Government of South Australia
Adelaide and Mount Lofty Ranges
Natural Resources Management Board

Applying a climate change adaptation decision framework

for the Adelaide-Mt Lofty Ranges Natural Resource Management Board

The potential risks to Mediterranean climate regions from climate change create an immediate need to ensure that regional natural resources management systems in South Australia take these risks into account.

The possible impacts of climate change for the Adelaide Mount Lofty Ranges region are likely to be negative for many stakeholders: farmers, experiencing less rainfall and greater evapotranspiration, will need to manage pastures, livestock and crops differently to avoid loss of productivity; water managers must consider both less groundwater recharge and annual runoff, and asset managers will face increased risks of extreme rainfall events; biodiversity managers must allow for the complex implications of rapidly changing climate on ecosystems; and increased risks of bushfires and coastal flooding must also be managed.

Recognising that climate change adaptation responses can no longer be considered separately from other NRM activities, the Federal and South Australian Governments and the Adelaide and Mount Lofty Ranges Natural Resources Management (AMLR NRM) Board worked in partnership to:

(I) Develop a framework to support natural resource managers in their decision making processes for climate change adaptation.

(II) Undertake an assessment of key areas of NRM that are vulnerable to climate change.

(III) Research community perceptions of climate change impacts.

(IV) Develop and demonstrate methods to assist natural resource managers to address climate change risk and develop adaptation responses in vulnerable sectors.

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I) Adaptation Decision Framework

The sheer enormity of the climate change challenges for NRM and the uncertainty of climate projections can be overwhelming and potentially lead to action paralysis. The framework developed by this project (outlined below) shows a clear, logical progression of how NRM managers can develop climate change adaptation strategies in their regions.

1. Awareness raising and ownership of climate change.
2. Vulnerability assessment of the region.
3. Development of adaptation responses.
4. Appropriate integration of adaptation responses into management and planning activities across different timeframes:
   (a) Incorporation of climate change into risk management approaches in the short-term.
   (b) Application of adaptive management techniques that can be adjusted over time.
   (c) Application of decisions based on the precautionary principle* that allow for increased long-term risk.
   (d) Rigorous analysis of alternative adaptation actions.
5. Ongoing revision, reassessment and alteration of those approaches including cost benefit analysis.

*The Precautionary Principle suggests that where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation

II) Regional Vulnerability Assessment

A vulnerability assessment of the AMLR region to climate change, undertaken as part of the project, showed that there is significant capacity for adaptation to potential climate change by 2030. In broad terms, the most vulnerable systems were initially assessed to be those that are under less human management and control such as biodiversity conservation, or those that have long management response timeframes, namely coastal and bushfire management, biodiversity conservation and perennial horticultural systems.

Other systems, particularly water and land management, will require significant human intervention to reduce their vulnerability, particularly within important local catchments and the neighbouring Murray-Darling Basin. Marine systems were not assessed.

III) Community Perceptions Research

Research to understand how key stakeholders perceive climate risk was seen as important to ensure that methods are employed to best engage the NRM community, to identify requirements for skills and knowledge development, and to help engender community ownership of management responses to change.

IV) Adaptation Responses

It was recognised by NRM stakeholders that considerably more integrated research was needed in the region to guide specific short and long-term planning goals, as described in the decision framework. Six case studies of some of the more vulnerable systems and their interaction with climate change were developed (Table 1). The case studies were designed to trial different approaches to developing adaptation responses and to avoid replicating other work underway in the region. The geographical distribution of these case studies is outlined in Figure 1.

Adaptation responses to climate change were developed in each case study. Through the case studies, four key approaches that are increasingly being used to guide decision-making across NRM sectors were applied namely: scenario modelling; applied and participatory GIS modelling; participatory action learning; and, environmental risk analysis.

The possible application of these different approaches for future studies is outlined in Table 2. These different approaches to guiding decision making represent a spectrum of approaches from those that rely strongly on science-led analyses and scenario modelling through to stakeholder-led participatory research.

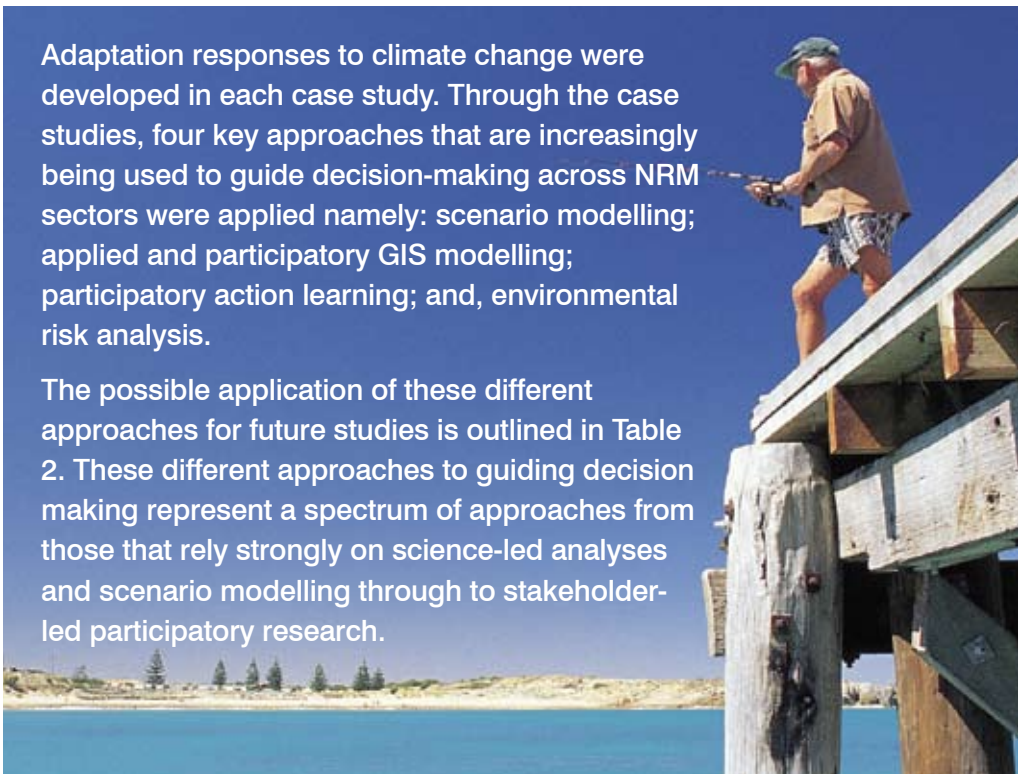

Table 1. Climate change adaptation case studies undertaken for this project

Case study	Title and Brief Description
Land capability	**Climate Change and the potential for wind erosion – a model for the Adelaide and Mt Lofty Ranges NRM region (DWLBC 2008)** This case study aimed to develop and test a scenario modelling approach to determine and analyse the possible impacts of projected climate change on the potential for soil erosion and land degradation. The results identified areas of land where the potential for wind erosion may increase, and located the most vulnerable areas of land susceptible to wind erosion. Appropriate land management practices are suggested in the report to offset any increase in the potential for erosion.
Groundwater	**Discussion paper on the potential impact of climate change on the groundwater resources of the McLaren Vale Prescribed Wells Area (Waclawik 2007)** This project analysed potential impacts of climate change on the groundwater resources of the McLaren Vale Prescribed Wells Area (PWA). The work used the McLaren Vale PWA groundwater flow model to estimate the impact of varying the rainfall recharge rate. A short discussion paper was developed to describe the implications of climate change on groundwater resources in the McLaren Vale PWA. Modelling results confirmed that previous management responses have improved the resilience of the groundwater system although the impact of climate change on groundwater dependent ecosystems was not quantified.
Biodiversity	**Modelling native and exotic flora distributions under climate change (Crossman, Bryan & Bardsley 2008)** This case study mapped changes to bioclimatic envelopes for identified species at risk due to climate change. Stakeholder surveys and feedback workshops, involving interactive discussion and revision of modelling were completed. The case study identified which species are most sensitive and where their current habitat is likely to shift in response to climate change. It also examined management opportunities to respond to those changes in relation to environmental planning, ecological restoration prioritisation and invasive species management.
Land use planning	**Room to move: towards a strategy to assist the Adelaide Hills apple industry adapt to climate change in a contested peri-urban environment (Houston & Rowland 2008)** This project examined key vulnerabilities to climate change within the apple industry in the AMLR NRM region. An interactive GIS model was developed, in consultation with industry representatives and specialists, to provide a better understanding of land suitability and resource availability for apple production under current and future climate conditions. Opportunities for adaptation in relation to land-use planning and management activities were examined.
Perennial Horticulture	**Developing industry climate change adaptation strategies: A case study for the McLaren Vale viticulture and Fleurieu Peninsula oliveculture industries (James & Liddicoat 2008)** An environmental risk assessment was undertaken in this case study to develop climate change adaptation strategies for two key horticultural industry groups in the AMLR region: the McLaren Vale grape growers and Fleurieu Peninsula olive growers. The City of Onkaparinga took the lead role in implementing the case study, engaging with key stakeholders and facilitating the adaptation planning process.
Coastal	**Mapping landscape values and perceived climate change risks for natural resources management: A study of the Southern Fleurieu Peninsula region, SA (Raymond 2008)** This project compared public perception and expert assessment of conservation values and the threats posed by climate change in the Southern Fleurieu Peninsula, with the goal of informing local climate change adaptation responses.

Table 2. The application of four key approaches to guide decision-making and development of climate change adaptation responses in the case studies

Case study	Adaptation approach	Case study process	Where approach could be used in future studies.
Land capability Groundwater	Scenario modeling	Adjusting resource condition assessments according to potential climate change scenarios to raise awareness of potential impacts and develop appropriate adaptation responses.	Scenario modelling is particularly useful when seeking specific guidance to better understand vulnerability of a natural resource. Also when good background data is available concerning the NRM issue, but specific climate change implications are uncertain.
Biodiversity Land use planning	Applied and participatory GIS modelling	Maximise engagement with industry stakeholders and natural resource managers as modelling is developed, so that key vulnerabilities can be further highlighted and responses discussed.	Applied and participatory GIS modelling is used when seeking specific guidance to better understand vulnerability of a natural resource. Also when the development of good background data concerning the NRM issue requires stakeholder input.
Perennial Horticulture	Environmental risk analysis	Conducting a formal risk assessment with impact and likelihood components to guide stakeholders through an analysis of their systems	Environmental risk analysis when trying to formally involve stakeholders in a process of analysing risk. Ideally supported with empirical data to best inform planning outcomes. Likelihoods and consequences are well understood.
Coastal	Participatory action learning	Where stakeholders need to identify and analyse local vulnerabilities to climate change in absence of information from external sources.	When community support needs to be generated and/or articulated to support difficult decision making. Particularly when seeking to generate greater awareness of climate change risks.

Key Findings:

Scenario modelling

- Scenario modelling successfully reinforced or improved the knowledge of climate change impacts and potential adaptation responses, particularly where resource use is currently close to the upper limit and is likely to become more so with projected climate change.
- Scenario modelling can suggest where a broadening of the resilience of existing management systems can significantly reduce their vulnerability irrespective of the change that eventuates (eg. McLaren Vale Prescribed Wells Area).
- Scenario modelling outputs are limited by the range of factors included in the model, incomplete knowledge of current systems and their lack of immediate application.

Applied and participatory GIS modelling

- Applied and participatory GIS modelling confirmed that better integration between scientific researchers, planners and managers of natural resources expands knowledge of current and historic resource condition and enhances the legitimacy of planning conclusions.
- The importance of good scientific evaluations and monitoring of resource condition to inform modelling cannot be overestimated. Of particular concern was the lack of detailed base-line information on sub-regional micro-climates within particular areas of the AMLR.

Environmental risk analysis

- The environmental risk assessment process raised immediate and valid concerns, but the risk assessment framework struggled to guide a broader examination of industry needs and associated natural resource management issues over the longer term.
- Due to the significant uncertainties related to climate change risk, appropriate adaptation responses will need to be framed more broadly than the specific responses to specific perceived risks.
- Rare historical events, that are becoming more common with climate change, may be discounted in risk assessments

Participatory action learning

- Climate change is likely to undermine important landscape values unless environmental planning is able to become more explicit about what is at risk within our landscapes, and as a consequence, what needs to be a focus of early attention for adaptation responses.
- Community knowledge may well be as important for guiding decision-making as the scientific information emerging from the down-scaling of global circulation models or the more detailed studies of climate impacts on future resource condition.

Key messages from this project:

- **The framework supported decision making processes and provided a clear sequence of steps for Natural Resource Managers to engage the community and develop climate change adaptation responses.**
- **The vulnerability assessment helps prioritise adaptation planning within a NRM region.**
- **Involvement of stakeholders and key decision makers is critical in developing adaptation responses, particularly where detailed local information on resource or climate conditions is unavailable or of limited quality.**
- **Information on likely impacts of climate change must include adequate reference to the level of uncertainty.**
- **While cost-benefit analyses were not undertaken in this work, more detailed future studies should incorporate the benefits of early action or costs from a lack of or inappropriateness of responses, to assess the suitability of investment.**

Consistent with good NRM practice, the industry and community representatives involved in this project identified that the sustainable management of future landscapes will require a mix of research and education, coupled with planning policies that incorporate both incentives and regulation. Positive, action-based leadership at all levels of NRM and societal governance is necessary to bring about the changes required.

Involvement of stakeholders and key decision makers is critical in developing adaptation responses

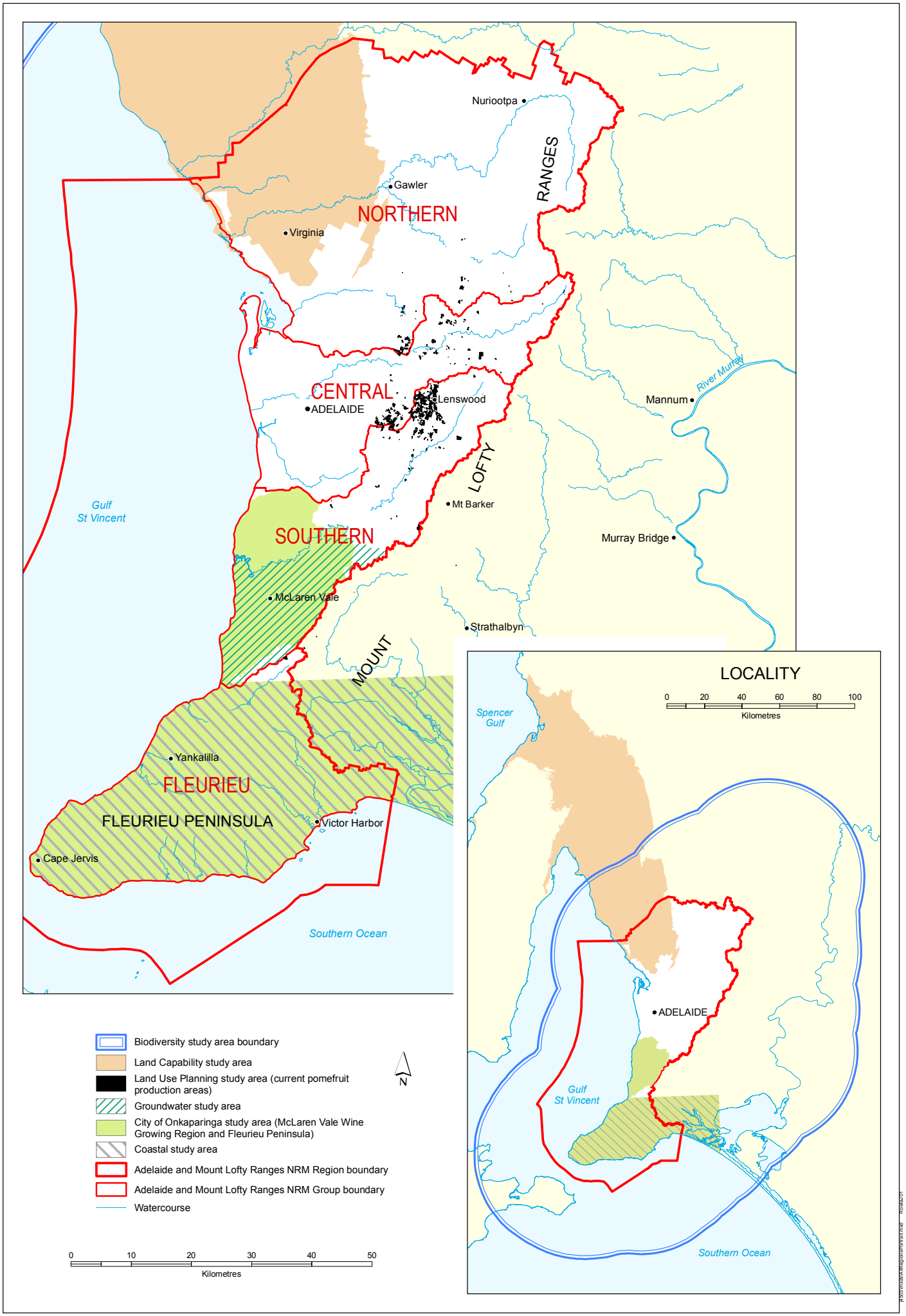

Figure 1. Map of AMLR NRM region showing the four subregions and case study areas.

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www.dwlbc.sa.gov.au/nrm/projects/rccdf/index.html

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This brochure can be cited as and is drawn from:

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