structured around the various research projects that comprise the East Coast Cluster research program. The full agenda is provided in Appendix A. Most of the sessions in the workshop ran as a presentation followed by a directed discussion, where the discussion focussed around the following key questions:

- How might you use the outputs from this project in your planning / implementation?
- How should the outputs / results be presented / made available to facilitate use in planning?
- What else would need to happen for you to make best use of these results in planning?

1.4 Purpose and structure of this document

The objectives of this workshop report are to:

- provide a summary of the workshop
- provide an opportunity for workshop participants to reflect on the content and processes for the workshop, and share those reflections with other participants
- provide ideas to improve future workshops and the wider project.

This report provides a summary of discussions for each of these topics, the session evaluation and suggested next steps. The summary provides a reflection on the workshop process and overall next steps for the research program.

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2 Regional body update

2.1 Description

Provide an update on regional body processes and progress in relation to incorporating climate change adaptation in NRM planning.

2.2 Objectives

- Improve understanding of current NRM planning processes and needs.

2.3 Discussion

SEQ Catchments

- Expert panels have been run to look at what has happened since the last plan (2009). Overall there have mostly been losses in natural assets. Experts have looked at why that is occurring, and what might happen in the next 100 years, and what will happen to the targets. We are not looking to change the targets.
- Community consultation during March-April was undertaken through community round tables throughout the region. These were aimed at existing networks to bounce the idea of natural assets / wellbeing approach to NRM and there were conversations about using an anthropocentric rather than nature conservation approach. The round tables were well received, particularly by local government, with lots of councillors and a few mayors attending. There weren't many representatives from state government at the round tables, but were at the expert panels. We are working through the Department of Infrastructure and Planning, linking with the single State Planning Policy and using the jargon from state plans e.g. the 4 pillar economy. The state government statutory regional planning process is now looking out to 2041.
- Main results from the round table in terms of priorities were pests and weeds; the new (statutory) regional plan and local government planning; fauna and corridors (maintain vegetation and linkages); land use change and development (these are likely to have bigger impacts than climate change in the immediate future), but keeping in mind climate change impacts; creeks and habitat. Few people raised carbon farming.
- About to move into wider public consultation, including online through the engagement HQ tool (now launched). This will include review of information and priorities identified from the round tables.
- As we had no spatial products for climate change, USC were commissioned to undertake a SimClim projection for temperature, rainfall and extreme projections – the extremes were quite useful.
- Final plan due in end of June / July. Funding (i.e. for Andrew's position) will also finish end of June.
- Currently working on implementation plans – 10 plans; one for each local government area (key administrative boundaries rather than catchment boundaries). These will focus on priority areas where we haven't done very well so far.

Burnett Mary Regional Group

- Regional NRM planning has a troubled history in the region with the recent state government led NRM plan not supported by the new incoming government. Recent extreme events (flooding) have opened up conversations with the community and stakeholders. The approach for the review is a whole NRM plan review with targets, monitoring and evaluation (M&E) strategy, and regional investment strategy. The review is based on work from 2011 on targets, M&E and actions – so we already have a base or draft to use. The focus of engagement is on adaptation and climate change.
- Currently still in science synthesis phase – we have delayed finalising this phase to allow for as much information as possible (e.g. from stream 2) to be included. Meetings of the internal technical panels will be held in the next fortnight to finalise the report on biophysical assets and the socio-economic community capacity assessment. Will look at these reports and the targets and finalise in May/June.
- Undertaking a vulnerability assessment through Natural Solutions in June (they are also doing vulnerability work for Victorian regional bodies). In this approach, people are not viewed as assets, but as either enabler or impacter – i.e. looking at the community capacity to influence natural asset.

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- A climate summit will be held on 3 July – presenting completed research; another summit may be held next year for research from stream 2. This has been jointly funded with the carbon farming project. It is aimed at broad community and decision makers - CEOs, mayors, regional coordination people from state government. Scenario planning for local government will be held in August – e.g. looking at sub-catchment demographics, regional economic committee, landscape and climate scenarios that the region might face – i.e. where local government business lies.
- Also developing a community capacity ready reckoner for actions developed through the biophysical assessment; undertaking action prioritisation exercise to look at political acceptability.
- In terms of community engagement, need to take a different approach as people are planned out. Recently undertaken community engagement survey and interviews with 60 people, which also included some specific climate change questions. Climate change was acknowledged as a big priority with a 60% hit rate as a concern against other impacts. A variety of responses were recorded during the survey – even people who did not believe that climate change was occurring were responding to changes in climate variability – e.g. discussion in terms of the land not bouncing back in terms of productive capacity.
- The planning framework will be completed by June. Rachel will continue in the role for at least 1.5 years; a final document will be produced in October 2015.

Fitzroy Basin Association

- Have completed science synthesis process and documentation, and undertaken initial consultations and community survey.
- The current focus is on targeted individual consultations with regional leaders (about 20-30 key sectoral representatives).
- The plan structure (of the paper version) and drafting will be done for the June deadline.
- Are undertaking early scoping of the plan as a website – likely to include a database of plan strategies and activities, libraries of maps and conceptual models, interactive spatial multi-criteria DSS (MCAS-S).
- Preparation of communication products for community consultation will be from September.
- Rachel's role will largely finish at the end of June. Elyse Riethmuller, FBA's business manager will remain primary contact point for FBA for their planning and stream 2 projects.

North Coast LLS

- The LLS are required to develop new strategic local plans by Christmas to feed into the strategic state plan; this is a very short planning timeframe and there is no possible negotiation on the deadline. The plan will need to look at CAPs, biosecurity, emergency response plans, and delivery of agricultural extension advice; as well as how to bring these together.
- The three East Coast LLS have combined to re-scope a project plan for their stream 1 project, and are in the process of engaging a contractor. The person will use MCAS-S and consult with the community and stakeholders to look for sequestration opportunities, and look at OEH projection data and impact assessment work. This will be a common framework for the three regions – looking at a larger scale than if we had all worked separately. Hoping to start this project in the next fortnight; there are some deadlines for this financial year to report to the federal government on the baseline mapping. The next report is due in August and the contract will finish at the end of next financial year. Have money from stream 1 that cannot be carried over and must be spent in the next couple of months – have a set agenda and tight project plan for the contractor. There are big challenges – e.g. dealing with the development of the local strategic plans and keeping involved with stream 2 information and aligning these.
- Also putting on a climate change officer to engage with this cluster, as Graeme will become more focused on the strategic plan development. Have good interactions with OEH about how this will plug in.

Hunter LLS

- One of the conditions on the approval of the CAP was to develop an implementation plan, and have been working over the last few months on a prioritisation process to develop a list of priority strategies. Have had

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interviews with key stakeholders on priorities. Have been identifying plans that feed into the 4 pillars of LLS (NRM, biosecurity, agricultural extension and emergency management), and looking at the alignment of strategies and objectives, and how these can feed into the new strategic plan. There is also a statewide working group looking at the framework for local plans.

- Have appointed a contractor to do vulnerability assessment (AECOM), project until the end of next financial year. This will include both natural resource and socio-economic vulnerability and will be in line with the Integrated Regional Vulnerability Assessments (IRVA). Need to start this financial year; the first stage is a desktop assessment, especially for priority asses. Will also look at scenario planning, especially with emergency management e.g. flood preparedness. The region has just come through drought, and some areas are still in drought.

Greater Sydney LLS

- Have recently gone through the IRVA process and this has provided advantages – it was a very interesting process and will inform adaptation part of planning. Also doing additional vulnerability work with Institute of Sustainable Futures - vulnerability assessment community workshops, to complement the work done through the IRVA.
- The institutional change to LLS has made it difficult to proceed against the project plan, and in December had to report only $30K spent against a $300K budget. Will still have unspent money in June, and cannot carry this over. Have been advised that the federal government will take back any uncommitted funds. Not sure about resourcing if the money disappears.
- CSIRO is coming to present at a workshop for key stakeholders – including 43 local governments in the new region. Relationship with local government is positive – Michelle has started a desktop assessment of what local governments are doing in the region. Found that when talk about climate change adaptation, get different responses from different people – could be about cost reduction for routine operations (e.g. energy efficiency), biodiversity, community public health, etc. There is a need to tighten terminology, or broaden the approach to include mitigation and other aspects of climate change. Local governments have been keen to get involved. Currently there is no common place in the region to find out what is happening in local government on climate change, and interaction between councils is dependent on individual personalities as there is no regional group. Have undertaken a desktop assessment of what has been done so far, and are keen to establish a network in the region. Also looking for opportunities to enhance climate change adaptation programs, especially for native vegetation. Sydney coastal councils have started a parallel process a few months ago, and will be working with them. Work with clusters of councils can look at groups likely to face the same impacts.
- Don't know where climate change work will sit in relation to the new planning process – it was to be appended to the CAP, but now are not sure. Might stay on its own. Will get useful information from the joint contract.
- The institutional context has changed so much just over the last year, on the back of more change.

2.4 Next steps

Regional bodies are keen to continue involvement in the stream 2 work, but funding constraints and potential loss of staff mean that involvement in subsequent workshops may not be possible.

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2.5 Evaluation

Regional body update	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
This session was useful and relevant				**3**	**4**
I have a better understanding of where the (other) regional bodies are up to				**3**	**5**
Comments					
Good to keep in touch.					

2.6 Conclusions and next steps

The regional update sessions have been well received at each workshop held so far. Assuming representatives are able to attend future workshops, this session should be held at the start of the workshop, with a longer time allocation, to enable the issues and context to be established for the rest of the workshop.

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3 Climate projections and modelling consistency

3.1 Description

Discussion of the regional projection summary reports and information available through the climate futures portal, and how this might be used in NRM planning and research projects.

3.2 Objectives

- Discuss any outstanding comments or issues from the regional projection reports.
- Discuss how the regional projections might be used in projects / planning.
- Discuss uses of climate change modelling and whether there is a need for consistency.

3.3 Presentation

The presentation slides are available in Appendix B.

- CSIRO and BOM have prepared and released draft regional projection reports for comment. Two website outputs have also been developed – the map explorer and the climate analogues site.
- Web tools are currently being tested and will be available after July. Reports will be available after July 2014 (exact timing dependent on organisational approvals).
- The Regional projection report – the executive summary brings together key messages from the report; it is still in technical language, but will give an understanding of the key messages and confidence in changes. It should support narrative formation in regions. The full report provides more detail and explanation as to how the available evidence has been used to reach conclusions.
- The models provide a reasonable representation of regional variability and seasonality. Model evaluation looked at a range of factors in detail. Even in the low case (RCP2.5), the climate is predicted to be warmer than in the past by about 1 degree. More extreme temperatures will occur under RCP4.5 – about 3-5 degrees of warming. The increase in temperature applies to maximum temperatures as well as the mean – e.g. if you look at the hottest day of the year, that will be 3-5 degrees hotter.
- The report has information for specific sites; comments were received to provide more of these examples. More can be provided to some extent in the report (at least Sydney), but the website will provide additional information.
- This report has reduced confidence in changes in rainfall for the ECC (compared with the interim regional statements), as a result of looking at additional information including some downscaling results. Spring rainfall changes are not well understood.
- Solar radiation changes follow temperature. Soil moisture and runoff are predicted with a very simple model and follow rainfall changes, but can't be predicted with any confidence due to uncertainty around rainfall.
- Climate futures website is designed to help users choose models.
- The climate analogues include some assumptions that need to be considered – this part of the site is useful as an illustration but not to be used by itself – also require more detailed projections of future change. Comment that it would also be useful to run it the other way around – where do I need to move to, to get the same climate that (e.g.) Brisbane has now? Also – if there is a threshold (for a particular impact), under what RCPs and what time scale would this threshold be crossed?

3.4 Discussion

- Why is relative humidity going down? – due to the difference between total moisture in the atmosphere and relative humidity. Relative humidity is a % of the saturation level in the atmosphere at a point in time, and is what we feel. Absolute humidity is more important for rainfall intensity. A warmer atmosphere will hold more moisture overall, and there will be an overall increase in atmospheric moisture. Model results show a decrease in relative humidity, particularly further away from the coast – this is not as strongly evident in the ECC as it is further inland.

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- Question on the change in rainfall confidence between the interim statements and this report. FBA commented that their science synthesis was based on a high confidence in future drying, and they are now writing the draft plan by June based on inconsistent evidence that is not publicly available. Keen to see a second draft of the interim statements / brochures that can be used internally as now have 2 conflicting documents.
- The interim statements provided the best information at the time. Probably the only significant change in the scientific understanding was the reduced confidence in spring rainfall changes, as they were not confident about the GCM results after looking at the downscaled results. Information in the regional report is more robust than information in the interim statements. Other sources such as the IPCC use a very broad brush and point towards drying for most of Australia, but the ECC is not typical of Australia in many respects and users should be wary of putting too much weight on broad Australian assessments.
- The final brochures will reflect the regional reports, not the interim statements. The style of presentation may change, and detailed numbers may have changed slightly, but there should be no overall change in the key messages.
- The dashboards have been available for comment, now closed – are trying to continue development of the websites while making the beta version available for people to look at.
- Fire danger information – Chris Lucas is doing calculations for that purpose. Intention is to show information for recent times and projections into the future.
- The website map explorer will contain all the features from OzClim. Will be available from 1st July with final data. There will be some resources available in CSIRO after July to provide support and answer specific data requests. The website will also have additional information on choosing GCMs through the climate futures approach, and contextual information about where a particular model sits in relation to the range of other models.
- Potential uses for the information include BMRG using the information to develop 3-4 climate scenarios for stakeholder engagement and to estimate impacts on assets in the science synthesis; SEQC need information in a format that can be used with tools already in use – e.g. using the narrative and quantitative information in tandem, using information to dig further into impacts on the identified important landscape areas; Northern Rivers qualitative information provides context and justification, need this for backup for questions about confidence etc. – the regional report provides a one-stop shop for all these questions. Need to keep using reports and numbers together.
- The report includes a key table at the end of the report (Appendix Table 1A in the report) – this has numerical information that can be applied to any point within the region – the information is relevant to all sites.
- Maps for download will contain spatial variation, but this can be quite different across models – so even though there are tools that show variation across the region, there may not be a certain basis for that variation.
- The website will only make available detailed time series data for a limited number of models and for selected locations, due to the volume of work involved. Data will be available to registered users – some for immediate download, and some on request due to large file sizes (e.g. daily datasets).
- In general, the narrative descriptions available now are useful on a strategic level, but more detailed work may be used in different applications later.
- Working on a brochure that summarises the tools and when they will be available.

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3.5 Feedback and evaluation

Climate projections and modelling consistency	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The project described is relevant to NRM planning				2	6
I will be able to use the results of the project			1		7
The workshop session improved my understanding of the project			2	3	3
I have a better understanding of how I might use the outputs from this project through attending this session			2	3	3
This session was useful and relevant				4	4

Comments	
Opportunities to use results from this project.	I have not yet had the chance to read report in depth so it was hard to relate to some of the info discussed. Penny's stuff very relevant! Highly relevant to my climate change modelling.
Barriers to using results from this project.	Some good tools.

3.6 Related documents

Climate change projections user guide:
www.australianclimatefutures.net.au/climate_futures_dap/alpha/documents/Climate_Futures_UserGuide.pdf

Draft Regional Report:

https://www.dropbox.com/s/wo5j7o2nri03acn/NRMRegReport_EC_DRAFT_FOR_CONSULTATION_ECCall.docx

Access to the web portals for testing and comments can be arranged by contacting Chris Gerbing, CSIRO.

3.7 Conclusions and next steps

The projections sessions in each workshop have been useful. The regional reports and websites are also highly relevant and useful. Some support will likely be required to use the reports and website after June.

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4 NarClim and adaptation from NSW

4.1 Description

The NSW Office of Environment and Heritage (OEH) is undertaking a range of adaptation research projects, including NarClim, Eastern Seaboard Climate Change Initiative (ESCCI), ClimDDir, Integrated Regional Vulnerability Assessments(IRVA) and Research Hubs.

4.2 Objectives

- Provide information on the NarClim, regional vulnerability assessments, research hubs projects and outputs – particularly for Queensland regional bodies.
- Facilitate discussion around use of the project outputs.

4.3 Discussion

The presentation slides are available in Appendix D. Discussion included:

- The climate information portal is being built; it is based on the California adaptation portal. The NSW government is committed to releasing the climate change adaptation information by December. Some testing will occur with users in October, and regional bodies may be able to access some data through a licence then – would need to know specifically what data to extract. The new ministerial arrangements are promising for climate change adaptation work.
- NarClim downscaling has focused on one emission scenario (A2); decided there was little value in providing multiple scenarios as there is not much difference in the near term, and limited ability to change the current emission course in the short term.
- The NarClim downscaling covers most of the East Coast Cluster (as well as all of the Central Slopes and all of Victoria). Only the NSW data will be on the website, but the other information is available on request. The downscaling uses a 10km resolution.
- OEH have spent a lot of time talking to users about how they use climate data. About 80% are spatial users, and need maps or graphics and narratives.
- ESCCI will provide summary information in November, which will also be available on the portal. The Matches tool is available now (through BOM, for registered users).
- The IRVAs are not just a desktop exercise, but include all government stakeholders (local and state), across all sectors. Look at how climate change will affect vulnerability and how they do their jobs – the focus is on government service provision. The process identifies and prioritises vulnerability and regional responses and projects.
- The Sydney IRVA used a climate scenario from NarClim and downscaled to 2km, with a series of biophysical impacts. Department of Planning and Infrastructure provided population projections including socio-economic profile and land use changes and growth patterns. The process looks at a particular sector in each workshop (e.g. human services) and asks (for example) how is climate and population change going to affect how you do your job; how are we vulnerable; and what can we do about it. Looks at particular impacts and traces the flow-on effects. It also prioritises adaptive capacity indicators for each sector, and identifies what needs and change and how.
- For each region, looked at specific sectors (5 in Sydney; 6 in North Coast). Tried to get asset managers, strategic planners, community services directors involved – to ensure the results are mainstreamed (i.e. not limited to the climate change or sustainability officer). A final integration workshop is then held to look at cross sectoral vulnerabilities and validate results, and generate cross sectoral projects. The process is about a large group of people building common understanding for common and integrated action going forward. So far IRVAs have been done for the South East, Riverine, Murray and Sydney; North Coast is underway. Hunter will probably be next, then New England and Central West.

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- The NSW adaptation research hubs were established to facilitate research projects that were being hampered by the end of financial year cut-off for funding – it was difficult to maintain projects and employ staff for 3 years. $2.75 million over 3 years has been put into the research sector, all matched by the hub nodes to leverage more funding from other sources, totalling about $6 million over time. The model gives 3 years of funding certainty and provides leverage for further funds. Impacts and adaptation overarches the three nodes, and the hubs talk to each other, and government staff are placed in each node for transfer of knowledge.
- It is difficult to know how NarClim products might be used in Queensland – Fitzroy is difficult due to the northern part being cut-off; SEQ has commissioned work with SimClim as the NarClim results and the national projections will not be available in time for this review.
- NSW are interested in using the impacts components once available.
- The IRVA process worked really well – the focus just on government was refreshing, and from a stakeholder perspective it was good to have the state government running the workshops. The process included a range of stakeholders, but also provided some integration across scales – the circle diagram was good. The final integration workshop was successful and attracted large attendance – having a list of projects as a result is a really good outcome (not done originally in South East, but caused problems; tried it in Sydney and had a bidding war for projects). The trick is getting all the key people in the room at one time – it is a relatively cheap way of generating common and integrated actions.
- In terms of applying IRVA processes in Queensland, the context is lacking at the moment as there is no drive, interest or motivation in state government for this type of work. BMRG had some early discussions, but there was no interest from other sectors. They are pursuing it for the NRM sector, with integration at the sub-catchment level – hoping to start, but it really needs the state to drive it and there needs to be appetite for it.
- Planning is always about adaptive management and continuously getting new information; there is no situation in which you know everything, and there is always something new coming up. There is a need to make sure that internal processes can cope with this new information – looking at plans as living documents that can be updated based on the latest available information. At the moment we have the luxury of a project officer to look at how to integrate information, e.g. look at planning for scenarios (droughts, floods etc). So far we have captured current knowledge, but there is a challenge to integrate the information that will be coming in the next 6, 12, 18 months. There are always questions about uncertainty and new emerging trends (e.g. changing funding opportunities).
- An important part of this is taking the information back to the rest of the organisation – this has not necessarily been a priority so far, as will not necessarily use the information in planning until all the 'meat' is available. To do this, need to think about how the information will relate to the rest of the organisation's work. For NSW, this means thinking about the new context and language (the 4 pillars). The key is the planning 'event' coming up (development of local strategic plans) – focused on collecting information and tools to communicate with the General Manager and relating to priorities. Can spend years learning how the network gets information together, but the process gets lost after people leave – the learning process is stronger for the person that writes the process/plan.
- There is an opportunity for this project to get ahead and prepare for the next step. Can conceptualise it as pre-planning for implementation – i.e. identifying up front the information, actions, people, projects, and have this ready for the next stage. The detailed information will be used for implementation or action planning. The key is having the information at the right time, and using it wisely.
- In terms of this preparation, a key is knowing what information and products are coming and when, and how they all fit together – e.g. conceptual maps / matrices of projects and outputs, how to access the information, and how to bring the information back to the NRM organisation and the wider stakeholders.
- For example, a list of NarClim products is still coming – still being decided what is most important.

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4.4 Feedback and evaluation

NarClim and adaptation from NSW	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The project described is relevant to NRM planning				2	6
I will be able to use the results of the project			2	3	3
The workshop session improved my understanding of the project			1	4	3
I have a better understanding of how I might use the outputs from this project through attending this session			1	5	2
This session was useful and relevant				5	3

Comments	
Opportunities to use results from this project.	I will have to look into it more when it becomes available – difficult to determine where it can be tied in. Need more info on the actual products that will be available.
Barriers to using results from this project.	Very familiar with this stuff. All good.
Suggested further work.	Already well briefed on this project – will be used in our spatial project, especially the impacts research.
Other comments.	GSLLS will find this very useful in working with coastal / estuarine councils which represent a significant percentage of councils. They don't all have this type of information. Timing with SEQ NRM Plan process.

4.5 Conclusions and next steps

The IRVA process was very useful; important factors were that it was driven by the state, included all relevant people from several sectors, and included development of integrated projects as an output.

Planning is always about being adaptive as there is always new information becoming available. There is a need for clear internal processes that can deal with this – e.g. a project officer can provide integration.

Taking information back into the organisation is important – to do this, need to understand how the information relates to the work of the rest of the organisation.

Forward planning to incorporate incoming information into implementation includes knowing what outputs are likely to be provided and when, the actions that might flow from that, the relevant people who will use it, and potential projects.

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5 Queensland state adaptation framework

5.1 Description

The Queensland Government has begun the very early stages of development of a state adaptation framework.

5.2 Objectives

- Provide information on the Queensland state adaptation framework and processes for input.

5.3 Discussion

- A ministerial decision was made to develop a Queensland State Adaptation Plan; has premier's support.
- There is no clear direction for the strategy at this stage – were originally going to link to the local government resilience road map, but this is moving in a different direction now.
- The focus at the moment is on getting the discussion started and seeking input. Looking for cost effective initiatives and partnerships with other organisations and industry. Keen to have a regional / local focus. Community consultation phase is coming, and the state is looking to partner with other organisations that can lead the consultation.
- The project has no funding at this stage, and less than 2 people working on it (2 people but also focused on the ERF and opportunities including co-benefits). No timeframes have been agreed to – there is a perspective that something in draft form should be produced before the next election, but there has been no commitment to that as yet. The Queensland Plan is being legislated – looking for hooks in there.
- The next Queensland regional planners meeting is in May in Cairns; could be a useful forum to start conversations. Need to involve the Regional Groups Collective. FBA is looking for interest in doing regional adaptation planning.
- Also working with LGAQ. Coastal communities adaptation planning, and there is additional NCCARF funding around coasts and local government , but the state plan needs to be broader than just the coast.
- Hunter found that their communities were over consulted, and a steering committee was important to bring in the results from other consultations.

5.4 Feedback and evaluation

Queensland state adaptation framework	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
This session was useful and relevant	**1**		**2**	**3**	**2**
The session improved my understanding of this project	**1**		**3**	**2**	**2**
I will be able to use the results of this project	**1**	**2**	**1**	**3**	**1**
Comments					
Not a lot of info available – but very interesting anyway. Useful to hear about how other states are dealing with issue. It was useful to see the lack of resourcing for this framework. Vague, nothing positive or structured reported. Regional bodies need to work with EHP to include current work on NRM Plan update. Very difficult to comment on, without the detail.					

5.5 Conclusions and next steps

There are opportunities for regional NRM bodies to contribute to the development of the state adaptation framework.

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6 Coastal vulnerability

6.1 Description

This project will apply a framework for undertaking coastal landform risk assessment to climate change, with particular focus on coastal floodplains, wetlands and estuaries. This approach will be validated in a catchment in the region under a range of future climate change scenarios, with particular emphasis placed on the effects of sea-level rise on inundation and erosion within the coastal zone.

6.2 Objectives

- Provide updates on coastal modelling project
- Facilitate discussion of the use of project outputs in NRM planning

6.3 Discussion

The presentation slides are available in Appendix E. The presentation focused on the first and second pass assessments and how they are derived.

- The first pass assessment will be available through a report and data layers, and may be able to be done for the whole region, depending on data availability for Queensland. The first pass assessment is useful for prioritising areas for further work.
- A second pass assessment may be possible for the Hunter, north coast, Tweed, and Moreton Bay (depending on data availability). A second pass assessment requires good quality detailed data.
- The vulnerability assessment may be able to be integrated with a socio-economic vulnerability assessment, but the household census data does not overlay very well. Land use information is also useful – e.g. NSW Department of Planning have done some population projections that are useful.

6.4 Feedback and evaluation

Coastal modelling	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
The project described is relevant to NRM planning				1	7
I will be able to use the results of the project		1		3	4
The workshop session improved my understanding of the project				3	5
I have a better understanding of how I might use the outputs from this project through attending this session			1	2	5
This session was useful and relevant				3	5

Comments	
Opportunities to use results from this project.	Depending on the scale of the products – is something where second pass work would be great across board.
Barriers to using results from this project.	Kerrylee's stuff is very relevant. We will no doubt use her findings and approach.
Suggested further work.	Extremely useful as a significant percentage of Sydney and the regional coastal zones will be impacted and a wide variety of coastal landforms are involved.
Other comments.	Need SEQ ASAP please.
	Was useful to see how the models are being applied to natural assets.

6.5 Conclusions and next steps

The regional bodies expressed interest in receiving the first pass work as soon as possible, and indicated that this would be useful for identifying areas requiring further work in each region. Applicability of the second pass work is dependent on the availability of good quality data, and will therefore be limited to specific areas. Further work with USC on possible methods to integrate the socio-economic vulnerability would be useful.

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7 Cereal modelling

7.1 Description

We will develop models of the probability of agricultural production (cereals and avocados at this stage) occurring under a range of future climate scenarios. Maxent is a species distribution modelling (SDM) program that estimates the relationship between the presence of the species/plant of interest at a site and the environmental and/or spatial characteristics (covariates) of those sites. Maxent is widely used for many purposes in biogeography, conservation biology and ecology and only more recently in agricultural applications.

7.2 Objectives

- Provide updates on agricultural modelling project
- Facilitate discussion of the use of project outputs in NRM planning
- Facilitate sharing and knowledge transfer.

7.3 Discussion

The presentation slides are available in Appendix F. The presentation focused on the application of Maxent species distribution modelling to cereal crops in the Fitzroy Basin. Next modelling will be done for avocados – present throughout most of the cluster and have had discussions with avocado grower organisation.

- Initial modelling has been run on the A1F1 projection from the CMIP3 set of models – this is very similar to RCP 8.5 from the CMIP 5 models. This was chosen as data indicate this is the emissions trajectory we are currently on. In terms of climate futures, will run on hot/dry and less warming/wetter futures to compare.
- Cereals chosen as they are vulnerable to climate change impacts as they are not irrigated and are susceptible to hot temperatures.
- Major question for crops is will climate change be a significant impact? – other factors such as market demand, availability of transport, proximity to markets etc will also still exist and may have greater impacts. (For example, currently in central Queensland the coal mines have taken over the railways and farmers can't get their crops on trains). Also, many crops are water dependent – would need to look at water availability under climate change as well as competition for water with other sectors.
- Would be good to do an analysis for grazing – but use a variety of pasture species, so may need to look at specific grass species. Might also be possible to look at it from the other direction – what is the most viable future pasture, or what is the next best pasture. Grazing is a major land use but a very loose industry with no peak body. It is the biggest industry by size, but the most marginal in terms of production.
- This may be useful to identify areas for revegetation (i.e. areas that will not be viable for agriculture) – but would also need to look at other potential crops. Might be best to link with marginal grazing land.
- Need to consider the variety of industries operating in the region, and may need to do an analysis across these, for example to answer the question – what can I do next when this crop becomes unviable.
- Lucerne is an important crop in some areas (Hunter) – it is irrigated with water from tidal areas – would be interesting to look at the effects of sea level rise on the extension of tidal influence further upstream, and the effects on that on water quality for irrigation.
- Sydney – no broadscale cropping, but a large proportion of produce grown there through intensive horticulture and market gardens. Growing is very water dependent – looking at water reuse.
- This could be useful to inform landscape scenarios.

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7.4 Feedback and evaluation

Cereal modelling	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The project described is relevant to NRM planning				3	4
I will be able to use the results of the project		1	1	3	2
The session improved my understanding of the project			1	3	3
I have a better understanding of how I might use the outputs from this project through attending this session			2	2	3
This session was useful and relevant				4	3

Comments	
Opportunities to use results from this project.	Would love more work in the pasture/grazing areas. This project needs to focus on more productive land uses at a finer scale. Our area is highly urbanised so cropping is not a major land use.
Barriers to using results from this project.	A really clear example. That would be useful for those still not clear on (or accepting of) the impacts to production.
Suggested further work.	Tomatoes and lettuce please (SEQ). Would be good to look at grazing. Meat and livestock Australia may be able to help or looking at particular pasture species that support grazing.
Other comments.	

7.5 Conclusions and next steps

The approach is seen to be useful, but usability also depends on other factors – e.g. importance of climate change impacts in relation to other factors affecting productivity and profit. Water dependence is also an important issue for some species.

Would be good to model more species, and to be able to look at the full range of species in a region.

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8 The three Rs: Regrowth Benefits tool, Ready Reckoner, Common framework for Revegetation

8.1 Description

Three related tools being developed: the regrowth benefits tool (ECC), Ready Reckoner (Burdekin Dry Tropics) and common framework (ECC).

8.2 Objectives

- Provide summary and update on regrowth benefits tool, ready reckoner and common framework for revegetation.
- Develop understanding of needs and uses of the three tools
- Provide feedback on the three tools for further development

8.3 Discussion

Presentations are provided Appendix G. Discussion included:

- The regrowth benefits tool would be useful for implementation with MCAS-S – e.g. including a slide control for inputs (e.g. opportunity costs) to see changes.
- The carbon data is available on licence from the federal government (Don can provide contact details).
- The rules for the carbon market are changing – e.g. the criteria for permanence may be reduced to 25 years but with fewer credits.
- Under Direct Action as currently described funds will be allocated based only on least cost across the whole economy – there is no interest in any other benefits, and no allocation for particular industries. There will be one crediting period; additionally is required but with a different definition. Emissions reduction for industry will also be based on intensity (rather than total emissions) – i.e. if fewer emissions are produced per widget industry will still get bankable credits even if total emissions increase.
- These changes mean the land sector will likely be a very small component. The main aim is therefore to get information and methodologies ready to go for use under future more favourable policies.
- The ready reckoner is a good decision making tool – it demonstrates complexity to the stakeholders. Adaptability to different uses is critical. Potentially has lots of benefits other than supporting specific decisions through demonstrating complexity and processes of decision making.
- Expect it to be similar to how the ABCD land condition framework worked – the framework changed over time and across regions, but there was common language and value in demonstrating the role of the regional bodies in science base while engaging farmers. This got investment from Reef Rescue, Reef regulations and was a trigger in revising reef plan. It is good to keep thinking about how tools might get picked up in a policy environment.
- The tools need to work at different scales – e.g. government regulators, national funding, regional NRM – how do all these complement and work together with the farmer at paddock scale. Need a common language.

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8.4 Feedback and evaluation

The three Rs	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The project described is relevant to NRM planning				1	4
I will be able to use the results of the project			1	2	2
The session improved my understanding of the project				1	4
I have a better understanding of how I might use the outputs from this project through attending this session			1	1	3
This session was useful and relevant				1	4

Comments	
Opportunities to use results from this project. Barriers to using results from this project. Suggested further work.	Still need to see detail of ready reckoner to gauge usability. Will integrate this work into our workplace very useful and relevant session! SEQ has other factors to consider in terms of opportunity costs e.g. lifestylers managing key areas of the landscape who are more flexible in terms of economic return.

8.5 Conclusions and next steps

This could be a very useful tool, as it is able to be modified for specific regions, but also as it provides some commonality and demonstrates the value of regional bodies in complex regional decision making processes.

8.6 Related documents

Guide to the Ready reckoner:
https://www.dropbox.com/s/u9y07df7n4w9i82/RNP13%20Guide%20Monsoonal%20North%20Mitigation%20Ready%20Reckoner%20Implement%201%20April%202014.pdf

Common framework summary
https://www.dropbox.com/s/09bftehe4ddw6lc/Commonframeworkrevegetation.docx

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9 Socio-economic vulnerability

9.1 Description

This project will apply a framework for undertaking a systematic assessment of socio-economic vulnerability to climate change impacts across the NRM regions and subregions. The approach will be grounded within internationally and nationally accepted procedures for conducting socio-economic vulnerability assessments. It will consider how the impacts of climate change are likely to be unevenly experienced across the regions and between sectors.

9.2 Objectives

- Provide updates on socio-economic vulnerability project.
- Facilitate discussion of the use of project outputs in NRM planning.
- Facilitate sharing and knowledge transfer.

9.3 Discussion

The presentation slides are available in Appendix H. The presentation focused on the initial assessments of ABS data undertaken for some of the vulnerability indicators.

- The vulnerability assessment will follow the definition of socio-economic vulnerability as put forward by Marshall et al. (2013), where resource dependency is used as a measure of socio-economic sensitivity to changes in ecological condition; i.e. high resource dependency = potential high sensitivity to climate change impacts.
- A literature review will be published in a few months for distribution, looking at approaches that can be used to compare across regions, and to develop systematic indicators with a clear rationale.
- The analysis will focus on agricultural sectors where they are significant (i.e. by number of people employed, or value of agricultural commodities produced) using ABS data.
- It is difficult to separate grazing from the ABS category of 'sheep, beef cattle and grain farming', as grain farms are often mixed enterprises; may be able to look at this in more detail in second phase.
- Some sector based fact sheets for focus sectors to be produced by end of May.
- It would be useful to have more feedback into what to include in the second phase – e.g. other sectors, more detail on specific sectors, trend analysis, something different e.g. indigenous vulnerability.
- There may be opportunity for cumulative trend assessments, but these are difficult as categories change – may be able to do for some categories. Projections and trends would also be useful.
- May look at spatial distribution of vulnerability by classification – i.e. combining layers into composite vulnerability layer.
- Can bring information together as text narrative, index, or map overlay.
- In Sydney, some grazing has been opportunistic on land waiting to be developed; there has been a lot of land use change recently. Recreation and tourism, and horticulture are important.
- Tourism is an important sector, but is difficult to extract from ABS data as it is not defined as a category; it may be possible to get tourism data from other locations.
- Climate change is not always the most important driver of sector change – e.g. land use change is still important in most regions.

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9.4 Feedback and evaluation

Socio-economic vulnerability	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The project described is relevant to NRM planning			1	1	5
I will be able to use the results of the project			2	2	3
The session improved my understanding of the project				3	4
I have a better understanding of how I might use the outputs from this project through attending this session			1	3	3
This session was useful and relevant				3	4

Comments	
Opportunities to use results from this project.	The link between sector socio-economic vulnerability and resource vulnerability is a big gap ~ even if guidelines on how there is integration in this area. Probably more interested in broader se vulnerability in more sectors than further delving down into case studies for our region (BMRG).
Barriers to using results from this project.	Agricultural focus will be useful for mainstreaming CC in our organisation.
Suggested further work.	Would like to see continuing discussion between Qld/NSW on IRVAs, and this work. Narrow focus on primary industry misses the need to look at the wider vulnerability of the whole community and the role of NRM in enhancing resilience.
Other comments.	Just not sure about some of the indicators and industry groups being used.

9.5 Conclusions and next steps

There was significant interest in the vulnerability assessments. The sector approach was broadly supported, but there was interest in separating grazing from cropping, and including the tourism sector.

More impact information is required to link climate change projections to impacts on specific sectors – e.g. the cereal modelling being done by UQ will do this for impacts on cereal cropping, but there does not appear to be equivalent information available for other industries.

Further discussions will need to be had to identify priorities for the second phase work.

9.6 Related documents

Marshall, N. A., Tobin, R. C., Marshall, P. A., Gooch, M. and Hobday, A. J. (2013) 'Social Vulnerability of Marine Resource Users to Extreme Weather Events', *Ecosystems*, 16(5): 797-809. Available: http://dx.doi.org/10.1007/s10021-013-9651-6.

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10 Integrated assessment reports

10.1 Description

To integrate the ecological/carbon and socio-economic vulnerability assessments and understand the implications for the major resource-dependant industry sectors in the regions (e.g. grazing, horticulture, tourism) and the capacity of those sectors to respond.

10.2 Objectives

- Provide updates on integrated assessment reports.
- Facilitate discussion of the use of project outputs in NRM planning.
- Facilitate sharing and knowledge transfer.

10.3 Discussion

The presentation slides are available in Appendix I. The presentation focused on the framework for the integrated assessments and possible sectors for the integrated assessments.

- CSIRO have started work constructing a table of the sectors (Appendix J).
- There are currently gaps in linking climate change to impacts on resources – avocado and cropping modelling is the only example so far (from the stream 2 research).
- Briefing notes are proposed to be aimed at a sector across the whole cluster; not region specific.
- Briefing notes could be useful, but scale and sector silos are problematic. The focus across the whole cluster will limit the use for regions – e.g. in the Fitzroy, the future scenarios are all about competition for water. The briefing notes have to be at regional or sub-regional scale to be useful. It may be possible to create a template for the cluster with some flexible data that can be cut and added to, to create a region-specific product: e.g. can't use anything with a map of the cluster –a regional map is the coarsest scale that would be useful. With a flexible product, at each step it would be necessary to think about whether information was valid across the whole cluster, or if there are differences between regions.
- The stakeholders will ask does this relate to my sector, and is it a critical factor? To be useful in a region, the briefing notes also need to focus on that region and the main issues for that region. Other sectors that are also important include mining, CSG, infrastructure (including linear infrastructure), health, community, urban, tourism, settlements/communities, marine (in coasts).
- Tourism is an important sector; it was not included as a discrete sector due to the difficulty of accessing socio-economic data. It was included under the coastal theme – but not all tourism in the regions is coastal (e.g. viticulture tourism in the Hunter). The coastal theme also includes land use impacts and coastal land squeeze.
- The proposed categories are not clear groupings – the first three are landuses, while the others are more amorphous. The audience for the other categories is not clear – who would identify with these categories? One audience could be peri-urban – this is possibly the only group that may not already have this level of information – all other audiences (e.g. specific industries) will want more detail. These other categories may need to be treated differently (a different framework). Urban liveability may be a better title (to fit with the lifestyle values) – mostly happy with the information under the peri-urban category, but not the title.
- Other possible frameworks could be based on assets or pressures; could include regional measures of adaptive capacity (e.g. USC work with the Sydney Coastal Councils); looking at processes, influences on different sectors and types of considerations for interventions. Information from the IRVAs can also inform the assessments.
- One important outcome is the change in thinking, to think about impacts, capacity, buffers, engagement, leadership etc. – how to minimise impacts and maximise opportunities – therefore the detail may not be

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important. Need to think about what the enabling factors to transition from a less desirable to a more desirable state.

- In the peri-urban areas, ecosystem services losses link with social vulnerability – to get investment and political buy-in, need to identify what natural assets can do to reduce vulnerability.

10.4 Feedback and evaluation

Integrated reports	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The project described is relevant to NRM planning			3	3	1
I will be able to use the results of the project			5	1	1
The workshop session improved my understanding of the project		1	1	2	2
I have a better understanding of how I might use the outputs from this project through attending this session		1	2	3	1
This session was useful and relevant			2	4	1

Comments	
Opportunities to use results from this project.	Unsure if all sections will be able to be populated – specifically exposure info needs to be sub-regional categorisation of info within reports. Use of infographics within report – more applicable to "general community" target audience.
Barriers to using results from this project.	Products will need tailoring to each region to be relevant. Too high level and broad brush otherwise. To my understanding, NRMs need information specific to their region (e.g. local agriculture and water competition with mining).
Suggested further work.	Peri urban elements getting closer to a natural assets approach to enhance the resilience of vulnerability communities and sectors.
Other comments.	Very unclear what this is about and how the information will be integrated. Integration should be the final stage to bring all the individual projects together and draw some results of conclusions for us all.

10.5 Conclusions and next steps

Integrated reports need to have a regional focus to be useful. The first three categories proposed are useful, but others are problematic and need further thinking, particularly in relation to the audience and how they will be used. The reports should support investment in activities, and mainstreaming of climate change adaptation.

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11 Adaptive learning

11.1 Description and background

The first stage of the East Coast Cluster project was to undertake an analysis of the needs and requirements of the regional bodies in relation to NRM planning for climate change adaptation. The over-arching theme identified was the need for capacity building for the NRM bodies to best use the information available at any point in time. Needs identified in relation to learning include:

- streamlined approach for monitoring and evaluation, linking outputs and outcomes and quantitative reporting, and capturing outputs from other organizations
- learning and capacity building at the institutional scale (dealing with staff churn)
- transfer of knowledge and interactions between regional bodies
- processes and tools that can be used by the regional bodies to develop and share learnings with stakeholders
- planning processes that allow for continuous input of information and capacity building of planners to deal with continuous information flows.

11.2 Objectives

The objectives of the project are to:

- Synthesise the key learnings from the research and planning throughout the project for sharing with other researchers, NRM agents, regions, clusters and stakeholders.
- Build the capacity of the regional body planners and researchers to foster adaptive learning in their institutions and stakeholders.

The objectives of this workshop session are:

- Present methodology as option for implementing adaptive learning throughout this project
- Trial methodology in relation to user-focused research and PWG processes
- Obtain feedback on the use of the methodology for further improvements
- Facilitate group reflection on the functioning of the PWG and interactions between the researchers and the regional bodies.

11.3 Discussion

Discussion loosely followed the proposed narrative structure for :*'Planners working group – A community of practice around incorporating CC adaptation research into NRM planning*', as described in the presentation in Appendix K.

A group narrative constructed by the planners and researchers from the East Coast Cluster. The primary audience is the ECC planners; the narrative may be shared with other regional bodies or clusters. The process may be used by the planners within their organisations.

The focus of the discussion was on:

How can the PWG best work to facilitate incorporation of climate change adaptation research into NRM planning?

The discussion has been grouped around emergent themes.

Project management

The main challenge is the mismatch in timing between the research and planning parts of the project. Regional bodies will not be able to use all the information that is generated, due to both a continuing funding after June 2013, and lack of time to incorporate information into plans.

Broader context

There is currently a lack of political support – regional bodies practise adaptive management, but state governments have limited capacity for adaptive management (in that they do not acknowledge mistakes in order to learn from them), which makes it difficult to undertake an adaptive management approach to climate change adaptation

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planning for NRM. Need to look for opportunities to include climate change in political agendas, for example the NSW state plan that allows things to happen without specific support from the top.

Information

Most regional bodies have already or are in the process of completing science synthesis for planning; have developed knowledge bases and identified useful research. Ideally, there would have been additional funding for another 12 months to be able to integrate all of this into products and see the final outcome.

To use the information, there needs to be confidence that we have the relevant information and that it is easy to defend and justify, and enduring (won't change significantly). If models are good then the information should persist into the future, and that is the basis on which we plan. Good, defendable, simple information makes planning easier.

Currently looking at potential impacts and risks, and how we can adapt and be more resilient. For example, with peak agriculture groups – how can we work with them to think about changes and planning for the future. For natural resource assets (e.g. wetlands that have been invested in) – how can we manage them into the future. For revegetation – what species should we be planting.

Trying to build planning process and framework that allows space for both general information and fine detail (e.g. a single estuary). The framework also should be able to be used each time to guide the use of information. So far there has been no such thing as adaptive planning, as each time the goal posts have shifted and have had to start from scratch. Finding a place for all the information in the plan is a challenge; also need to be able to select information for communication.

Different planning structures and frameworks have limited the amount of information that can be used across regional borders, especially in Queensland – even the scale of the plans is different. Queensland planners are looking at guidelines for planning and an audit process to endorse plans to ensure they meet key elements. Need to know how information could fit into each plan. Also need to be able to identify similar elements of plans, especially to improve usability by state government.

Mainstreaming

Need to mainstream climate change adaptation into all NRM business; and mainstream NRM into other business (enhancing the resilience of the economy). Mainstreaming means the average punter can acknowledge and think about climate change adaptation – it's about dealing with climate change in a broader context and with more people. This may mean taking the focus off climate change and putting it back on strategic planning that is common across everything we do – need to convince the board and executive (of regional bodies) that climate change is core business as it affects all aspects of the business. They might endorse further work on climate change if they see it as a risk to which it is essential to respond. Climate change must be part of all NRM business, and not seen as something that is bolted on afterwards as an additional chapter of the plan – for example community consultation is part of the whole program. It needs to be part of the conversation with colleagues. In NSW, the local strategic plans may offer an opportunity for a paradigm shift and to mainstream climate change. Demonstrating the value of climate change planning in relation to the other responsibilities of the LLS will help in bidding for internal budget.

The role of the regional bodies in this is to pave a path that more people will follow as they see a need to respond from their own experience. There will be a community demand for more information as the need arises, and need to be proactive and not starting from scratch in responding.

Research interaction

The network is very useful – it is good to have a network that supports liaising with colleagues. Up until now there was limited conversation across state borders. The challenge going forward is to keep the conversations going and keep up the networks as funding disappears – there is so much research going on, and generally need to have personal contacts to be aware of it and know how to use it – keeping in touch is important. You also need to understand enough about the research to be able to ask more detailed questions – the one page documents have helped with that.

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It is also important that others (in the regional bodies and stakeholders) understand that this is a network and there are other people behind the planners, and the information is credible and defendable. Need to be able to refer to an organisation or individual. It would also be useful to have logos for the research partners – e.g. to put on presentations – to add legitimacy to quality of information and strength of the plan.

There is a need to clearly articulate what is happening, what the proposed outcomes are, timing of these and how they fit together, who the contact people are, and what has been achieved so far.

Greater Sydney has undertaken a desktop review of local government plans and strategies, and developed a database of local government staff with a key role in climate change planning. Will use the considerable skills available in local government by developing effective networks and community of practice.

NRM collaborations

The three NSW bodies working together to employ a spatial contractor is a different approach and beneficial for the regions in terms of interaction and networking. This will enable delivery against the mitigation part of the stream 1 contracts. NSW bodies are lucky that OEH is accessible, and have benefited from involvement with IRVAs and access to expertise.

In NSW the CMAs met statewide as a group (during the previous round of CAP review), and the coastal CMAs did state agency and resilience training, which gave this approach greater weight in terms of accreditation – it was harder for the state government to point at one CAP as not being done well, as there had been regional collaboration and the state was dealing with a group. There was value in doing something big and together with shared resources and training, even though they ended up with separate plans – there were still differences between the regions in terms of different plans, applications and interpretations of concepts such as whole of government and resilience were interpreted differently in each region.

Institutional change

The NSW LLS face a challenge to prove themselves as new institutions – nobody knows whether this model will work, and there is a lot of cynicism in relation to reduced resources and the ability to provide the same level of service. Landholders are also sceptical and there has been negative media e.g. over the election of boards. There was also a lot of work and community involvement in the development of the CAPs but now stakeholders are asking what happened to that? The change has also disrupted the project timetable and expenditure of the budget, and the federal government intends to close future funding and take back any unspent money. Future work on climate change adaptation may well be unsupported.

Need to look for opportunities for climate change planning in the next phase of developing local strategic plans for the LLS regions.

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11.4 Feedback and evaluation

Adaptive learning	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The project described is relevant to NRM planning			1	2	3
I will be able to use the results of the project			3	3	
The workshop session improved my understanding of the project			2	1	2
I have a better understanding of how I might use the outputs from this project through attending this session			3	2	
This session was useful and relevant			1	3	1

Comments	
Opportunities to use results from this project.	Still getting my head around the significance of the capture of this info and its use – I will probably come around ☺
Barriers to using results from this project.	Good to share how adaptation can manifest itself in other regions. There is much multi-layered information and data involved, that even the workshop participants find it challenging to keep up. A plan/map/chart/matrix would be invaluable.
Suggested further work.	Good to hear the experiences in NSW – where NRM/CAPs site in the planning framework. Use depends on timing and resources. Problems with timeframe – losing staff resources in June.
Other comments.	Ensuring we are continually adapting. Mainstreaming the information into core business is essential.

11.5 Conclusion and next steps

Part of the value in the research collaboration is in increasing the credibility of the information generated. To further assist, research partners have provided logos for regional bodies to use when presenting results from research to add legitimacy and credibility.

Need to have a PRG meeting with the new GMs soon to regain support for climate change adaptation in the plans.

The PWG is useful, but budget and resource constraints mean not all regions may be able to continue to attend workshops after June.

One page summaries need to be finalised and branded, with clear outputs and dates – these are important communication tools especially for others within the NRM organisations. In addition, a summary of outputs (directory, framework, table, etc) and how they link together would be useful to enable planners to prepare for using the information in the next stage of planning.

Mainstreaming climate change into NRM work is seen as essential in terms of moving forward.

11.6 Related documents

Methodology description for group narrative construction:

https://www.dropbox.com/s/tsorty1jx4wnyud/group%20narrative%20method.docx

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12 Communication and website

12.1 Description

As part of the national project, there are plans for a website that will incorporate information from all the stream 2 projects. In addition, the Terranova website, built to store data and information from NCCARF, will be available as long term storage for project outputs. All information on Terranova must have some metadata provided, including key words to improve discoverability.

12.2 Objectives

- Raise awareness of the plans for a national website
- Facilitate discussion around what information should be disseminated more widely, and in what format
- Provide input to design of ECC website pages.

12.3 Discussion

The presentation slides are available in Appendix L. Discussion included:

- Is there a quality assurance procedure for loading data onto Terranova – how will users know that the information is of high quality? If so, are the criteria publicly available? – A registration process is required to upload information; Cath to check on this and Chris and Melanie to trial putting existing reports on Terranova.
- The national team have developed templates for cluster reports, to be finalised shortly.
- It is not clear how the stream 2 website will work, how many pages each cluster will have or how the navigation will work – Cath to clarify if possible.
- It is important for regional bodies to have access as soon as possible to other cluster products. It would also be useful to have a thematic level to access information for the whole program as well.
- For website use, consistent keywords and tags are important for searching.
- Main users will include local government stakeholders and planners, and implementation stakeholders.
- It is important for websites to have new information otherwise people won't go back to it.

12.4 Actions

- Mel and Chris to trial putting information on Terranova as test to see how it works
- Cath to check on criteria to upload information to Terranova
- Chris has circulated photos for template cover for comment.
- Cath and Mel have circulated information on other cluster projects from the last national meeting.

12.5 Feedback and evaluation

Communication and website	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
This session was useful and relevant				**6**	**1**
I have a better understanding of project communication				**6**	**1**
Comments					
Good to see where this is at. Would like to know more. Would like to know more about long-term maintenance of the site and how it will be promoted.					

12.6 Conclusions and next steps

The website is potentially useful for sharing information with other clusters. Terranova is potentially useful for storing information longer term, as long as there is some quality assurance for material uploaded, and useful key words and tags (metadata) are included.

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13 Workshop organisation evaluation

Workshop organisation	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The workshop was well organised				1	5
The objectives of the workshop were clear				2	4
I feel that I benefited from attending the workshop				1	5
Comments					
Great couple of days. Learnt heaps that I can take home and apply.					
Great! Well done, thanks.					
Did a great job facilitating and keeping it all going.					
Thanks – well organised and facilitated!					

14 Summary and conclusions

Several key points came out of the discussions in relation to further work and the next steps.

- The collaboration and PWG workshops have been very useful for both the planners and the researchers. One concrete result is the collaboration of the three NSW LLS to employ a spatial contractor. The information sharing, establishing relationships with researchers and ability to think broadly ('ramble all over the place') and get ideas for projects have been particularly useful.
- The process also provides a really good opportunity for knowledge sharing, as everyone is doing similar things at the same time – what can we do to maximise the outcomes from this? It would be good to know more about what the other clusters are doing.
- The collaboration is also useful as it provides credibility for the information – i.e. the information is provided by credible institutions, and the processes are being applied by more than one regional body.
- The 'one-pagers' were very useful in providing more information to the planners on specific outputs from each of the projects. They are potentially useful as a communication tool about the project, and should therefore be finalised, branded and made publicly available.
- It would also be useful to provide detail – as specific as possible (e.g. identifying specific map layers) – on the exact products and outputs and the expected timing of delivery. This can then be linked to specific people who might use the information, actions and projects that might flow from the research.
- In addition, a list/directory/conceptual map of how all the research components fit together would also be useful. This could be linked to the planning cycle.
- Broader awareness of other processes (e.g. NCCARF) is also required – e.g. NCCARF will focus on coastal councils' capacity to respond to climate change, so it may not be necessary to include coastal capacity in this project.
- Mainstreaming climate change adaptation into the regional bodies is essential. This includes understanding how climate change relates to all aspects of regional body work, and identifying the risks. The IRVA process is a very good example of this.

Actions to be progressed before the next PWG workshop include:

- There are opportunities for regional NRM bodies to contribute to the development of the Queensland state adaptation framework.
- Further discussions are required to scope the second phase of more detailed socio-economic vulnerability assessments.
- Melanie and Chris to trial adding reports to the Terranova website.
- Chris to circulate cluster branding and templates when available.

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- Investigate possibilities for adding the socio-economic vulnerability assessment to the coastal vulnerability assessments.
- One page summaries need to be finalised and branded, with clear outputs and dates.
- A summary of outputs (directory, framework, table, etc) and how they link together would be useful to enable planners to prepare for using the information in the next stage of planning.
- Logos of each of the partners to be circulated for use on presentations etc. (to provide credibility for information used).
- A Project Reference Group meeting with the new GMs soon to be held soon to regain support for climate change adaptation in the NRM plans.

14.1 Next workshop

The next PWG is scheduled for September this year. Proposed format is 1 day for the first day of the scenario planning, and 1 day as a normal PWG. There was no interest in extending this format to allow for more time for the normal PWG session, although a full 2 days may be required (no early finish on the second day).

All planners were keen to continue involvement in the cluster, but some regional bodies may not have resources to attend future workshops – due to lack of funds after June, a specific planner no longer being employed in the position, or both. One solution may be to set dates for the next workshop now, to allow regional bodies to book travel and accommodation in advance.

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15 Abbreviations

ABS	Australian Bureau of Statistics
BMRG	Burnett Mary Regional Group
CAP	Catchment Action Plan
CEO	Chief Executive Officer
ClimDDir	Climate Model Downscaling Data for Impacts Research (http://www.climddir.org/)
ECC	East Coast Cluster
ESCCI	Eastern Seaboard Climate Change Initiative
FBA	Fitzroy Basin Association
GCM	General Circulation Model
IPCC	Intergovernmental Panel on Climate Change
IRVA	Integrated Regional Vulnerability Assessment
LLS	Local Land Services
M&E	Monitoring and Evaluation
MCAS-S	Multi-Criteria Analysis Shell for Spatial Decision Support (http://daff.gov.au/ABARES/Pages/data/mcass.aspx)
NarClim	NSW / ACT Regional Climate Modelling (http://www.environment.nsw.gov.au/research/Regionalclimate.htm)
NRM	Natural Resource Management
OEH	Office of Environment and Heritage
OzClim	Climate information for Australia (http://www.csiro.au/ozclim/home.do)
PRG	Project Reference Group
PWG	Planners Working Group
SEQC	SEQ Catchments
SimClim	Climate Systems software (http://www.climsystems.com/simclim/)
USC	University of the Sunshine Coast

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Appendix A Workshop Agenda

Theme: A working workshop – developing, testing and progressing projects – research into planning
Griffith University, South Bank Campus, SO2, level 7 Board room (SO2_7.16/7.07)

Day 1 – Tuesday 29 April

Session	Topic	Description	Who
8:45-9:00	Registration	Registration	
9:00-9:45	Introduction and adaptive learning	Outcomes from previous workshop + introduction to this workshop Objectives of this workshop Set up adaptive learning process for this workshop	Melanie Cox
9:45-10:30	RB update	Quick round table update from each of the regional bodies	Silvia Serrao-Neumann
10:30-11:00	MORNING TEA		
11:00-12:00	Climate projections and modelling	Discussion on regional projections summary and website material Discussion on using projections results and climate change modelling	Penny Whetton, CSIRO
12:00-12:45	Coastal modelling	Potential vulnerability of coastal landforms under multiple future scenarios	Kerrylee Rogers, UW
12:45-1:30	LUNCH		
1:30-2:00	Qld adaptation	Qld adaptation plan	Kirsten Lovejoy, EHP
2:00-3:00	NarClim + adaptation work	Presentation on expected outputs from NarClim, plus adaptation work – regional vulnerability assessments, research hubs etc	Suzanne Dunford, OEH
3:00-3:30	AFTERNOON TEA		
3:30-4:30	Cereal modelling	Looking at example case study for Fitzroy Basin – presentation on modelling (UQ) and discussion on how this could be used by the regional bodies in planning	Chris Hoskings, UQ
4:30-5:00	Reflection on first day	Continuing adaptive learning framework – individual input	Melanie Cox, GU

Day 2 – Wednesday 30 April

Session	Topic	Comments	Who
9:00-9:15	Welcome back	Recap on first day	
9:15-10:15	Reveg framework	Ready reckoner, regrowth benefits tool and common framework Discussion seeking input to considerations, data available, processes underway	Alastair Buchan, Don Butler, Melanie Cox
10:15-10:45	MORNING TEA		
10:45-11:45	Socio-economic vulnerability	Socio-economic vulnerability – introduction to work done so far	Erin Smith, USC
11:45-12:45	Integrated reports	Presentation and discussion	Nadine Marshall, CSIRO
12:45-1:30	LUNCH		
1:30-2:00	Communication and website	Presentation on website and discussion on communication needs	Cath Lovelock, UQ
2:00-2:45	Adaptive learning cont.	Continuing adaptive learning framework – group narratives	Melanie Cox, GU
2:45-3:30	After the plan and wrap up	Intentions and approaches for moving from strategic planning to implementation Summary and next steps	Darryl Low Choy, GU
3:30	AFTERNOON TEA		

Appendix B Workshop attendees

Group	Organisation	29-Apr	30-Apr
Regional bodies	Greater Sydney LLS	2	2
	Hunter LLS	1	1
	North Coast LLS	1	1
	SEQ Catchments	1	1
	BMRG	1	1
	FBA	1	1
Research partners	Griffith University	5	2
	University of Queensland	1	2
	Queensland Herbarium	1	1
	CSIRO	0	2
	University of the Sunshine Coast	0	2
	NSW Office of Environment and Heritage	1	0
	University of Wollongong	1	0
Presenters	Queensland Dept. Environment & Heritage Protection	1	0
Video conference	CSIRO projections team	2	0
	Burdekin Dry Tropics	1	0

Appendix C Projections presentation

CLIMATE CHANGE PROJECTIONS

FOR AUSTRALIA'S NATURAL RESOURCE MANAGEMENT REGIONS

EAST COAST CLUSTER
CLIMATE PROJECTIONS PROJECT UPDATE

PENNY WHETTON, CSIRO

TUESDAY | 29 APRIL 2014

CURRENT PROJECT STATUS

Most products are due for release after 1 July, 2014. To ensure the scientific processes are followed, final versions will follow organisational approvals.

- **Website**: Web tools currently at user testing stage. Scheduled for project participant access on 1 July. Public access date TBC.
- **Projections reports**
  - **Technical**. Final drafting stage currently. Extensive peer and organisational review required. Publish date, Aug/Sep 2014.
  - **Regional Reports**: Regional review comments received. Final drafting stage currently. Organisational review required. Publish date, Aug/Sep 2014.
- **Cluster brochures**: In preparation. Available to project stakeholders 1 July. Final draft (minimal revisions), Aug/Sep 2014.

EAST COAST PROJECTIONS REPORT

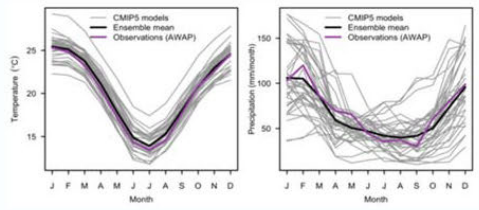
Purpose: A summary of projections for the East Coast cluster, giving regional detail where appropriate. Aimed at regional planners and decision makers, with some knowledge of climate change and projections science.

Draft report supplied for regional review on Tues 15/4.

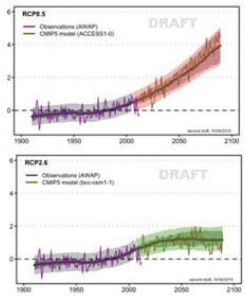
Some comments from East Coast received, including DOTE.

Walk through the key figures and messages.

MODELS PERFROM WELL IN TERMS OF SIMULATING THE SEASONAL CYCLE FOR THE EAST COAST.



HIGHER TEMPERATURES.

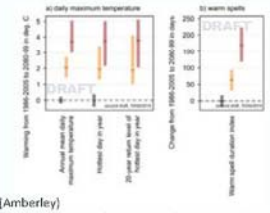


Continued substantial warming for the East Coast cluster region for mean, maximum and minimum temperature is projected with *high confidence*,

For the near future (2030), the mean warming is around 0.4 to 1.3°C above the climate of 1986–2005, with only minor difference between RCPs

For the far future (2090) it is 1.3 to 2.5°C for RCP4.5 and 2.7 to 4.7°C for RCP8.5.

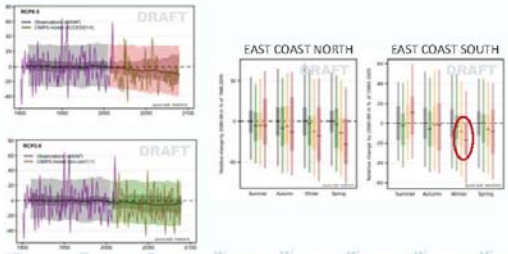
MORE FREQUENT AND HOTTER HOT DAYS; LESS FROST



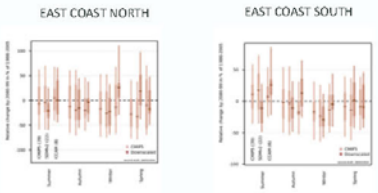
Brisbane (Amberley)

Threshold (°C)	1995	2030 RCP4.5	2090 RCP2.6	2090 RCP4.5	2090 RCP8.5
35	12	18 (15 to 22)	18 (14 to 30)	27 (21 to 42)	55 (37 to 80)
40	0.6	1.2 (1.1 to 1.6)	1.2 (1.1 to 2.5)	2.1 (1.5 to 2.9)	6.0 (2.9 to 11)
Frost days	22	16 (9 to 14)	17 (20 to 12)	11 (14 to 7.4)	3.1 (6.8 to 0.7)

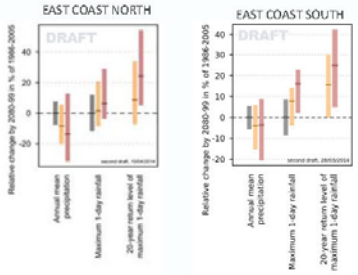
OVER NEXT FEW DECADES RAINFALL VARIABILITY WILL BE MAJOR DRIVER OF RAINFALL CHANGE. LATE IN THE CENTURY WINTER RAINFALL DECLINE WILL BE EVIDENT



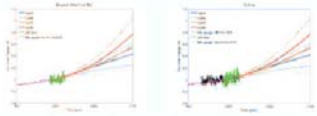
Downscaled rainfall changes



INCREASED INTENSITY OF HEAVY RAINFALL EVENTS; CHANGES TO DROUGHT LESS CLEAR.



HIGHER SEA LEVEL AND MORE FREQUENT SEA LEVEL EXTREMES

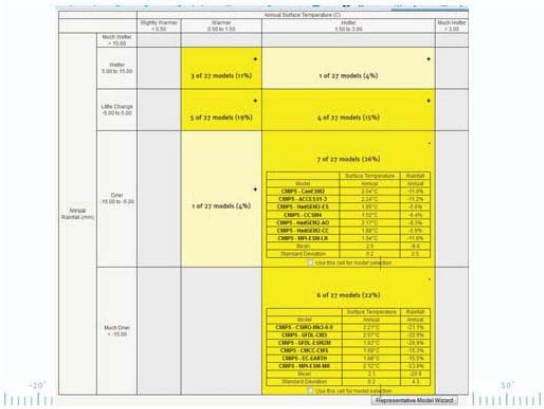


Variable	Location	Season	2030, RCP2.6	2030, RCP4.5	2090, RCP6.0	2090, RCP8.5	2090, RCP2.6	2090, RCP4.5	2090, RCP8.5
Sea Level Rise (m)	Gladstone (151.31, -23.85)	Annual	0.13 [0.08-0.17]	0.13 [0.09-0.17]	0.13 [0.09-0.18]	0.18 [0.13-0.24]	0.47 [0.30-0.64]	0.64 [0.44-0.86]	
	Brisbane (153.17, -27.37)	Annual	0.13 [0.09-0.17]	0.13 [0.09-0.18]	0.14 [0.09-0.18]	0.19 [0.13-0.25]	0.47 [0.31-0.63]	0.65 [0.43-0.87]	
	Sydney (151.21, -33.86)	Annual	0.13 [0.09-0.18]	0.13 [0.09-0.18]	0.14 [0.10-0.19]	0.19 [0.13-0.24]	0.47 [0.30-0.63]	0.66 [0.43-0.88]	
Sea attendance (m)	Gladstone (151.31, -23.85)	Annual	0.14 [0.14-0.14]	0.14 [0.14-0.15]	0.15 [0.13-0.15]	0.29 [0.23-0.34]	0.71 [0.57-0.77]	1.01 [0.99-1.11]	
	Brisbane (153.17, -27.37)	Annual	0.15 [0.13-0.15]	0.15 [0.13-0.16]	0.15 [0.13-0.17]	0.73 [0.69-0.84]	0.90 [0.83-1.00]	1.30 [1.19-1.43]	
	Sydney (151.21, -33.86)	Annual	0.15 [0.13-0.16]	0.15 [0.13-0.16]	0.17 [0.13-0.17]	0.66 [0.61-0.72]	0.79 [0.74-0.87]	1.17 [1.08-1.29]	

OTHER VARIABLES DISCUSSED IN REPORT INCLUDE

- Winds, storms and weather systems
- Solar radiation
- Relative humidity
- Potential evapotranspiration
- Soil moisture and runoff
- Fire weather

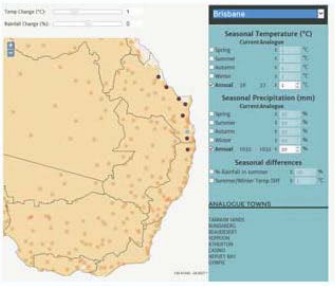
USING PROJECTIONS FOR ADAPTATION PLANNING: CLIMATE FUTURES



SOME KEY CLIMATE SCENARIOS

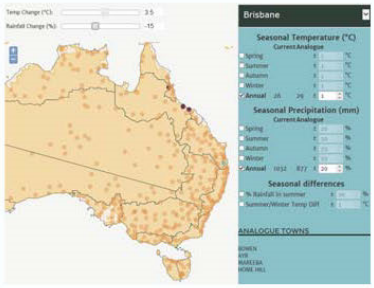
- ***Warmer*** (0.5-1.5°C warming) with ***little change in rainfall*** (-5 to +5%). This would occur by 2030 under any emission scenario, but may persist through to the end century under RCP2.6.
- ***Hotter*** (1.5-3°C warming), and ***much drier*** (>15% reduction). This is possible mid- to late century in the northern part of the cluster and especially under RCP4.5 and RCP8.5.
- ***Much hotter*** (>3°C warming), and ***much drier*** (>15% reduction). This is also possible late in the century under RCP8.5 in the northern part of the cluster.
- ***Warmer*** (0.5-1.5°C warming) and ***wetter*** (5-15% increase). This would occur by 2030 under any emission scenario, but may persist through to the end of this century under RCP2.6.
- ***Hotter*** (1.5-3°C warming), but ***drier*** (5-15% reduction). This is also possible by 2050 under RCP4.5 or RCP8.5.

SCENARIOS AND ANALGOUES FOR THE EAST COAST



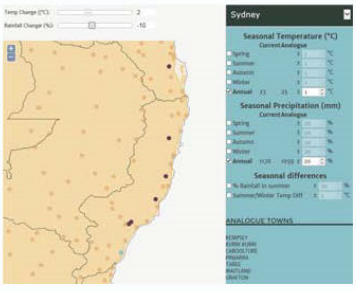
Warmer (0.5-1.5°C warming) with ***little change in rainfall*** (-5 to +5%).

SCENARIOS AND ANALGOUES FOR THE EAST COAST



Much hotter (>3°C warming), and ***much drier*** (>15% reduction).

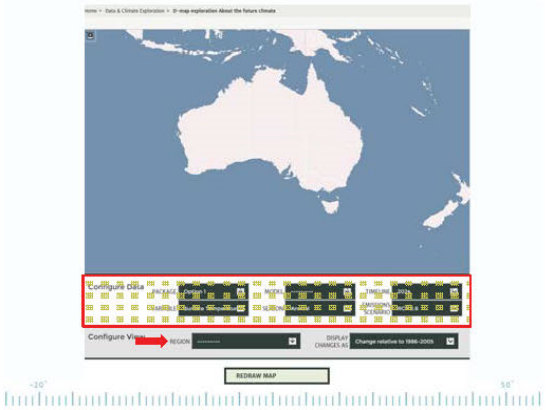
SCENARIOS AND ANALGOUES FOR THE EAST COAST

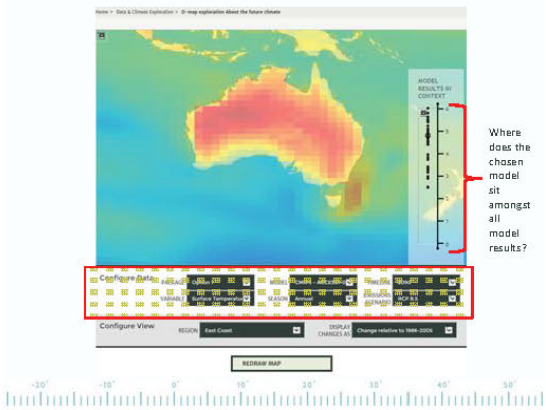


Warmer (0.5-1.5°C warming) and ***wetter*** (5-15% increase).

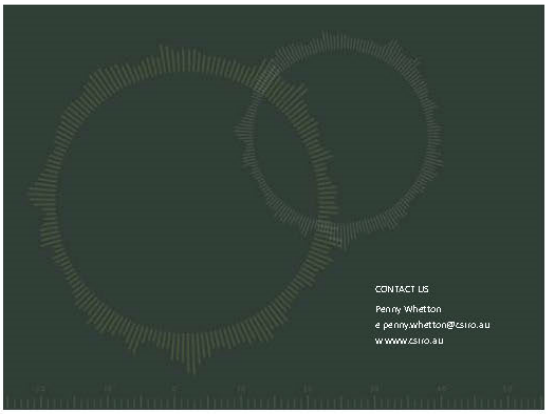
CLIMATE CHANGE IN AUSTRALIA WEBSITE

CLIMATE MAP EXPLORER





Where does the chosen model sit amongst all model results?



Appendix D OEH presentation

CLIMATE INFORMATION

Update on OEH contribution to ECC information:
- NSW and ACT Regional Climate Model
- Eastern Seaboard Climate Change Initiative
- Integrated Regional Vulnerability Assessments
- NSW Adaptation Research Hub

Office of Environment & Heritage

CLIMATE INFORMATION :RECAP

- NARCLiM
  - 12 model ensemble dynamically downscaled to 10km chosen for spread of futures
  - 1990-2009; 2020-2040; 2060-2080
  - Levels of processing and synthesis is being made available
  - Supporting documentation
    - CMIP5
    - A2
    - Methods/evaluation etc.
- Eastern Seaboard Climate Change Initiative/ NSW Adaptation Research

NARCliM Domain

HOW DO PEOPLE USE CLIMATE DATA?

NetCDF Users

```
001110100100001
010001000100101
010010100101010
001010111110001
010010101010010
100111010011001
0
```

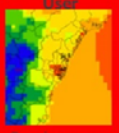
- Require numerical data
- Can manipulate netCDF files

CliMDDIR Users

year	day	rads	max	min	rain
()	()	(MJ/m2)	(oC)	(oC)	(mm)
1888	1	35.9	36.3	8.3	0.0
1888	2	27.2	26.9	13.6	0.0
1888	3	15.2	23.1	16.5	0.0
1888	4	27.3	25.9	9.8	0.0
1888	5	21.6	27.8	13.4	0.0
1888	6	25.2	25.9	9.7	0.0
1888	7	23.8	28.2	10.9	0.0
1888	8	22.5	18.4	9.9	9.8
1888	9	19.3	26.9	13.4	0.0
1888	10	28.8	30.8	17.5	0.0
1888	11	23.9	36.0	15.5	0.0
1888	12	25.5	38.5	13.1	0.0

- Require data in ASCII or GIS format
- Unfamiliar with netCDF

Spatial Context User



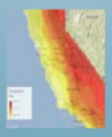
- Require maps and other graphics
- Unlikely to use numerical data

"PRODUCTS"

PEOPLE WANT TO ACCESS NUMBERS

year	day	rads	max	min	rain
()	()	(MJ/m2)	(oC)	(oC)	(mm)
1888	1	35.9	36.3	8.3	0.0
1888	2	27.2	26.9	13.6	0.0
1888	3	15.2	23.1	16.5	0.0
1888	4	27.3	25.9	9.8	0.0
1888	5	21.6	27.8	13.4	0.0
1888	6	25.2	25.9	9.7	0.0
1888	7	23.8	28.2	10.9	0.0
1888	8	22.5	18.4	9.9	9.8
1888	9	19.3	26.9	13.4	0.0
1888	10	28.8	30.8	17.5	0.0
1888	11	23.9	36.0	15.5	0.0
1888	12	25.5	38.5	13.1	0.0

PEOPLE WANT TO SEE MAPS



PEOPLE WANT WORDS

ACCESSING NUMBERS

NARCliM Dataset

- Stored in netCDF
- Very big!
  - Many simulations
  - Many variables
  - Many atmospheric layers
  - High resolution
  - Large region
- Data on an irregular model grid

CliMDDIR

Reformat from binary

Extract relevant data

Reproject/interpolat

Data Collections for Impacts Research

- ASCII or GIS-readable files
- User-selected simulations
- User-selected surface variables
- User-selected locations
- Data on a regular grid or for point locations

	Daily data	Monthly data
Site-specific / gridded	1. [illegible] 2. [illegible]	1. [illegible] 2. [illegible]
Interpolation methods	1. [illegible] 2. [illegible]	1. [illegible] 2. [illegible]
Variables	1. Precipitation accumulation 2. Mean surface air temperature 3. Minimum surface air temperature 4. Maximum surface air temperature 5. Mean surface pressure 6. Mean surface specific humidity 7. Mean near-surface wind speed 8. Mean surface evaporation flux 9. Mean soil moisture content 10. Mean sea surface temperature 11. Mean potential evaporation 12. Mean downward shortwave radiation 13. Mean downward longwave radiation 14. Mean upward longwave radiation 15. Precipitation rate for wettest 5min period 16. Precipitation rate for wettest 10min period 17. Precipitation rate for wettest 20min period 18. Precipitation rate for wettest 30min period 19. Precipitation rate for wettest 60min period 20. Maximum wind speed for windiest 10min period	1. Precipitation accumulation 2. Mean surface air temperature 3. Minimum surface air temperature 4. Maximum surface air temperature 5. Mean surface pressure 6. Mean surface specific humidity 7. Mean near-surface wind speed 8. Mean surface evaporation flux 9. Mean soil moisture content 10. Mean sea surface temperature 11. Mean potential evaporation 12. Mean downward shortwave radiation 13. Mean downward longwave radiation 14. Mean upward longwave radiation 15. Precipitation rate for wettest 5min period 16. Precipitation rate for wettest 10min period 17. Precipitation rate for wettest 20min period 18. Precipitation rate for wettest 30min period 19. Precipitation rate for wettest 60min period 20. Maximum wind speed for windiest 10min period
File formats for output	1. [illegible] 2. [illegible]	1. [illegible] 2. [illegible]

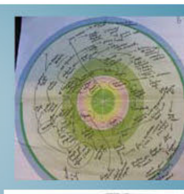
EASTERN SEABOARD CLIMATE CHANGE INITIATIVE

- *MATCHES – BOM Historical Tracking Tool*
- *East Coast Low (ECL) Future Changes - UNSW*
- *Long term Historical Variability in ECL – Macquarie University*
- *Assessing regional coastal and estuarine impacts of extreme ECLs – Macquarie University*
- *Determining the influence of ECL on regional water security – Newcastle University*
- *A framework to determine the economic impact to case study community from a cluster of East Coast Lows – Risk Frontiers*

INTEGRATED REGIONAL VULNERABILITY ASSESSMENT (IRVA)

UNDERSTANDING VULNERABILITY IN THE CONTEXT OF REGIONAL SYSTEMS

- *Develops regional understanding of the sectoral impacts and vulnerability based on local operational knowledge*
- *Integrates the vulnerability of all stakeholders across multiple sectors*
- *Intensive consultation with State & Local Government*
- *Builds on the existing capacity of local and state government decision makers*
- *Identifies and prioritises vulnerability and potential regional responses*



Sectoral Workshops

Identify sectoral impacts and flow on effects of climate drivers

Prioritise adaptive capacity indicators for each sector

Discuss what needs to change, where and how

Integration workshop

Validate and prioritise vulnerabilities and identify collective responses

REGIONAL VULNERABILITY & ASSESSMENT

- SOUTH EAST
- RIVERINA MURRAY
- SYDNEY
- NORTH COAST

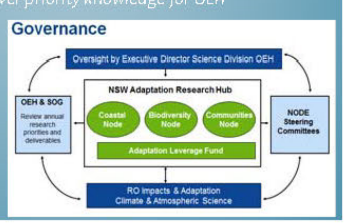
IN THE REGIONAL ACTION PLANS ATTACHED TO NSW 2021 (19 ACTIONS)

NSW ADAPTATION RESEARCH HUB

- *Designed to produce knowledge for OEH and its customers, through harnessing the capabilities of NSW research institutions to deliver climate impact and adaptation science*
- *Research priorities were developed through the OEH Knowledge Strategies and a need to develop research that is operationally and policy relevant*
- *Funded for $2.75 million over 3 years under the WELE Regional Vulnerability and Adaptation Research Program and is expected to leverage upwards of $3 million in research activity*

HUB OBJECTIVES

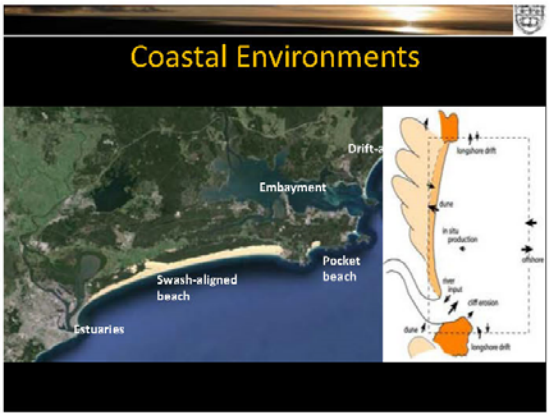
- *Foster integrated climate impacts and adaptation research in the NSW university sector to enable effective climate change adaptation in NSW*
- *Ensure transfer of skills and knowledge between universities, government staff, local stakeholders and local communities*
- *Cost effectively deliver priority knowledge for OEH and our customers*

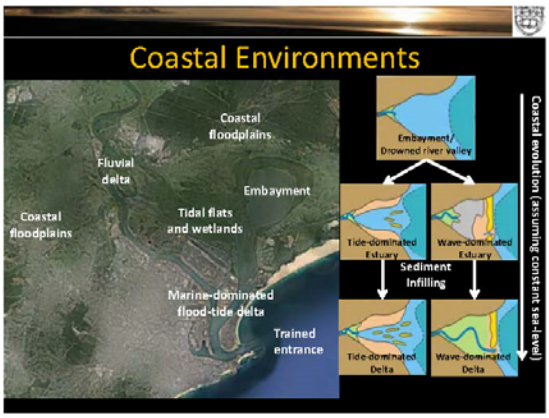


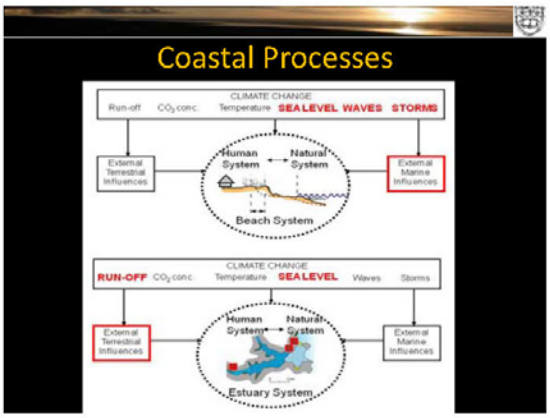
MORE INFORMATION?

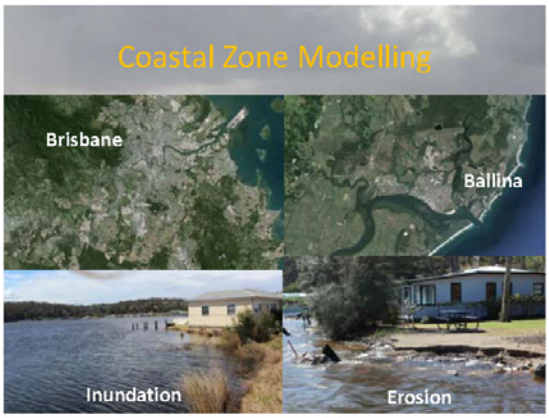
- ***IRVA Guide:***
  www.environment.nsw.gov.au/resources/climatechange/130016IRVAguide.pdf
- ***South East of NSW IRVA resort***
  www.environment.nsw.gov.au/climatechange/irvadescription.htm
- ***NSW Adaptation Research Hub***
  www.environment.nsw.gov.au/climateChange/adaptreshub.htm

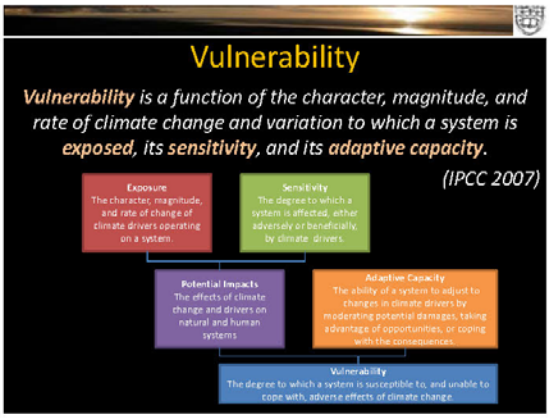
Appendix E Coastal vulnerability presentation











Scale Dependant: Three-Pass Approach

- **First pass** - Regional broad-scale assessment
  - Often termed a sensitivity assessment
- **Second pass** – System focussed; or
  - Captures exposure
- **Third pass** – Site specific assessment
  - High resolution
  - Data intensive
  - Should capture exposure and sensitivity, maybe adaptive capacity
- Open coasts **or** estuaries.
- Few integrate estuaries and open coasts

First-pass assessment of estuary vulnerability

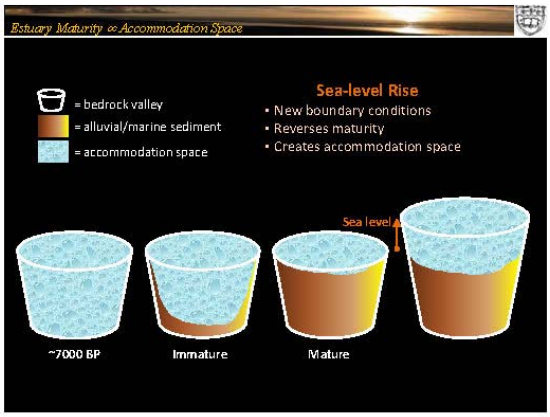
- Broad-scale and regional based
- Uses readily available datasets
- Derived from a geomorphic framework of estuary evolution
- Applied in a spatial environment e.g. ARCGIS

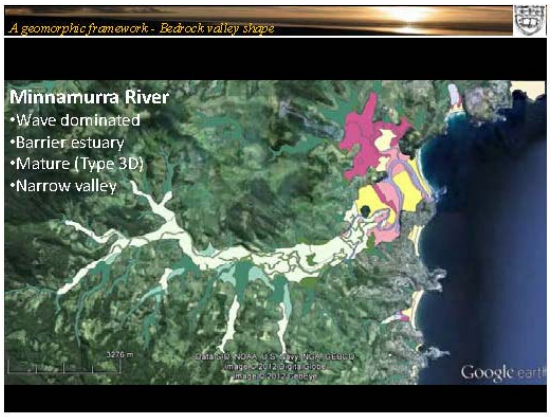
A geomorphic framework - Evolution

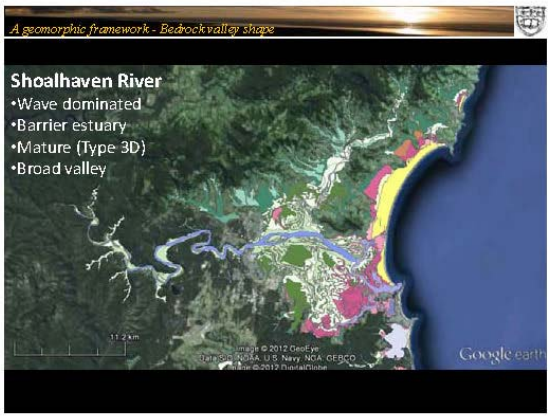
A geomorphic framework - Evolution

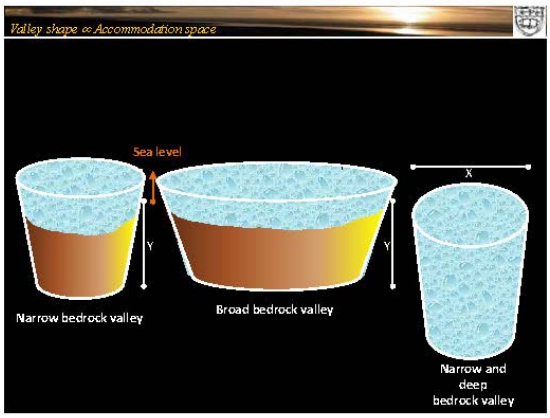
A geomorphic framework - Evolution

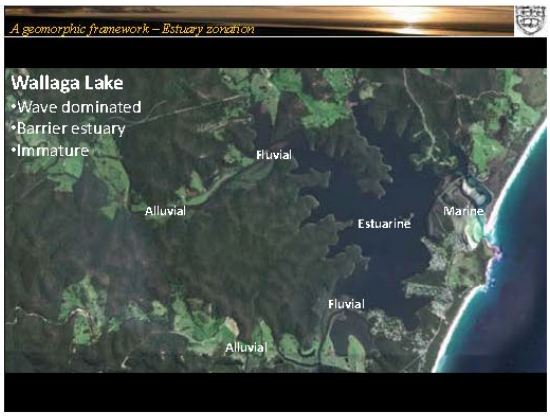
A geomorphic framework - Evolution

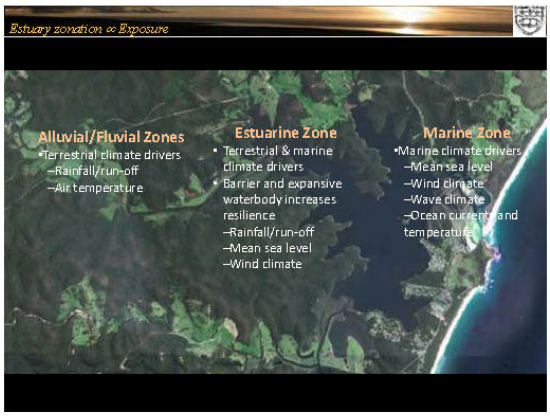

Estuary Maturity ∝ Accommodation Space
= bedrock valley
= alluvial/marine sediment
= accommodation space
Sea-level Rise
• New boundary conditions
• Reverses maturity
• Creates accommodation space
Sea level
~7000 BP
Immature
Mature


A geomorphic framework - Bedrock valley shape
Minnamurra River
•Wave dominated
•Barrier estuary
•Mature (Type 3D)
•Narrow valley
Google earth


A geomorphic framework - Bedrock valley shape
Shoalhaven River
•Wave dominated
•Barrier estuary
•Mature (Type 3D)
•Broad valley
Google earth


Valley shape ∝ Accommodation space
Sea level
Y
Y
X
Narrow bedrock valley
Broad bedrock valley
Narrow and deep bedrock valley


A geomorphic framework – Estuary zonation
Wallaga Lake
•Wave dominated
•Barrier estuary
•Immature
Fluvial
Alluvial
Estuarine
Marine
Fluvial
Alluvial


Estuary zonation ∝ Exposure
Alluvial/Fluvial Zones
•Terrestrial climate drivers
–Rainfall/run-off
–Air temperature
Estuarine Zone
• Terrestrial & marine climate drivers
• Barrier and expansive waterbody increases resilience
–Rainfall/run-off
–Mean sea level
–Wind climate
Marine Zone
•Marine climate drivers
–Mean sea level
–Wind climate
–Wave climate
–Ocean currents and temperature

Geomorphic framework for assessing estuary vulnerability

Vulnerability *is a function of the character, magnitude, and rate of climate change and variation to which a system is* ***exposed****, its* ***sensitivity****, and its* ***adaptive capacity****. (IPCC 2007)*

Vulnerability = Exposure + Sensitivity + Adaptive Capacity

Exposure to drivers ∝ Zonation
- Marine zone
  - –SLR, storms
- Fluvial zone
  - –Rainfall/run-off
- Estuarine zone
  - –SLR, rainfall/runoff
  - –Sensitivity varies with maturity

Sensitivity to Inundation ∝ Maturity
- Immature
- Mature

Sensitivity to Erosion ∝ Lithology
- Hard bedrock
- Soft Holocene deposits

Adaptive Capacity ∝ Valley Shape
- Broad valley
- Narrow Valley
- Deep valley

Adaptive Capacity ∝ Maturity
- Immature
- Mature

First-pass assessment Northern NSW

Indicators
- Elevation (DEM)
- Geology

Drivers (Processes)
- Marine
- Fluvial

Effects
- Inundation
- Erosion

Apply spatial datasets to geomorphic framework

Fluvial drivers causing erosion

Component	Indicator	Input data set	Explanation	Cell score and description
Exposure	Deposit type Slope Elevation	Quaternary geology DEM	Fluvial deposits (lesser extent estuarine deposits) exhibit greater exposure to fluvial drivers Steep slopes exhibit greater runoff Low elevations exhibit greater exposure to fluvial drivers	3=Alluvial unit + Elevation < 5 m + Slope > 2° 2=Alluvial/Estuarine unit + Elevation < 5m 1=Quaternary deposits + Elevation > 5m 1=Coastal unit + Elevation < 5 m
Sensitivity	Geology	Bedrock & Quaternary geology	Hard bedrock geology less sensitive to erosion than quaternary deposits	3=Quaternary deposits 1=Bedrock geology
Adaptive capacity	Maturity	Quaternary geology DEM	Intertidal units have the greatest capacity to build elevation High elevation Quaternary deposits, particularly alluvial and estuarine units, have the lowest capacity to build elevation due to limited opportunities to deliver sediment.	1=Elevation < 2 m 2=Elevation > 2 m and < 5 m 3=Alluvial/Estuarine unit + Elevation > 5 m

Fluvial drivers causing inundation

Component	Indicator	Input data set	Explanation	Cell score and description
Exposure	Deposit type Elevation	Quaternary geology DEM	Marine and estuarine deposits exhibit greater exposure to wave activity and storm surge Steep slopes exhibit less run-up Low elevations exhibit greater exposure to wave activity and storm surge	3=Fluvial + Elevation < 5 m 2=Estuarine + Elevation < 5 m 1=Fluvial/Estuarine + Elevation > 5m
Sensitivity	Equal sensitivity			
Adaptive capacity	Maturity	Quaternary geology DEM	Supratidal environments (lesser extent intertidal environments) exhibit past capacity to build elevation	3=Elevation < 2 m 2=Elevation > 2 m and < 5 m

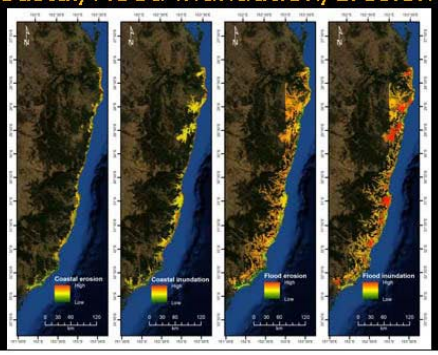
Marine drivers causing erosion

Component	Indicator	Input data set	Explanation	Cell score and description
Exposure	Deposit type Slope Elevation	Quaternary geology DEM	Lower elevations exhibit greater exposure to wave action Greater exposure to wave action near shoreline Steep slopes limit wave run-up Marine drivers exhibit history of operating near coastal and estuarine Quaternary deposits.	3=Distance < 500 m + Elevation < 5 m + Slope < 10° 2=Distance < 5 km + Elevation < 5m 2= Distance < 500 m + Elevation < 5 m + Slope > 10° 2= Coastal/estuarine unit + Elevation < 5 m 1=Coastal/Estuarine unit + Elevation > 5m
Sensitivity	Geology	Bedrock & Quaternary geology	Hard bedrock geology less sensitive to erosion than Quaternary deposits	3=Quaternary deposits 1=Bedrock geology
Adaptive capacity	Maturity	Quaternary geology DEM	Supratidal (2-5 m elevation), and to a lesser extent intertidal environments(< 2 m), exhibit past capacity to resist erosion & build elevation Higher elevations (5-10 m) unlikely to be exposed to marine and terrestrial hydrological processes that build elevation	1=Elevation > 5 m and Elevation < 10 m 2=Elevation < 2 m 3 = Elevation > 2 m and Elevation < 5 m

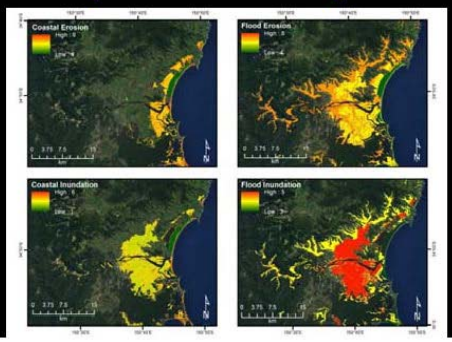
Marine drivers causing inundation

Component	Indicator	Input data set	Explanation	Cell score and description
Exposure	Deposit type Elevation	Quaternary geology DEM	Marine deposits (lesser extent estuarine deposits) exhibit greater exposure to marine drivers then estuarine and alluvial units, sequentially Low elevations exhibit greater exposure to marine drivers	3=Coastal unit + Elevation < 5 m 2=Estuarine unit + Elevation < 5m 1=Coastal/Estuarine unit + Elevation > 5m 1=Alluvial unit + elevation < 5 m
Sensitivity	Equal sensitivity			
Adaptive capacity	Maturity	Quaternary geology DEM	Supratidal environments (2-5 m elevation), and to a lesser extent intertidal environments(< 2 m), exhibit past capacity to resist erosion and build elevation Higher elevations (5-10)m unlikely to be exposed to marine and terrestrial hydrological processes that build elevation	1=Elevation > 5 m and Elevation < 10 m 2=Elevation < 2 m 3 = Elevation > 2 m and Elevation < 5 m

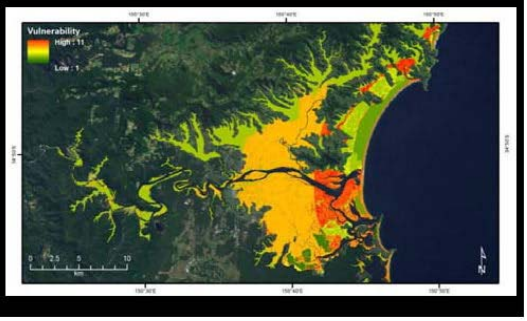
Coastal/Flood Inundation/Erosion



Coastal/Flood Inundation/Erosion



Combined Vulnerability



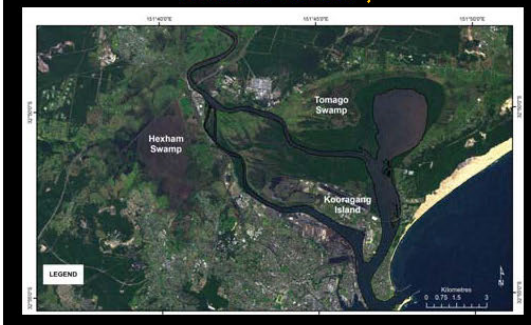
Outcomes for NRM

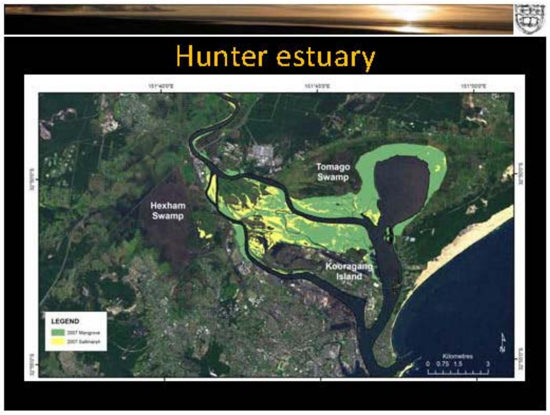
- Qualitative assessment of vulnerability of estuaries and nearby low-lying land to climate change
- Incorporates a range of drivers that cause inundation and erosion
- Can be used to identify hotspots of vulnerability
- Assessment is not quantitative; hence hotspots should be targeted for detailed assessment of vulnerability.
- Can be integrated with socio-economic datasets such as land-use, and utilities.

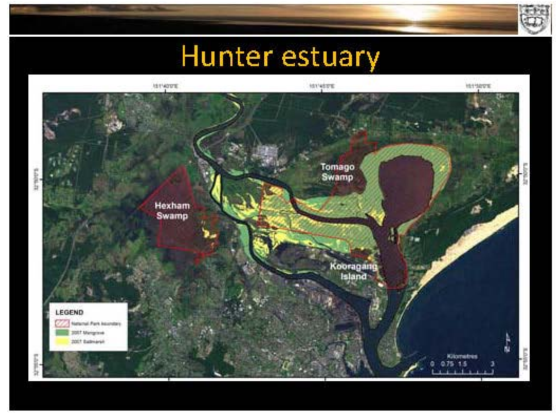
Second-pass assessment of estuary vulnerability

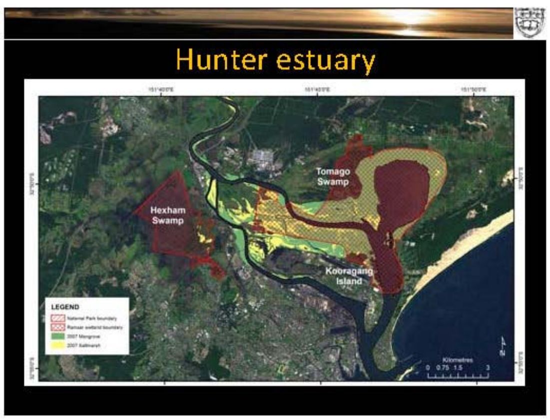
- System focussed – whole estuary and floodplain
- Applies higher resolution data; though some trade-offs may be necessary due to spatial scale of analysis.
- Data manipulation will allow exploration of different climate change and management scenarios

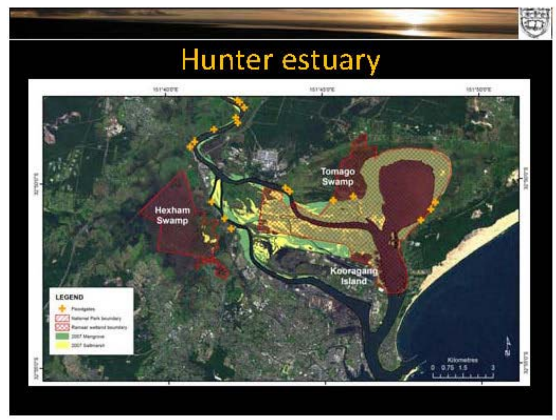
Hunter estuary

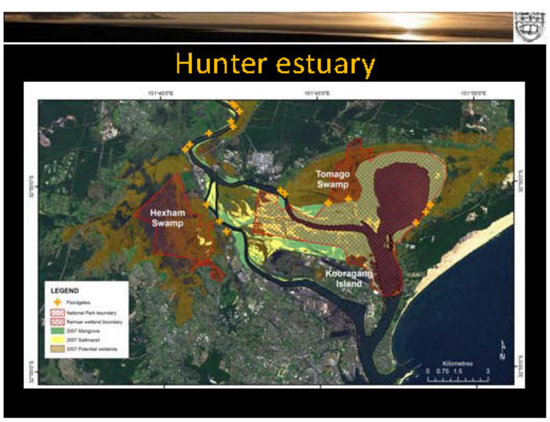


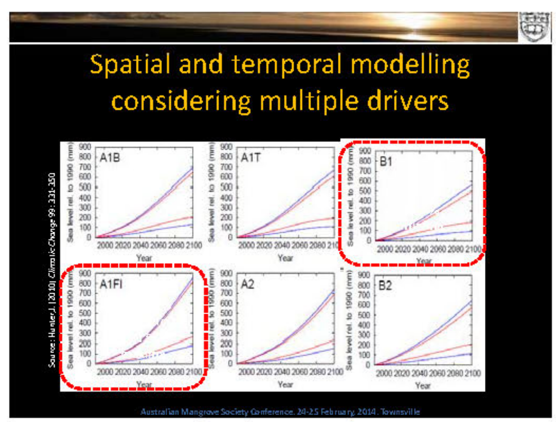

Hunter estuary
Tomago Swamp
Hexham Swamp
Kooragang Island
LEGEND
Kilometres
0 0.75 1.5 3

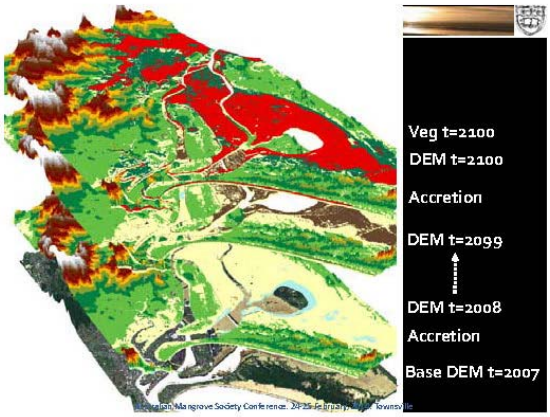

Hunter estuary
Tomago Swamp
Hexham Swamp
Kooragang Island
LEGEND
Kilometres
0 0.75 1.5 3


Hunter estuary
Tomago Swamp
Hexham Swamp
Kooragang Island
LEGEND
Kilometres
0 0.75 1.5 3

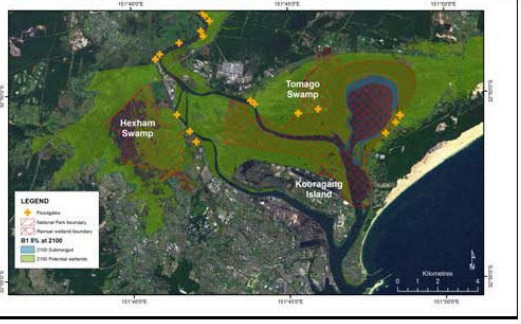

Hunter estuary
Tomago Swamp
Hexham Swamp
Kooragang Island
LEGEND
Kilometres
0 0.75 1.5 3


Hunter estuary
Tomago Swamp
Hexham Swamp
Kooragang Island
LEGEND
Kilometres
0 0.75 1.5 3

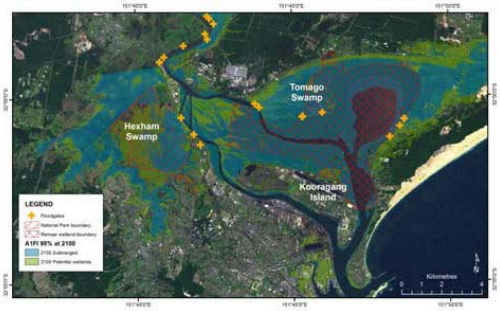

Spatial and temporal modelling considering multiple drivers
Source: Hunter J. (2010) Climatic Change 99: 331-350
A1B
A1T
B1
A1FI
A2
B2
Sea level rel. to 1990 (mm)
Year
Australian Mangrove Society Conference, 24-25 February, 2014, Townsville



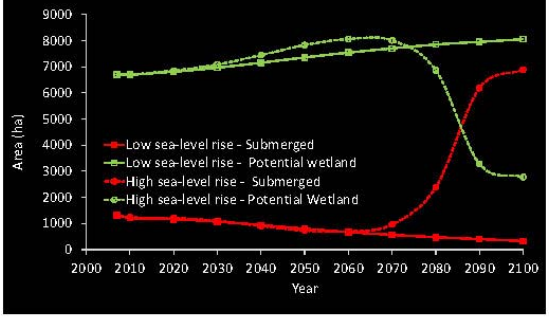
Low SLR Scenario



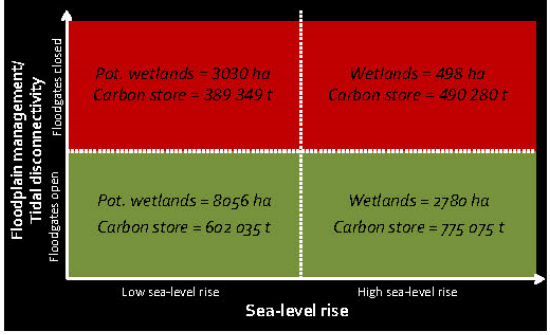
High SLR Scenario



Adaptation and resilience



Ecosystem Services



Outcomes for NRM

- **Does not predict the distribution of coastal wetlands at 2100**
  A range of other factors will also influence their distribution, such as:
  - Future developments and planning actions
  - Manipulation of hydrodynamics
  - Physical expression of climate change drivers on an estuary
- **Does allow exploration of actions that improve adaptation and resilience of coastal wetlands,**
  e.g. low SLR, opening floodgates, improving sedimentation

  Facilitates exploring management actions to improve ecosystems services

Limitations and further work

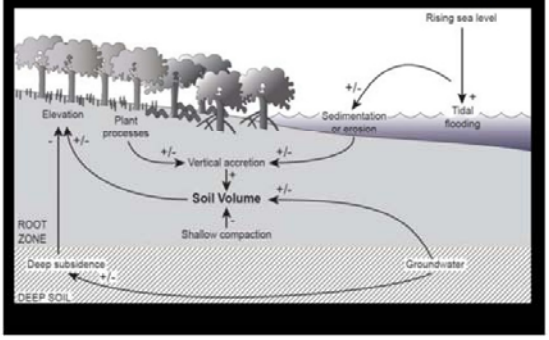
- Limitations:
  - Minimum data requirements are accretion and DEM. This is not available for many (most) estuaries
  - Utility is limited by the quality of input data
- Further work:
  - Compare 2nd pass assessment approaches e.g. Statistical modelling of SE (here) vs Sea Level Affecting Marshes Model (SLAMM)
  - Extend to other estuaries e.g. Tweed River and Moreton Bay

Third-pass assessment of estuary vulnerability

- Small spatial scale
- Applies higher resolution data with fewer trade-offs in data quality

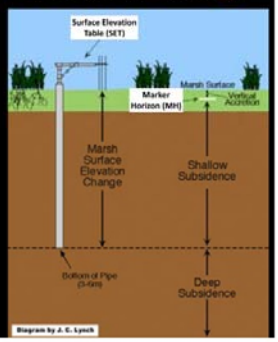
Ukerebagh Island, Tweed River

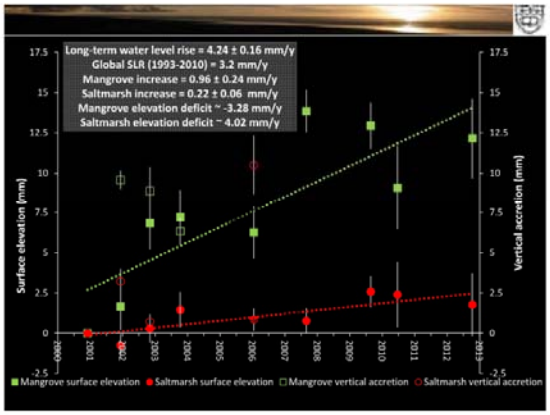
Drivers of surface elevation change

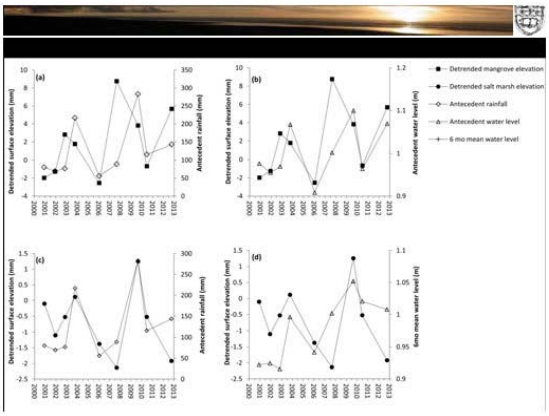


Monitoring surface elevation change

1. Monitor:
   - elevation, accretion and subsidence using SET-MH
   - hydrological and climatic variables
   - spatial distribution of vegetation communities
2. Establish relationships between components
3. Apply relationships to project surface elevation change







Outcomes for NRM

- Identifies:
  - Processes driving surface elevation change and adaptation to SLR; (e.g. 1st driver = long-term water level changes, or SLR; 2nd driver = climatic perturbations)
  - Areas exhibiting greater capacity to adapt to SLR; (e.g. mangrove > saltmarsh)
  - Climatic conditions which reduce the resilience of an ecosystem; (e.g. low rainfall, El Nino conditions)
  - Deficits between elevation adjustment and SLR (elevation deficit);
  - Lags between SLR or other perturbation and adaptation response.
- Triggers for management intervention may be designated on the basis of elevation deficits and lags between perturbations and elevation adjustment
- Informs discussion of catchment processes limiting ecosystem resilience
- May be up-scaled to second-pass assessments

Limitations and further work

- Limitations:
  - Data intensive and can be supplemented with additional biogeochemistry and hydrodynamic data
  - Utility is limited by the quality of input data
  - Up-scaling to 2nd pass approaches may be limited by the spatial resolution of analyses
- Further work:
  - Apply data to project small scale ecosystem changes
  - Up-scale to 2nd pass assessment approach

Questions?

Acknowledgements

- Neil Saintilan – OEH; Colin Woodroffe – UOW; Donald Cahoon – USGS
- Field assistance with SET installation – Kylee Wilton, Nick Wilson, Debashish Mazumder, Kamal Hossain and others.
- Data sources – NSW Coastal comprehensive assesment, Tweed Shire Council, OEH
- Data analysis - % carbon at ANSTO

Appendix F Cereal modelling presentation

Climate Change Adaptation for Natural Resource Management in East Coast Australia project.

BIOPHYSICAL RESEARCH

Christine Hosking
Morena Mills
Cath Lovelock

Planners Working Group Workshop
29-30 April 2014

BIOPHYSICAL RESEARCH

Aim

To develop case-study agricultural/horticultural climate change models in the East Coast Cluster

Research questions

1. What are the main variables influencing crop distribution?
2. Where do the highest probability areas of viable agriculture/horticulture occur in the landscape?
3. Comparison of suitable areas now and future?

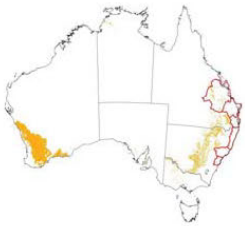
BIOPHYSICAL RESEARCH

1. Cropping

Mostly relevant to Fitzroy Basin

- Min temp and rainfall in planting window (April/May)
- Rainfall and min temps growing period (May-Oct)
- Max temps summer (Dec/Jan/Feb)

Sources:
Richard Sequeira, Principal Research Scientist (DAFF, Emerald)
Peter Long (FBA, Rockhampton)



BIOPHYSICAL RESEARCH

Methods

MaxEnt:
Species distribution modelling (SDM) program for modelling species distributions from presence-only species records.

Estimates the relationship between species records at sites and the environmental and/or spatial characteristics of those sites.

Algorithm attempts to get as close as possible to an estimate of the probability that the species is present, given the environment.

Develops predictive models to display spatial probability distributions of species.

The MaxEnt models for this study were developed at 10 x 10 km grid cell size.

BIOPHYSICAL RESEARCH

Two Global Climate Models will be used:

1. CSIRO Mk3.5 (hot/dry future)
2. MIROC-M (less warming/wetter future)

With the A1FI scenario:

Represents a future of rapid economic growth, a global population that peaks in mid-century and a continuation of high energy demand being met by fossil fuel sources (CSIRO, 2011).

BIOPHYSICAL RESEARCH

Environmental variables

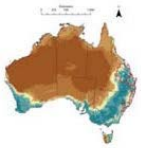
- Seasonal max/min temps (current baseline and at 2020-2035) (BOM/CSIRO)
- Seasonal rainfall (current baseline and at 2020-2035) (BOM/CSIRO)
- Elevation
- Erodibility(MCAS-S)
- Soil types (ABARES/MCAS-S)

BIOPHYSICAL RESEARCH

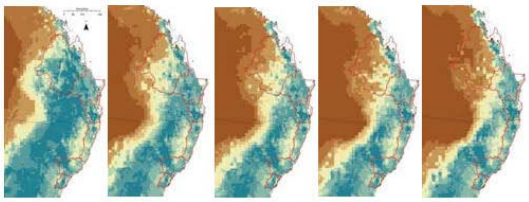
Cropping

Results

Blue = higher probability
Brown = lower probability



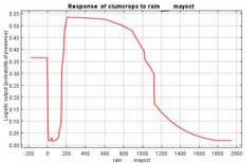
MaxEnt prediction for current (baseline) climate.

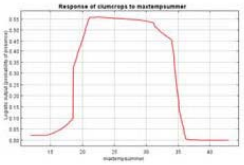


Current 2020 2025 2030 2035

BIOPHYSICAL RESEARCH

Results:





AUC = 0.761
(no better than average AUC = 0.5)

Variable	Percent contribution
Rain may - oct	84.9
Max temp summer	12.6
Av rain summer	0.7
Cracking clay	0.7
Erodibility	0.6
Elevation	0.5
Red duplex	0
Massive earths	0
Yellow duplex	0
Min temp may-oct	0

2. Avocado

Occurs throughout the ECC

- July minimum temperatures below 15°C (for flower induction) but above 4°C (to avoid cold damage).
- September minimum temperature above 12°C for effective pollination.
- Temperatures below 33°C during flowering and fruiting (October or November depending on the region) to avoid the negative impact of high temperatures on fruit set.

Sources:
David Putland (GrowCom)
John Tyas (Avocados Australia)

BIOPHYSICAL RESEARCH

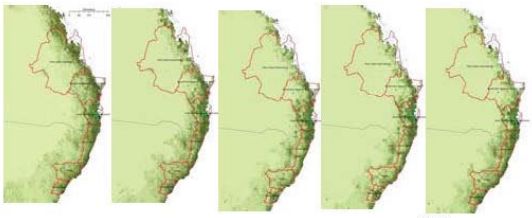
MaxEnt model 2020

Climate envelope model 2020 (Mallerie et al, 2010)

Avocado

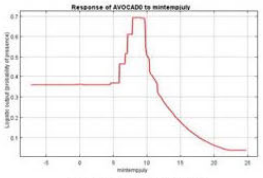
Results

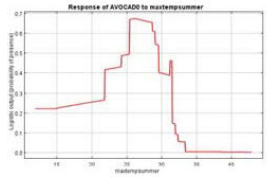
Darkening green = higher probability



Current 2020 2025 2030 2035

BIOPHYSICAL RESEARCH





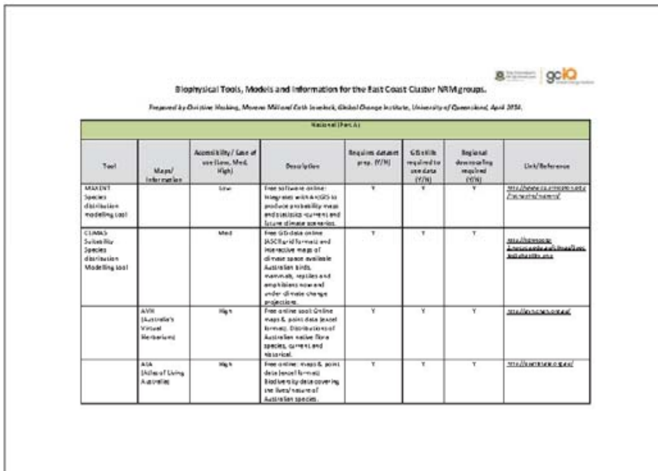
AUC = 0.968
(no better than average AUC = 0.5)

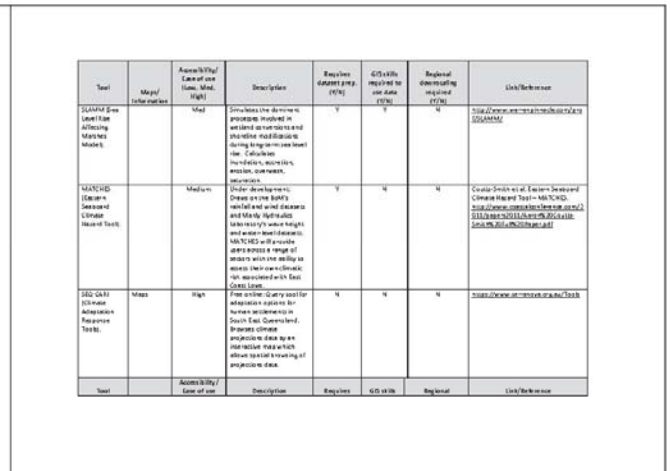
Variable	Percent contribution
Max temp summer	65.9
Elevation	12.7
Min temp july	11
Cracking clay	2.8
Yellow duplex	2.3
Av rain summer	2.2
Massive earths	1.8
Erodibility	1
Red duplex	0.2
Min temp may-oct	0

BIOPHYSICAL RESEARCH

Summary

- Results generally correspond with known most important climatic variables:
  - Rainfall in growing period (May-Oct) contributed most to **cropping** and was the most important variable in the model (jacknife test).
  - Maximum summer temperature contributed most to **avocado** and was the most important variable in the model.
- These models can potentially assist in decisions regarding highest probability areas for agriculture in the ECC under climate change.


Biophysical Tools, Models and Information for the East Coast Cluster NRM groups.
National (Part A)
Tool
Maps/ Information
Accessibility / Ease of use (Low, Med, High)
Description
Requires dataset prep. (Y/N)
GIS skills required to use data (Y/N)
Regional downscaling required (Y/N)
Link/Reference
MAXENT Species distribution modelling tool
Low
Free software online: integrates with ArcGIS to produce probability maps and statistics current and future climate scenarios.
Y
Y
Y
CLIMAS Suitability Species distribution Modelling tool
Med
Free GIS data online (ASCII grid format) and interactive maps of climate space available Australian birds, mammals, reptiles and amphibians now and under climate change projections.
Y
Y
Y
AVH (Australia's Virtual Herbarium)
High
Free online tool: Online maps & point data (excel format). Distributions of Australian native flora species, current and historical.
Y
Y
Y
ALA (Atlas of Living Australia)
High
Free online: maps & point data (excel format). Biodiversity data covering the flora/fauna of Australian species.
Y
Y
Y


Tool
Maps/ Information
Accessibility/ Ease of use (Low, Med, High)
Description
Requires dataset prep. (Y/N)
GIS skills required to use data (Y/N)
Regional downscaling required (Y/N)
Link/Reference
SLAMM (Sea Level Rise Affecting Marshes Model).
Med
Simulates the dominant processes involved in wetland conversions and shoreline modifications during long-term sea level rise. Calculates inundation, accretion, erosion, overwash, saturation.
Y
Y
N
MATCHES (Eastern Seaboard Climate Hazard Tool).
Medium
Under development. Draws on the BoM's rainfall and wind datasets and Manly Hydraulics Laboratory's wave height and water level datasets. MATCHES will provide users across a range of sectors with the ability to assess their own climatic risk associated with East Coast Lows.
Y
N
N
SEQ CARI (Climate Adaptation Response Tools).
Maps
High
Free online: Query tool for adaptation options for human settlements in South East Queensland. Browses climate projections data by an interactive map which allows spatial browsing of projections data.
N
N
N
Tool
Accessibility/ Ease of use
Description
Requires
GIS skills
Regional
Link/Reference


References:
Commonwealth Scientific and Industrial Research Organisation (CSIRO) (2011) Exploring climate change scenarios for Australia.
Phillips, S.J., Anderson R.P. and Schapire, R.E. (2006) Maximum entropy modeling of species geographic distributions. Ecological Modelling 190, 231-259.

Appendix G Regrowth benefits, Ready Reckoner and common framework presentations

Opportunities for carbon farming in the east coast cluster

Original offer… building on previous work

Document potential for carbon farming (broad-acre land-based activities), risks from climate change and potential co-benefits to biodiversity

- Carbon Farming Initiative policy development and implementation, especially around native forest methodologies
- Forest carbon-stock modeling
- Land and weed management knowledge
- Fire, salinity and other risks
- Online tool development
- Mapping potential for biodiversity co-benefit from reforestation

Opportunities for carbon farming in the east coast cluster

Late last year… milestone -> identify models to be used

Carbon storage potential
- Maximum above ground biomass (NCAS)
- Landuse mapping
- Vegetation condition

Biodiversity benefit
- % pre-clearing type remaining
- % native veg in 10km
- Suitability for threatened species
- Connectivity to native veg

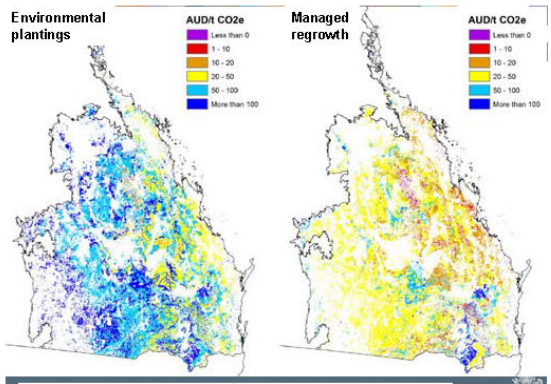
Opportunity cost
- Farm profitability
- Cost of establishment and maintenance
- Discount rate
- Permanence requirement

Hotspots/blackspots for carbon farming

e.g. Polglase *et al.*, Evans *et al.* in review – plus report on risks (fire, weeds, salinity)

Parameters used in Evans et al. study of CFI profitability

Variable	Primary value	Source
Discount rate (%)	10	Paul et al. (2013a), Polglase et al. (2013)
Project duration (yrs)	100	
Opportunity cost ($/ha)	Profit full equity (PFE)	Marinoni et al. (2012)
Establishment costs ($/ha)		
Environmental Plantings	2,000	Crossman et al. (2011), Polglase et al. (2013)
Environmental Plant (RF)	8,000	Catterall & Harrison (2006)
Managed Regrowth	0	Commerford et al. (2011), Schirmer & Field (2000)
Management cost ($/ha/yr)	40	Commerford et al. (2011), Bryan & Crossman (2013)
Market participation costs		
Transaction cost ($ per t CO2-e)	1	Paul et al. (2013a), Commerford et al. (2011)
Monitoring ($/ha/yr)	10	Paul et al. (2013a), Commerford et al. (2011)
Project establishment ($/ha)	100	Paul et al. (2013a), Commerford et al. (2011)



Evans, Carwardine, Fensham, Butler, Wilson, Possingham & Martin (in review)

Issues

- Fitness for purpose
  - Really what the planners need? Dry report vs. model black box…
  - Are assumptions in models (re costs etc.) appropriate?
  - How to accommodate multiple scenarios without being confusing
- Fluid policy environment
  - Instantly out of date
  - Risks evolving
  - Changes to permanence requirements
  - Market being redefined
- How to include key considerations that can't be mapped e.g. risks?

-> needed a framework for application to decision making in planning

A way forward

Alastair Buchan, Peter Arthofer & Allan Dale "**Ready Reckoner**" (monsoonal nth)

Came to attention through ongoing assessment of planner's needs – dialogue

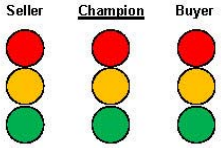
Special thanks to Melanie Cox & Rachel Eberhard

Ready reckoner may provide framework for decisions

3 standpoints for carbon projects: seller – 3rd party champion – buyer

Questions for each stand point about whether a project idea is good

Some questions can be informed by the work we are doing!



Conclusions

Little has changed in terms of work programme (i.e. tools, data)
- scope potential carbon farming project types
- identify potential and assess risks across cluster
- provide spatial data where possible e.g. biodiversity co-benefits

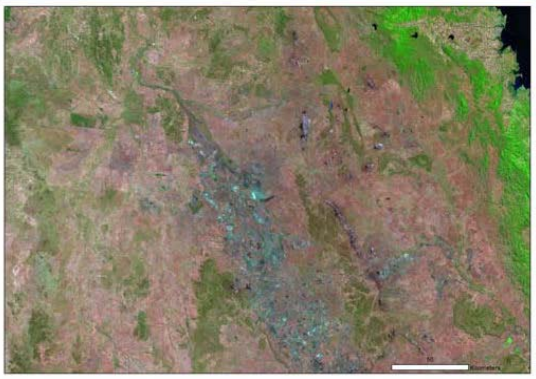
Dialogue with planners (led by planners) very productive

Framework under development will result in application ready outcome

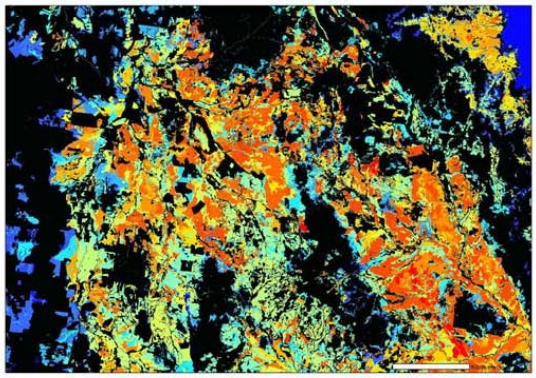
e.g. Spatial metric – biodiversity co-benefit

- Aim: map potential to support biodiversity by restoring a given site. (i.e. a score)
- Higher value if restoring:
  - Extensively cleared regional ecosystems (pre-clear)
  - Extensively cleared landscapes (remnant mapping)
  - Likely habitats for priority species (models)
  - Neighbourhoods with high habitat value (Drielsma et al)

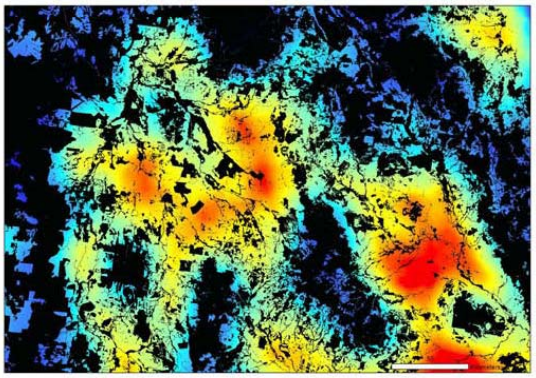
Landsat – northern Brigalow



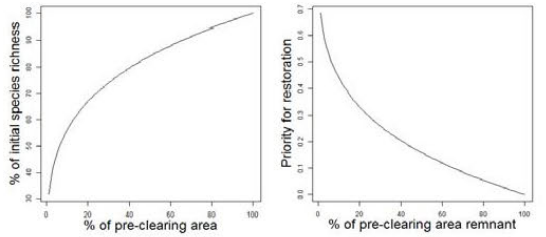
% remnant for pre-clearing ecosystems – red highest priority -> blue lowest



% remnant vegetation in 10km - red highest priority -> blue lowest

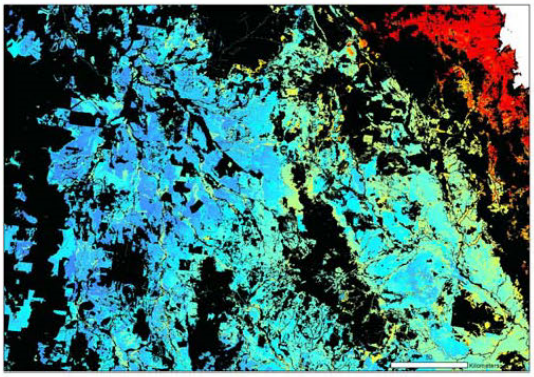


Species area transformations of area based metrics

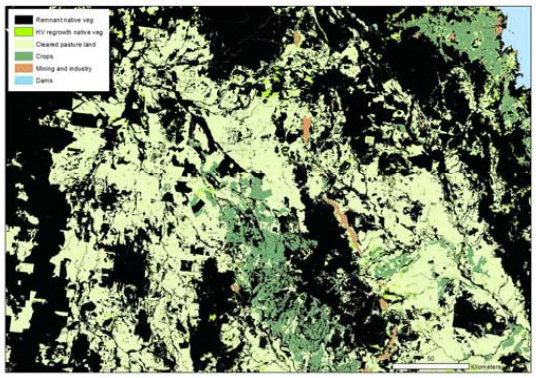


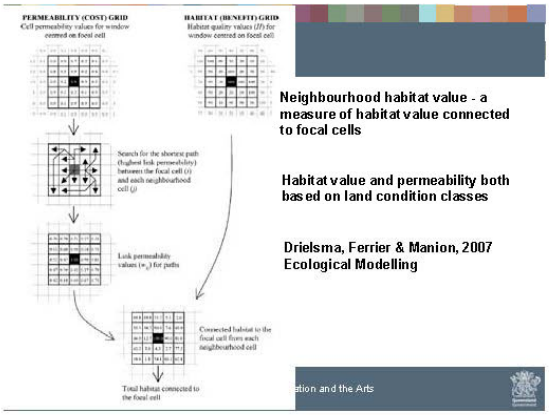
Department of Science, Information Technology, Innovation and the Arts

Priority species likelihood - red highest likelihood -> blue lowest



Land condition for connectivity analysis



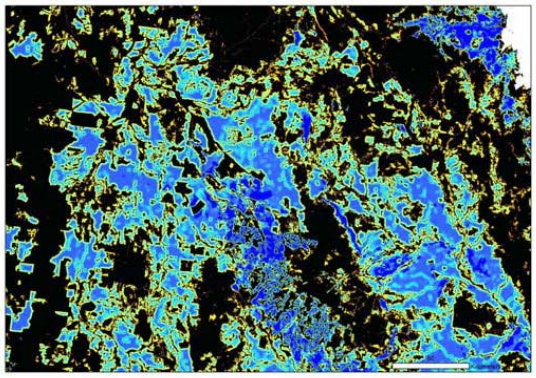


Neighbourhood habitat value - a measure of habitat value connected to focal cells

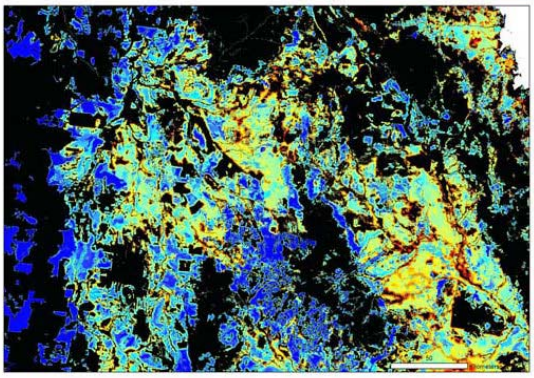
Habitat value and permeability both based on land condition classes

Drielsma, Ferrier & Manion, 2007 Ecological Modelling

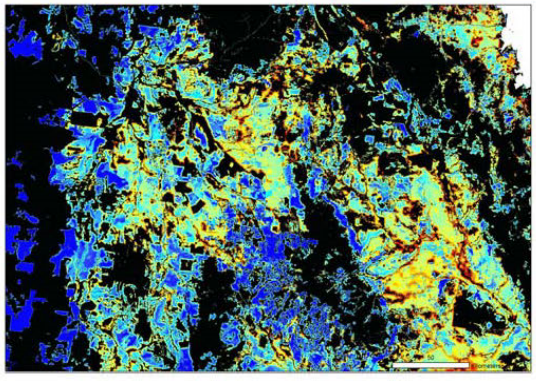
Neighbourhood habitat value - red highest priority -> blue lowest



The sum - red highest priority -> blue lowest



The sum - red highest priority -> blue lowest



NQ DRY TROPICS

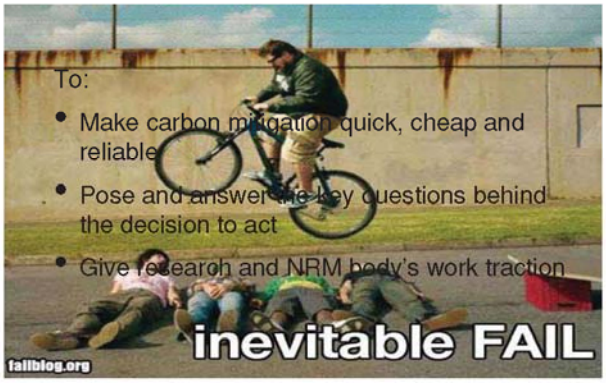
A Ready Reckoner Decision Tool for Carbon Mitigation In Monsoonal Landscapes

Alastair Buchan NQ Dry Tropics &
Allan Dale JCU

Introduction

- Why build a 'Ready Reckoner' for the Monsoonal North?
- What principles apply?
- What does the Ready Reckoner look like?
- How is the tool to be used to make decisions?
- What is the potential for technology transfer?
- What happens next?

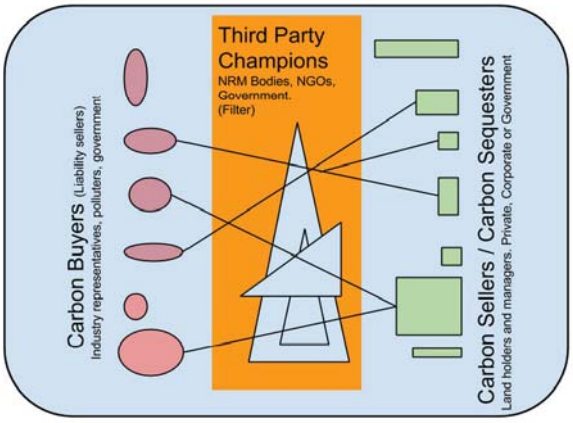
Why Build?



Principles

- Most decisions are contractual
- The process of decision making is common
- Limited number of decision making roles
- Heads of consideration are common & information based
- The most important thing to know is what it is important to know – How to ask good questions

What does it look like?



Third Party Champions (Regional NRM body)

UO = User Opinion Creating Options | UR = User Research Exploring Options | RR = In Ready Reckoner Focusing Options

#	Question	Info. Source
C1	Can you identify buyers or sellers who want to may potentially enter transactions involving landscape based carbon capture?	UR-RR
C2	Is the transaction likely to affect land or sea scapes in NRM region covered by your NRM Plan?	UO
C6	Have you identified, soil types, topography, vegetation communities, regional ecosystems or habitat with the highest and lowest potential? (Tons Carbon/Ha) (Prepare regional map with zones)	UR-RR
C 11	How might ecosystem assets / structure (biodiversity) be affected? (4 part SWOT analysis list)	UO-UR
C 19	Is the transaction area consistent with Land Use Planning Zones and Local Government Environmental / Master Plans?	UR
C 20	Is the transaction ethically and morally in the interests of the regional community?	UO

How will it be used?

To:

- Store good questions about mitigation
- Frame the research need
- Allocate the research responsibility
- Guide and speed the decisions
- Find common ground across scales & boundaries
- Give NRM bodies a clear common function

Is it transferable?

Yes as:

- The idea
- A mitigation framework
- A guide or a working tool

But customise for:

- Other transactions
- Geographic areas
- Questions over time

What's next?

- Feedback on the guide
- Complete the 1st working DST by July
- Market test DST with decision makers 2014
- Adapt and Refine
- Promote the process across NRM bodies
- Strategically market to governments

Thank You

DRY TROPICS

Common framework for carbon and biodiversity benefits

East Coast Cluster PWG
30 Apr 2014

Common framework carbon and biodiversity benefits

Aim

- Develop a common framework for prioritising investment for carbon and biodiversity outcomes.

Need

- Reduce duplication of effort; facilitate state and federal involvement or use of outputs
- Investigate inclusion of additional information to existing processes

Outputs

- Decision framework including:
  - list of factors to be considered
  - data sources available
  - Metrics, aggregation methods, spatial layers where available
- Case studies or examples

Use

- preparing regional scale maps with priority and constrained areas
- Evaluating or comparing individual sites

Content

Actions

- Revegetation, regeneration, avoided deforestation, land management (soil carbon)
- Other (mangrove, seagrass) if data available

Constraints

- Mining, other development or land use
- Cropping land

Perverse effects

- Fire risk
- Hydrology
- Weeds
- Other ecosystems (groundwater, grasslands)

Costs

- Opportunity costs

Benefits / synergies

- Carbon (national carbon accounting model maximum biomass)
- Biodiversity (biodiversity co-benefit metric or other)
- Water quality
- Salinity
- Policy fit (CFI, offsets)
- Regional priorities / synergies with existing projects
- Stakeholder priorities
- Landowner preferences
- Social benefits
- Indigenous benefits

Questions and input

- How would you use this?
- How would you like to be involved?
- What outputs would be required?
- Any comments on the list of factors, data available or examples?

DRAFT

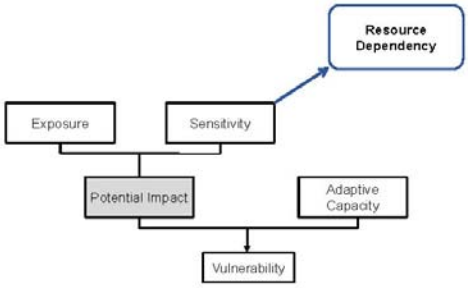
Appendix H Socio-economic vulnerability presentation

SOCIO-ECONOMIC VULNERABILITY ASSESSMENTS

UNIVERSITY OF THE SUNSHINE COAST

PLANNERS WORKING GROUP WORKSHOP
30 APRIL 2014

COMPONENTS OF VULNERABILITY



RESOURCE DEPENDENT SECTORS

1. High resource dependency = potential high sensitivity to the impacts of climate change
   a. Focus upon primary industries
2. Which primary industries where?
   a. Areas where primary industries are socially and economically significant
   b. Social significance = number of persons employed
   c. Economic significance = value of agricultural commodities produced (VACP)

SOCIAL SIGNIFICANCE

The number of persons employed in the agricultural sectors across the NRM regions in the East Coast Cluster

	Fitzroy	Burnett-Mary	SEQ	Northern Rivers	Hunter-Central	Hawkesbury-Nepean	Sydney Metro
Nursery & Floriculture	90	203	997	274	287	714	244
Mushroom & Vegetable Growing	51	1,055	1,956	542	200	1,398	452
Fruit & Tree Nut Growing	221	1,590	1,805	1,822	306	273	128
Sheep, Beef Cattle & Grain farming	4,445	2,695	2,654	4,270	2,306	1,128	568
Dairy Cattle Farming	41	449	562	664	617	207	106
Other Crop Growing	219	1,001	453	488	64	22	30
Poultry Farming	20	32	675	121	417	620	129
Deer Farming	0	0	0	0	0	0	3
Other Livestock Farming	58	298	540	250	818	411	134

Source: Australian Bureau of Statistics; Census of Population and Housing, 2011

SOCIAL SIGNIFICANCE

The number of persons employed in the agricultural sectors across the NRM regions in the East Coast Cluster

	Fitzroy	Burnett-Mary	SEQ	Northern Rivers	Hunter-Central	Hawkesbury-Nepean	Sydney Metro
Nursery & Floriculture							
Mushroom & Vegetable Growing		1,055	1,956			1,398	
Fruit & Tree Nut Growing		1,590	1,805	1,822			
Sheep, Beef Cattle & Grain farming	4,445	2,695	2,654	4,270	2,306	1,128	
Dairy Cattle Farming							
Other Crop Growing		1,001					
Poultry Farming							
Deer Farming							
Other Livestock Farming							

Source: Australian Bureau of Statistics; Census of Population and Housing, 2011

ECONOMIC SIGNIFICANCE

The Value of Agricultural Commodities Produced (VACP) across the NRM regions in the East Coast Cluster

	Fitzroy ($m)	Burnett-Mary ($m)	SEQ ($m)	Northern Rivers ($m)	Hunter-Central ($m)	Hawkesbury-Nepean ($m)	Sydney Metro ($m)
Fruit	27.8	196.4	129.7	167.4	10.7	16.1	1.5
Nurseries/cut flowers/turf	8.5	39.7	184.9	62.3	33.8	158.5	*
Vegetables for human consumption	9.4	305.3	340.9	51.4	10.9	164.9	5.4
Livestock slaughterings	682.6	330.5	422.3	574.5	336.5	335.0	4.3
Livestock products	9.5	69.4	78.1	127.8	144.0	100.5	*
Broadacre crops	259.7	154.6	42.1	83.5	34.9	10.2	*

Source: Australian Bureau of Statistics; Agricultural Census 2010-11

ECONOMIC SIGNIFICANCE

The Value of Agricultural Commodities Produced (VACP) across the NRM regions in the East Coast Cluster

	Fitzroy	Burnett-Mary	SEQ	Northern Rivers	Hunter-Central	Hawkesbury-Nepean	Sydney Metro
	($m)	($m)	($m)	($m)	($m)	($m)	($m)
Fruit		196.4	129.7	167.4			
Nurseries/cut flowers/turf			184.9			158.5	
Vegetables for human consumption		305.3	340.9			164.9	
Livestock slaughterings	682.6	330.5	422.3	374.5	336.5	335.0	
Livestock products				127.8	144.0	100.5	
Broadacre crops	259.7	154.6					

Source: Australian Bureau of Statistics; Agricultural Census 2010-11

WHICH SECTORS WHERE?

1. **Horticulture (employment & VACP classifications align)**
   a. Fruit; Vegetables; Nursery/Floriculture
2. **Grazing**
   a. Econ: Livestock slaughterings, Livestock products
   b. Social: Sheep, Beef Cattle & Grain farming; Dairy Cattle Farming
3. **Cropping**
   a. Econ: Broadacre crops

WHICH SECTORS WHERE?

1. **Horticulture (employment & VACP classifications align)**
   a. Fruit; Vegetables; Nursery/Floriculture
2. **Grazing**
   a. Econ: Livestock slaughterings, Livestock products
   b. Social: Sheep, Beef Cattle & Grain farming; Dairy Cattle Farming
3. Cropping
   a. Econ: Broadacre crops (excluded from May milestone)

	Horticulture	Grazing	Cropping
Fitzroy		✓	✓
Burnett-Mary	✓	✓	✓
South East Queensland	✓	✓	
Northern Rivers	✓	✓	
Hunter-Central Rivers		✓	
Hawkesbury-Nepean	✓	✓	

WHICH SECTORS WHERE?

1. **Horticulture (employment & VACP classifications align)**
   a. Fruit; Vegetables; Nursery/Floriculture
2. **Grazing**
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   a. Econ: Broadacre crops (excluded from May milestone)

	Horticulture	Grazing	Cropping
Fitzroy		✓	✓
Burnett-Mary	✓	✓	✓
South East Queensland	✓	✓	
Northern Rivers	✓	✓	
Hunter-Central Rivers		✓	
Hawkesbury-Nepean	✓	✓	

DETERMINANTS OF SOCIO-ECONOMIC VULNERABILITY

RESEARCH
Studies of vulnerability to climate change impacts

1. Systematic Literature Review
2. NSW/QLD focus
3. Considerable diversity in approaches used
4. Typically at smaller scales (e.g., Cairns, one sector)
5. High reliance on primary data

DATA
Secondary data sources

1. Easily accessible – can be extended in the future
2. Customise to NRM boundaries
3. Changes to data collection
4. Sub-NRM scales
   a. Issues of small counts
5. Classification issues
   a. Differences between Ag. Census & Population Census

DETERMINANTS OF SOCIO-ECONOMIC VULNERABILITY

RESEARCH
Studies of vulnerability to climate change impacts

DATA
Secondary data sources

1. % of labour force employed in agriculture
2. Socio-economic disadvantage
3. Economic Diversity
4. Remoteness
5. Age (workforce; owner managers)

DETERMINANTS OF SOCIO-ECONOMIC VULNERABILITY

RESEARCH
Studies of vulnerability to climate change impacts

DATA
Secondary data sources

1. % of labour force employed in agriculture
2. Socio-economic disadvantage
3. Economic Diversity
4. Remoteness
5. Age (workforce; owner managers)

Multiple Lines of Evidence Approach
Areas in which multiple determinants intersect suggest *potential vulnerability*

ANTICIPATED OUTPUTS

Date: End of May	
Executive Summary	Details of approach and data sources
Fact Sheets	Sector based for each NRM region where relevant
Example Maps	Refined version of today's example

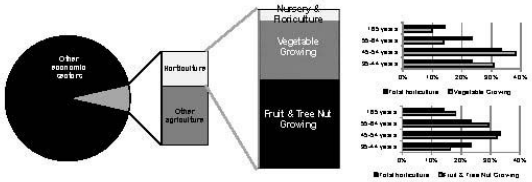
Date: Start of December	
Final maps	All sectors in relevant NRM regions
Info Graphics	Graphic summary of fact sheet information
Trends over time	Subject to data availability
Case studies?	

FACT SHEETS

Example: Burnett Mary Horticultural Sector

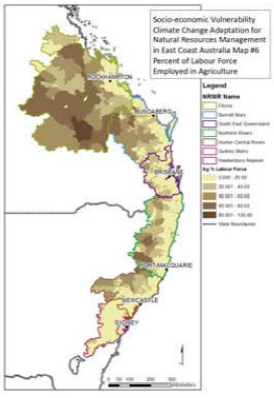
INFO GRAPHICS

Example: Burnett Mary Horticultural Sector

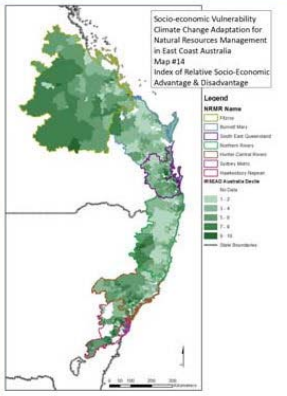


MAPS – 2011 SNAPSHOT

Percent of Labour Force Employed in Agriculture



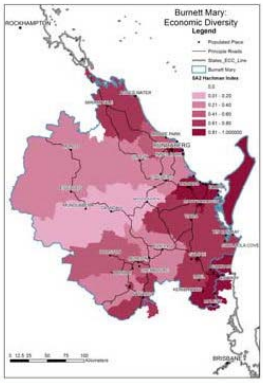
Index of Relative Socio-economic Advantage and Disadvantage



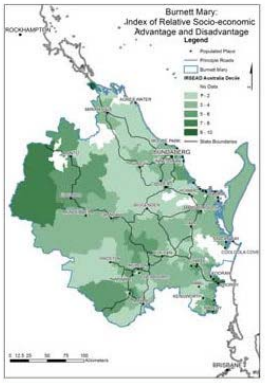
Maps for each agricultural sector in Relevant NRM Regions

Example: Burnett Mary Horticultural Sector

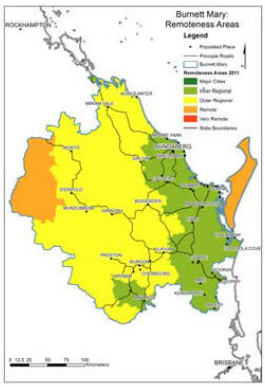
Economic Diversity



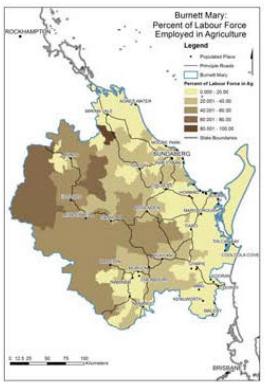
Index of Relative Socio-economic Advantage and Disadvantage



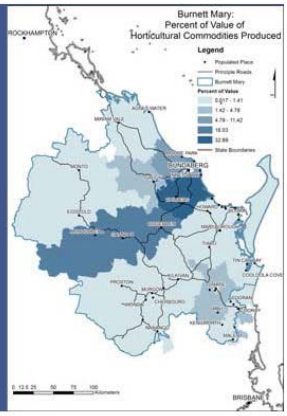
Remoteness Areas



Percent of Labour Force Employed in Agriculture

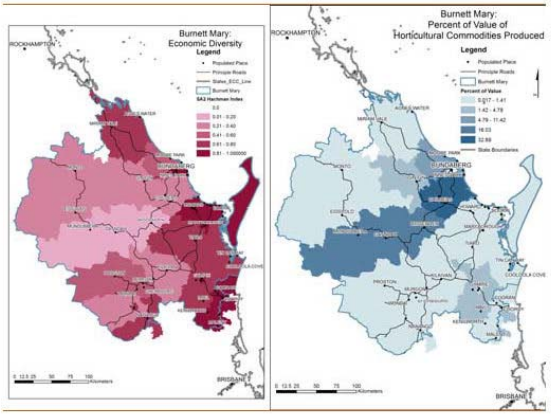


Percent of Value of Horticultural Commodities Produced



COMBINING LINES OF EVIDENCE...

Example 1
Economic Diversity & Value of Horticultural Commodities Produced



POINTS FOR DISCUSSION

1. Feedback on proposed outputs
2. Breadth vs Depth?
3. Inclusion of second agricultural sector for relevant NRM regions

Appendix I Integrated Assessments presentation

East Coast Cluster: CSIRO Integrated assessments

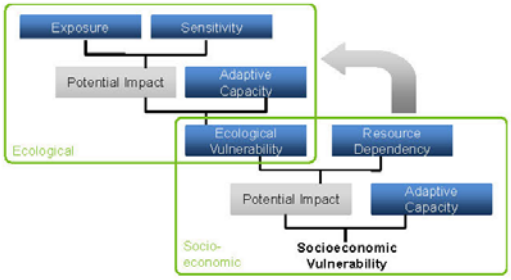
Bruce Taylor, Nadine Marshall and Ben Harman
28 March 2014

ADD BUSINESS UNIT/FLAGSHIP NAME

Integrated assessments: "Briefing notes"

- **Project Aim:** Provide info on climate impacts and opportunities
- **Our job:** To synthesise climate, carbon, ecosystems and socio-economic information across project
- **Our hope:** Briefing notes will provide platform for regions to engage with stakeholders & encourage sector-based Investment programs
- **Our strategy:** Develop "briefing notes" (3-5 pages each)
- **Our approach:** Focus on vulnerability of specific sector-landscape relationships

Understanding Vulnerability



Marshall , Tobin, Gooch, Marshall and Hobday 2012 **Ecosystems.**

Current briefing note titles

1. Grazing
2. Cereal Cropping
3. Horticulture
4. Peri-Urban
5. Coasts

Briefing Note Structure

Part 1 Sectoral and policy context
- Sector distribution / significance
- Key trends (market, environmental)
- Sector aspirations
- Policy context

Part 2 Vulnerability assessment
- Exposure (climate threats)
- Ecological vulnerability (incl. impacts and adaptive capacity)
- Social vulnerability (incl. sensitivity / resource dependency /impacts/adaptive capacity)

Part 3 Adaptation Options
- Resource / Ecosystem Interventions and enhancing adaptive capacity
- Socio-Economic Interventions enhancing adaptive capacity

Part 4
- Trade-offs & interactions

1. Grazing

Description: Increasing climate variability and changes to rainfall and temperature patterns may see different grazing landscapes and strategies in the future

Stakeholders : Grazing sector, Agforce, NSW Graziers

Region: Fitzroy, Burnett, SEQ, Hunter Central, Northern Rivers

***Part 1.* Context:** Large land user and economic activity; structural and demographic change in some regions; Changes to vegetation legislation and lease conditions; Changing supply chains and markets; animal welfare

***Part 2.* Exposure:** Temperature, water stress, increasing variability

Ecological vulnerability: Vegetation composition change, carbon balance, weed and fire risk; landscape condition

Social vulnerability: Stock losses/stress; Declining profitability; Enterprise re-structure and diversification, Management capabilities, risk management, and grazing strategies

***Part 3.* Options** Strategic re-vegetation and re-growth management; farm forestry, carbon farming; biodiversity credits; intensification;

2. Cereal Cropping

Description: Changing temperature and rainfall distribution may see the southward migration of the northern grains industry

Stakeholders: NSW Farmers, Agforce

Region: Burnett, Fitzroy, Hawkesbury-Nepean

Exposure: Temperature, water stress, rainfall distribution, increasing variability

Ecological vulnerability: Changing spatial extent of suitable cropping land; change in land uses from cropping to grazing or semi-natural environments

Social vulnerability: Decreasing profitability in current locations; Enterprise and supply chain dislocation; Land availability and conflict; Management capabilities, age structure, risk management practices

3. Horticulture

Description: Impacts of temperature and extreme events on resilience of high value-added crops (fruit, vegies, nurseries)

Stakeholders: Growcom, HAL

Regions: SEQ, Burnett, Hawkesbury Nepean, Northern Rivers

Exposure: (i)Temperature (heat stress), rainfall timing & distribution, (ii)frequency / severity of extreme events such as storms and floods;

Ecological vulnerability: Change in growing seasons, fruit setting, picking times

Social vulnerability: Enterprise and supply chain dislocation; Recovery times , management capabilities, age structure, risk management practices

4. Peri-Urban

Description: Maintaining green infrastructure assets and their benefits on the peri-urban fringe under threats of fire, weeds

Stakeholders: Local Governments, Peri-urban residents

Exposure: Temperature, rainfall

Ecological vulnerability: Vegetation composition change, carbon balance, weed and fire risk

Social vulnerability: Changes or losses in ecosystem services from green infrastructure around cities and towns (amenity, heat island, biodiversity and open space)

5. Coasts

Description: Changing coastal landforms under SLR, ecosystem change and coastal development pressures

Stakeholders: Local Governments, Tourism sector, utilities, asset managers, residents,

Exposure: Sea level rise, storm surge, rainfall

Ecological vulnerability: Coastal landform change, wetland / ecosystem migration, inundation extents

Next Steps

- Feedback from researchers (mid March, 2014)
- Feedback from Planners (today)
- We will work with all researchers and 'interpret and integrate'
- Finalise framework, 'indicators' and likely data inputs (May 31)
- Compile the briefing notes (June-November 30, 2014)
- Refine briefing notes following consultation with project team and planners (May 2015)

Thank-you!

- Contact details:

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Appendix J Overview of integrated assessment products

Table: Overview of proposed products (Briefing notes 1-5) for the "Integrated Assessment" component of East Coast Cluster

Briefing note		**1. Grazing**	**2. Cereal Cropping**	**3. Horticulture**	**4. Peri-Urban**	**5. Coasts**
Description		Increasing climate variability and changes to rainfall and temperature patterns may see different grazing landscapes and strategies in the future	Changing temperature and rainfall distribution may see the southward migration of the northern grains industry	Impacts of temperature and extreme events on resilience of high value-added crops (fruit, vegies, nurseries)	Maintaining green infrastructure assets and their benefits on the peri-urban fringe under threats of fire, weeds	Changing coastal landforms under SLR, ecosystem change and coastal development pressures
Key sector /stakeholders		Grazing sector, Agforce, NSW Graziers	NSW Farmers, Agforce	Growcom, HAL	Local Governments, Peri-urban residents	Local Governments, Tourism sector, utilities, asset managers, residents,
Focus regions		Fitzroy, Burnett, SEQ, Hunter Central, Northern Rivers	Burnett, Fitzroy, Hawkesbury-Nepean	SEQ, Burnett, Hawkesbury Nepean, Northern Rivers		
Part 1 Sectoral and policy context	• Sector distribution / significance • Key trends (market, environmental) • Sector aspirations • Policy context	Large land user and economic activity; structural and demographic change in some regions; Changes to vegetation legislation and lease conditions; Changing supply chains and markets; animal welfare				

Part 2 Vulnerability assessment	• Exposure (climate threats)	Temperature, water stress, increasing variability	Temperature, water stress, rainfall distribution, increasing variability	(i)Temperature (heat stress), rainfall timing and distribution, (ii)frequency / severity of extreme events such as storms and floods;	Temperature, rainfall	Sea level rise, storm surge, rainfall
	• Ecological Impacts (sensitivity) • Ecological vulnerability (incl. adaptive capacity)	Vegetation composition change, carbon balance, weed and fire risk; landscape condition	Changing spatial extent of suitable cropping land; change in land uses from cropping to grazing or semi-natural environments	Change in growing seasons, fruit setting, picking times	Vegetation composition change, carbon balance, weed and fire risk	Coastal landform change, wetland / ecosystem migration, inundation extents
	• Social impacts (sensitivity / resource dependency) • Social vulnerability (incl. adaptive capacity)	Stock losses/stress; Declining profitability; Enterprise re-structure and diversification Management capabilities, risk management, and grazing strategies	Decreasing profitability in current locations; Enterprise and supply chain dislocation; Land availability and conflict; Management capabilities, age structure, risk management practices	Enterprise and supply chain dislocation; Recovery times Management capabilities, age structure, risk management practices	Changes or losses in ecosystem services from green infrastructure around cities and towns (amenity, heat island, biodiversity and open space)	
Part 3 Adaptation Options	• Resource / Ecosystem Interventions and enhancing adaptive capacity • Socio-Economic Interventions enhancing adaptive capacity	Strategic re-vegetation and re-growth management; farm forestry, carbon farming; biodiversity credits; intensification;				
Part 4 Trade-offs & interactions						

DRAFT

Appendix K Adaptive learning presentation

Workshop introduction

Planners Working Group
28-29 Apr 2014

Results from previous workshop

Key points included:

- The workshop improved knowledge of regional climate change projections, but at future workshops focus more on the use of the information in planning and linking projections with impacts.
- Planning for future workshops would benefit from identifying up-front clear outputs and links to activities on the day, and lining up workshop outputs with project outputs.
- Adaptive planning cycle is not smooth but iterative with elements occurring concurrently. This has implications for the learning and improvement processes.
- Reflections or documentation of planning processes does occur, but is not necessarily available to other regional bodies or interested public (e.g. audit of CAP processes).
- There is a need to continue discussions around implementing adaptive learning and processes that can be used at the individual, organisational and community of practice level; both to enhance sharing of learnings and document processes and outcomes.
- There was definite interest in scenario planning as a technique, and this will continue to be progressed throughout the project. (Sept workshop).

Results from previous workshop

Actions proposed to be progressed before the next PWG workshop include:

- Consortium members to prepare short (1 page) summaries of research projects for input by regional bodies, including intended outputs and timing
- Adaptive learning framework and processes to be tested as possible tool to enhance learning across organisations and document current processes
- (if agreed) composite planning narrative of recent experience to be reviewed and circulated to other interested regional bodies
- Development of decision tree for consistent application of carbon and biodiversity benefits tool
- Development of framework for consistent method for choosing climate change projection models
- This review to be circulated for comment.

Workshop objectives and process

Objectives

- Provide updates on research projects, NRM planning and institutional changes
- Facilitate input to project development and progress
- Facilitate discussion of the use of project outputs in NRM planning (planning packages)
- Facilitate sharing and knowledge transfer
- Opportunity for group reflection on cluster processes so far (adaptive learning)

Process

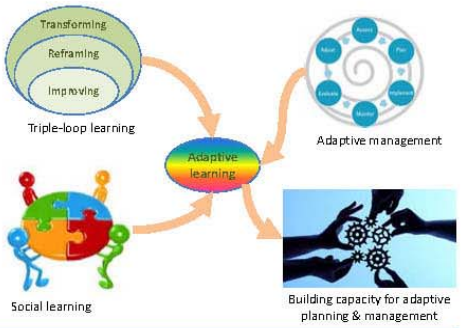
- Usually presentation followed by discussion around these questions:
  - What are the opportunities / barriers to using the results of this project in your planning / implementation?
  - How should the outputs / results be presented / made available to facilitate use?
  - What else would need to happen for you to make best use of these results?
- Evaluation

Adaptive learning

Planners Working Group
28-29 Apr 2014

Why?

- One of the key issues highlighted in previous workshops is the need for capacity building activities that reinforce institutional learning and address the issue of ongoing uncertainty.
- Tools and processes to improve adaptive learning are part of the response to that need. The aim is to refine and test a process that planners can use within their organisations to improve adaptive learning for NRM planning and implementation.
- We have developed a 'prototype' process that aims to facilitate shared (group) learning throughout a project (adaptive), while providing documentation of the process and results for wider sharing.
- We would like to test and demonstrate the process with the PWG.
- Aim is to develop and continue the process, to support further adaptive learning within regional bodies. Opportunity for input to the process.



The process – Structured group narrative development

Objective

- Ongoing learning throughout a project
- Shared / group learning (spatially disparate, multiple organisations, limited time)
- Documenting processes for wider audiences – planning packages

Elements

- Group input to narrative (iterative)
- Individual written input to narrative
- Other individual input (discussion and interviews etc)
- Actions
- Narrative construction

The process – Structured group narrative development

Process summary

Group input to narrative (now)

- Identify need, focus, objectives, timing of learning review
- Identify initial team for reflection – individual, team, wide group
- Provide group input to narrative

Individual input (afternoon session)

- Individual narratives
- Input to group narrative
- individual or group interviews

Actions

- Identify next steps for improvement and implement (Wed session)

Reflect and repeat

- Repeat as necessary
- Compile all stages together into desired narrative format.

Narrative structure

- Narrator(s)
- Audience
- Focus and objectives
- Background
- Challenge
- Action
- Results
- Turning point
- Resolution
- Choose your own adventure – next steps
- Lessons / moral

Adaptive learning

Researcher workshop
28 Mar 2014

Collaborative transdisciplinary research – working together for better NRM outcomes

Narrator

A group narrative constructed by the consortium researchers of the East Coast Cluster.

Audience

The primary audience is the ECC researchers, the narrative and/or lessons may also be shared with other research groups in the NRM research program, and more widely as a journal paper.

Focus

How can we best work together in a spatially dispersed, multi-disciplinary team, to provide research outcomes for NRM planning?

Setting

East Coast Cluster research 2013-2015

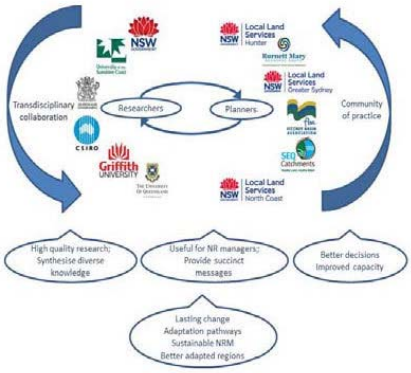
Background

In 2013, researchers from UQ, GU, USC, the Qld Herbarium, OEH and CSIRO formed the East Coast Cluster research consortium to deliver the 'Climate Change Adaptation for NRM Planning in East Coast Australia' project. The project was funded by the Australian Government as one of 8 research clusters across Australia. The East Coast Cluster includes the 6 coastal regional NRM bodies from Rockhampton to Sydney.

Some of the research team had worked together in previous projects; some had worked with the regional bodies before. The regional bodies were also funded under a different, but related scheme, to incorporate climate change adaptation into their NRM plans. Draft plans were due in June 2013 and the research was funded until 2015.

Challenge

- The challenge for the research consortium is to deliver high quality research that results in outputs that lead to managers making better decisions, leading to lasting change and adaptation pathways.
- The ultimate aim is sustainable natural resource management in regions that are well adapted to climate change. To get there, we need to provide a lasting boost to the capacity of planners in regional bodies to respond to change; we need to create a situation where what we are doing is mainstreamed.
- We need to integrate and synthesise a diverse set of data and knowledge that crosses discipline boundaries, to provide succinct message that RBs can relate and communicate. We also need to provide ways to convey messages that lead to adaptation pathways (not too negative).
- The research must be useful for NRM groups, but also high quality and interesting research. We would also like to maintain or develop successful cross-disciplinary working relationships that can continue into the future.



Action(s)

- The challenges and goals as framed above broadly fall under 3 categories:
- collaboration between researchers;
- working with the regional bodies; and
- developing the community of practice for NRM planners (PWG).
- The actions and results are discussed together under these three themes.

Action(s) – researchers working with RBs

- Formal mechanisms – PRG and PWG.
- Discrepancy in timing between research and planning
- Initial needs analysis (*did this reflect actual needs, how was it used?*)
- Request for more detailed information – one pagers - *were they a good format for providing / receiving feedback or discussion on the projects?*
- Input from regional bodies to the projects occurred through the general needs analysis, feedback on the one-pagers, discussions at the PWG workshops and individual communications between researchers and planners. Any other mechanisms? *How did this work in relation to expectations for providing input? How could the process be improved?*

Action(s) – researchers working with RBs

- Griffith University identified as the primary point of contact with the planners, responsible for organising the PWG workshops, undertaking the needs analysis and the planning packages. Benefits: clear role and responsibility for maintaining communication (to prevent liaison from becoming too diffuse), and a timeline for organising inputs. Negatives: that all of the researchers may not be available to all of the regional bodies. *How can the liaison role be used to facilitate and maximise interaction between researchers and regional bodies, without swamping everyone?*
- The UQ team also worked directly with the FBA and stakeholders to groundtruth their modelling approach. This worked really well and provided important feedback to the project. *What are the opportunities / limitations for more of this detailed contact?*
- Dialogue, discussions and general engagement between the researchers and planners are the most successful part of the project. One measure of success would be if the regional bodies see the value in the researchers as a resource, and if there is ongoing engagement in subsequent projects. The federal government will be asking the regional bodies to evaluate the researchers. *Any other success measures?*

Results so far

What happened as a result of the actions taken so far?

Choose your own adventure – next steps

Group reflection is useful to help communication (among researchers) – we will aim to have another researcher meeting before the major milestones in November (maybe September). In the meantime, we need to maintain communication and continue discussing and meeting in smaller groups.

As we approach the major milestone at the end of 2014, there may be a need to increase the frequency of interaction / speed of feedback with the regional bodies. For example, the next PWG is at the end of April, which is too late to provide input to USC for their May milestone, and also getting too late to provide input to UQ before June.

Lessons

And the morals of the story are

Planners working group – A community of practice around incorporating CC adaptation research into NRM planning

Narrator

A group narrative constructed by the planners and researchers from the East Coast Cluster.

Audience

The primary audience is the ECC planners; the narrative may be shared with other regional bodies or clusters. The process may be used by the planners within their organisations.

Focus

How can the PWG best work to facilitate incorporation of climate change adaptation research into NRM planning.

Setting

East Coast Cluster research 2013-2015

Background

In 2013, the federal government formed 8 clusters across Australia comprising research consortia and regional NRM bodies. Most of the clusters were large in area and crossed state borders.

The East Coast Cluster comprises 6 regional bodies and 6 research consortia members.

The regional bodies were contracted to incorporate climate change adaptation into their regional NRM plans.

The research consortia were contracted to provide the regional bodies with relevant, regional scale climate change adaptation information.

Challenge

What is the challenge we are trying to solve, and how would we like to see it met?

Action(s)

What have we done so far? Why are we doing that?

choose multiple specific focal points – eg workshops, PRG, etc

For each, start chronologically and narrate in steps-

this was the problem, we did this because, and then that happened, so…

Results

What has happened so far? What are the results, good and bad? What led to these, what are the possible causes?

Turning point

Has anything happened that changed what we were doing, or why?

Outcomes

What were the final outcomes? Did the story end happily?

Choose your own adventure – next steps

What are the available options for progress? What would we like to happen next? What can we do to get there?

Lessons

And the morals of the story are

What next?

- Was the process useful?
- How could it be improved?
- Is there interest in continuing?
- Next PWG for the group; individual responses as well?
- Any interest in contributing to paper or case study?
- The tool is designed to achieve 3 goals (ongoing learning, shared group learning, ongoing documentation). Are these the highest need goals for an adaptive learning tool? Are there other things it should be aiming to do?
- Is the functioning of the PWG a useful area for reflection?
- Would it be useful to also look at development of NRM plans (using previous workshop exercise as starting point?)
- (Once the tool has been further refined) do you think it would be useful within your project / organisation?
- What would be the opportunities / barriers for using the tool?
- What else is required to make the tool more useful?

Appendix L Website and Communication presentation

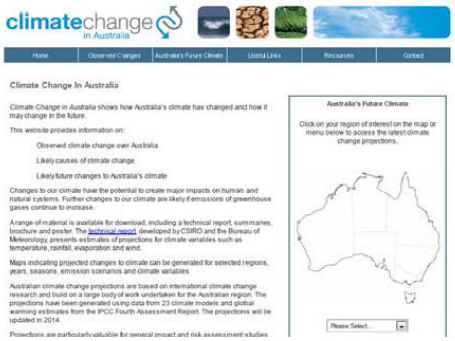
Update on web site developments and web communications

Cath Lovelock
The University of Queensland

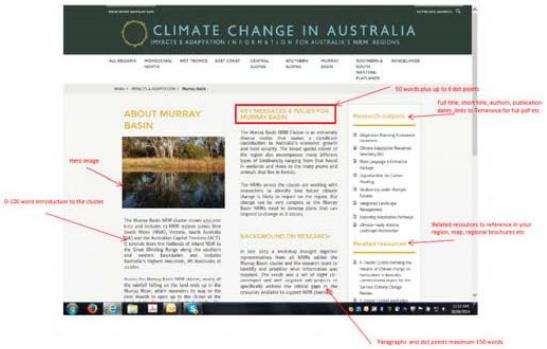
Who is in this space:

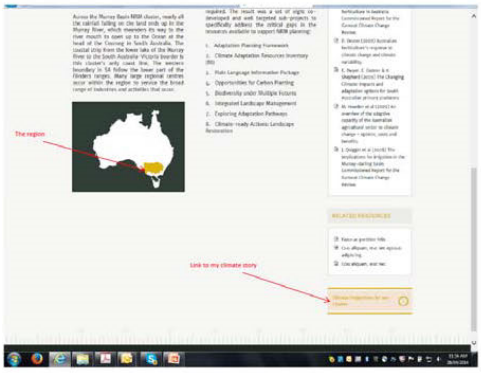
- DoE
  - Govdex
- CSIRO
  - Climate projections
  - National project website (under development)
- Griffith
  - Climate Change Adaptation Information Management Support Project
  - Directly funded from DoE
  - TerraNova

Projections http://www.climatechangeinaustralia.com.au/



CSIRO site – where we enter





Support Project Objectives

Ensure that Element 2 outputs (data and information) is:

- **Securely stored** for the long term (user driven)
- Able to be **discovered** by NRM stakeholders
- **Easily accessible** for NRM groups
- Discoverable and re-usable by a range of **secondary audiences** (e.g. LGAs, state Governments, researchers etc)

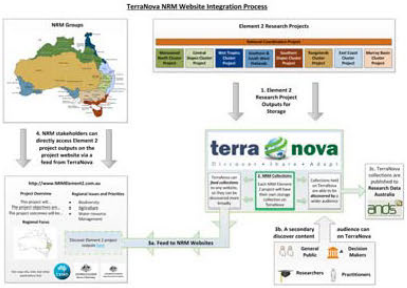
This slide from Sam Mackay

TerraNova

The Australian National Data Service (ANDS) funded Griffith University and the Queensland Cyber Infrastructure Foundation (QCIF) to develop a national information hub for climate change adaptation data and information.

Griffith UNIVERSITY

Long-term Storage Solution



A one way street?

Supporting TerraNova uploads