



## Climate change adaptation in the Coorong and Lower Lakes

### Introduction

Adaptation is essential to address climate change impacts. However, the capacity of natural and human systems to adapt is limited, either by the severity of the climatic perturbation, or by vulnerabilities in the system. This is one of six regional case studies of the limits to adaptation that explore the underlying causes and potential to transcend these limits.

### Context

The Coorong and Lakes Region is a large and complex wetland system of international importance located at the end of the River Murray in South Australia, where the river discharges to the Southern Ocean. It includes the mouth and lower end of the River Murray, the Coorong - a barrier lagoon, and Lakes Alexandrina and Albert. The region has been subject to continual environmental change from a range of natural and human drivers. Recent environmentally-damaging human interventions include physical barriers to prevent water flow between parts of the system. The region is highly sensitive to changes in freshwater inflow due to non-climate changes (water extraction upstream) as well as climate variability: it was under immense stress during the 2002-2010 Millennium Drought. The Region is the traditional country of the Ngarrindjeri Nation and supports a variety of communities and industries including agriculture, viticulture, boating, and tourism.

### Current stresses

The most important limit or barrier to climate change adaptation and a key current stress concerns water availability and associated arrangements for sharing water at national, state and local levels. The history of "water-sharing" and consequent "adaptation" to changing conditions (such as major technological interventions) illustrates the societal stress created by long-standing disagreements between communities, governments and a range of stakeholder groups. Two further stresses are lack of connection between parallel institutional planning initiatives (governance) as well as lack of capacity to create and maintain trust and effective working relationships between communities, governments and scientists (societal).

### Future climate scenarios

#### *A rise in temperature of 2°C*

Freshwater inflows into the region from the Murray-Darling Basin are projected to decline drastically under climate change, with higher temperatures and greater evapotranspiration. Reductions of inflows of more than 60% with a 2° C rise in average temperatures are possible



(although CSIRO do report the possibility of higher inflows under an extreme wet scenario). Loss of freshwater inflows would result in increasing salinity of the Coorong and Lakes rendering the water too salty for most biota. There would be more instances of drying of the Lakes as droughts become more frequent and inflows decline. This would result in a loss of key biota including aquatic plants, water birds and fish.

#### *A rise in temperature of 4°C*

Under a 4° C scenario of warming it is envisioned that the environment of the region would transition to a different, more marine state due to sea level rise and reduced freshwater inflows. With a sea level rise of 85-100 cm the barrages separating the Coorong from the Lakes would be over-topped resulting in inundation of low-lying lands, transition of the Lakes to a more saline condition and constriction of the estuary. Lake Albert and the Coorong would become hypersaline. Species and ecological communities would be lost due to higher salinity. New ecosystems would form, such as mudflat communities on newly inundated lands.

### Impacts of future climate change

A number of threatened species and ecological communities in the region would be lost, such as the Coorong sea grass beds, freshwater refuge areas and species of fish. As well as impacts to ecosystems due to decreased freshwater inflows and higher salinity the socio-economic impacts would be substantial. With valued aspects of the ecosystem being progressively lost, such as fisheries, the cultural and economic base of the many communities living in the region would be severely degraded. The Ngarrindjeri Nation would lose culturally important species such as Black Swans, reeds and fish. Recreational and tourism industries would

suffer as declining water levels reduce boat passage and fisheries. Loss of modest areas of low-lying farmlands and infrastructure is likely with sea level rise and saltwater intrusion into formerly freshwater areas. Livestock-based producers around the waterways would be particularly vulnerable.

At different times different thresholds will be crossed which curtail or eliminate valued aspects of the environment, economy or society. For example, shallow habitat for water birds in the south lagoon of the Coorong would become too deep at a particular point of sea level rise, and this will differ from the timing of drying events in the Lakes that prevent passage for recreational boats. Societal tensions and conflict over declining resources are a likely impact of climate change. Such tensions were seen during the Millennium Drought when there was widespread disagreement about the need for and use of technological interventions, such as the temporary barriers between different parts of the Lakes, and about the extent of risk in ecological problems such as lake-bed acidification. Such conflicts are likely to continue under a changing climate and to have a negative impact on societal cohesion and well-being in the Region.

### Adaptation: options and barriers

In the region, adaptation to upstream water extraction and to climate change are inextricably intertwined.

Five key adaptation options have been identified. These are not mutually exclusive but have different benefits, costs, risks and barriers.

1. Increase environmental flows into the Lakes and Coorong, which would be the most effective measure for sustaining the environmental, economic and social values. This option is supported by local stakeholders, but not by all interest groups in the broader Murray-Darling Basin.
2. Manage water more actively through engineering interventions such as weirs and channels. This would enable the system to be compartmentalised in dry periods into freshwater refuge and sacrifice areas.

Such engineering interventions are highly contested and create perceived winners and losers. Greater research and engagement with local communities is required to establish that the benefits would outweigh the costs. A significant risk is that organisations capable of wisely operating such infrastructure indefinitely are required: governments in the Murray-Darling Basin have not yet sufficiently demonstrated this capability.

3. Strengthen the barrages to reduce the impact of sea level rise. The IPCC anticipates an 18-59 cm rise by the end of the century, although faster and higher rises are possible. This option would be expensive.
4. Focus on better catchment management within the region, including revegetation, regulating water extraction, and measures to reduce erosion and control salinity.
5. A vital adaptation option is to create better, longer-term, governance structures which can develop greater community consensus on long-term objectives, rather than the perceived crisis-driven responses witnessed in the Millennium Drought. Local ecological knowledge and aspirations should underpin management options.

### Policy implications: Limits to adaptation

With many types of adaptation possible, it becomes unlikely that any single adaptation strategy is acceptable to all stakeholders, nor is a single strategy likely to address all the climate risks that concern all potential stakeholders.

A key finding is that adaptation options for the region have not been openly or broadly discussed as part of the “bigger picture” of Murray-Darling Basin management. This is due, in part, to bureaucratic and political constraints, inadequate community engagement, social conflict, several parallel but unconnected planning initiatives, and lack of institutional arrangements to develop a truly long-term perspective. These constraints can be addressed through the establishment of institutions that take a genuinely anticipatory and long-term approach to include two of the major long-term drivers of change: inflows from the Murray-Darling Basin and ongoing climate change.

A new regional institution is recommended, one in which local communities, including the Ngarrindjeri Nation, are respected for their local knowledge and capacity for innovation and can play a major part in formulating and managing an adaptive management vision for the area.

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This document summarises key findings from the NCCARF report ‘Limits to Adaptation in the Coorong, Murray Mouth and Lakes Alexandra and Albert.’ by Catherine Gross, Jamie Pittock, C. Max Finlayson and Michael Geddes.

Download the full report at [www.nccarf.edu.au](http://www.nccarf.edu.au)

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