

LAKE EYRE BASIN KNOWLEDGE STRATEGY

SUMMARY



**LEB MINISTERIAL FORUM
SCIENTIFIC ADVISORY PANEL**

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Background and context

The Lake Eyre Basin (LEB) Intergovernmental Agreement (2000) gives rise to a number of processes, including: annual meetings of the LEB Ministerial Forum; the biennial Lake Eyre Basin Conference; regular meetings of Departmental Officers representing the participating Governments; and regular meetings of both the Scientific Advisory Panel (SAP) and the Community Advisory Committee (CAC) for the Lake Eyre Basin (www.lebmf.gov.au/). The Agreement also mandates the Lake Eyre Basin Rivers Assessment; a review of the condition of all watercourses and catchments in the Basin to be undertaken on a ten yearly basis.

In 2002 the Lake Eyre Basin Ministerial Forum agreed on five policies under the Lake Eyre Basin Intergovernmental Agreement, to which a sixth policy was added in 2004 (see Appendix A). These included the following policy on research and monitoring:

Research and Monitoring Policy:

'Management of water and related natural resources associated with the river systems in the Agreement Area will be guided by the best available scientific information and local knowledge, and by the results of ongoing monitoring and periodic assessment of the condition of these river systems. Targeted research may also be undertaken to address identified knowledge gaps.'

This Knowledge Strategy is intended to serve as a blueprint to implement the above policy of the Ministerial Forum.

Our current understanding of the Lake Eyre Basin remains patchy and in many cases is based on limited data. The state of knowledge was reviewed by the SAP in 2004 in a series of brief information papers that focused primarily on the biophysical components of the system (Cullen *et al*, 2004¹). There is a need to identify and prioritise knowledge gaps that are considered to be significant obstacles to avoiding or eliminating adverse cross-border impacts on water and related natural resources in the Lake Eyre Basin.

This Knowledge Strategy has been developed by the SAP in conjunction with scientific representatives of the participating LEB Governments and in consultation with the CAC. It is not an intended to be an investment strategy; rather a discussion and planning document intended to provide:

1. a description of critical questions facing the Governments under the Lake Eyre Basin Agreement for which sufficient work may not yet exist;
2. an overview of the key knowledge already available to answer those questions;
3. an overview of the new knowledge, information and research required to better answer those questions;
4. a reference point to guide the continuing discussions of the SAP members and Government scientific representatives in their task of advising the LEB Ministerial Forum on strategic investment in improving our knowledge of the Lake Eyre Basin.

Importantly, the Strategy considers social and community issues that are informed and prioritised by more recent analyses of the settlements, services and governance of remote areas

¹ Cullen, P., S. Bunn, T. McMahon, M. Stafford Smith, S. Morton and G. Lawrence. 2004. *Lake Eyre Basin Ministerial Forum Scientific Advisory Panel Information Papers*. Australian Government, Canberra



undertaken by the Desert Knowledge CRC (particularly the ‘desert syndrome’ ideas, Stafford Smith 2008).

The Knowledge Strategy aims to support other LEB Ministerial Forum processes, and takes a broad view of the important gaps in understanding and the knowledge needed to address them. It assumes the Rivers Assessment is underway operationally but identifies research needs for future monitoring to underpin the LEB Rivers Assessment. It also acknowledges that some questions are being addressed through work carried out by Government Departments, regional NRM Boards in the Basin, their partner research organisations and other research institutions.

The Knowledge Strategy must keep pace with both the changing land use pressures in the Lake Eyre Basin, and our changing knowledge of the biophysical and socioeconomic function of the Basin. Accordingly, this is intended to be a dynamic document and will be subject to regular review.

Conceptual framework

The SAP has developed this Knowledge Strategy around a conceptual framework that describes the key biophysical relationships influencing water and related natural resources associated with the river systems of the LEB, and in turn considers this within the context of the social and institutional system.

The biophysical model acknowledges that important ecosystem goods and services are provided to humans, and that human decision-making through management affects the state of these resources (Figure 1). The institutional framework around these biophysical processes is structured in terms of an ideal adaptive learning cycle (Figure 2). It is important to note that the Basin exhibits a series of features common to remote regions (but which differ from most more settled regions), including being remote from markets, corporate headquarters and centres of government, having relatively high population turnover (and an overall declining trend in some areas), high dependence on individuals, and diverse stakeholder interests. These features have been canvassed in the regional profiles produced by the Lake Eyre Basin Socio-Economic Project (Herr *et al*, 2008²). The underlying reality of high variability and uncertainty in many drivers means that promoting adaptive approaches is important.

This conceptual framework has been used by the SAP to identify priority knowledge needs, and has led to the LEB Social and Economic Review Project ‘People, Communities and Economies of the Lake Eyre Basin’, the compilation of the LEB Hydrological Atlas, and the re-instatement of stream gauging stations in the upper Lake Eyre Basin. Additional knowledge requirements identified in Table 2 of this Strategy are also cross referenced to the conceptual framework, by mapping the question numbers from Table 2 onto Figures 1 and 2 below.

² Herr A., Smith T. and Brake L. 2008. Regional Profile of the Lake Eyre Basin Catchments. In Measham T.G. and Brake L. (Eds). *People, communities and economies of the Lake Eyre Basin*, DKCRC Research Report 45. Desert Knowledge CRC, Alice Springs

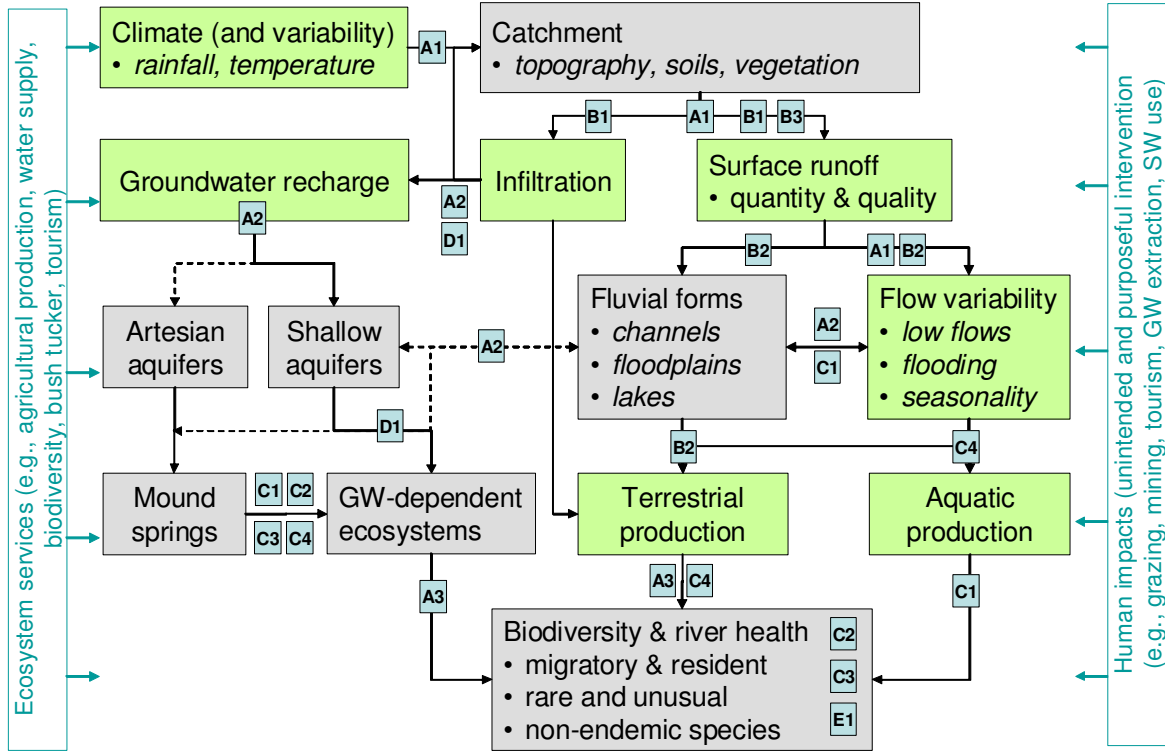


Fig.1: Conceptual framework for the key biophysical relationships in the LEB. Numbers refer to questions and issues identified in the Knowledge Strategy.

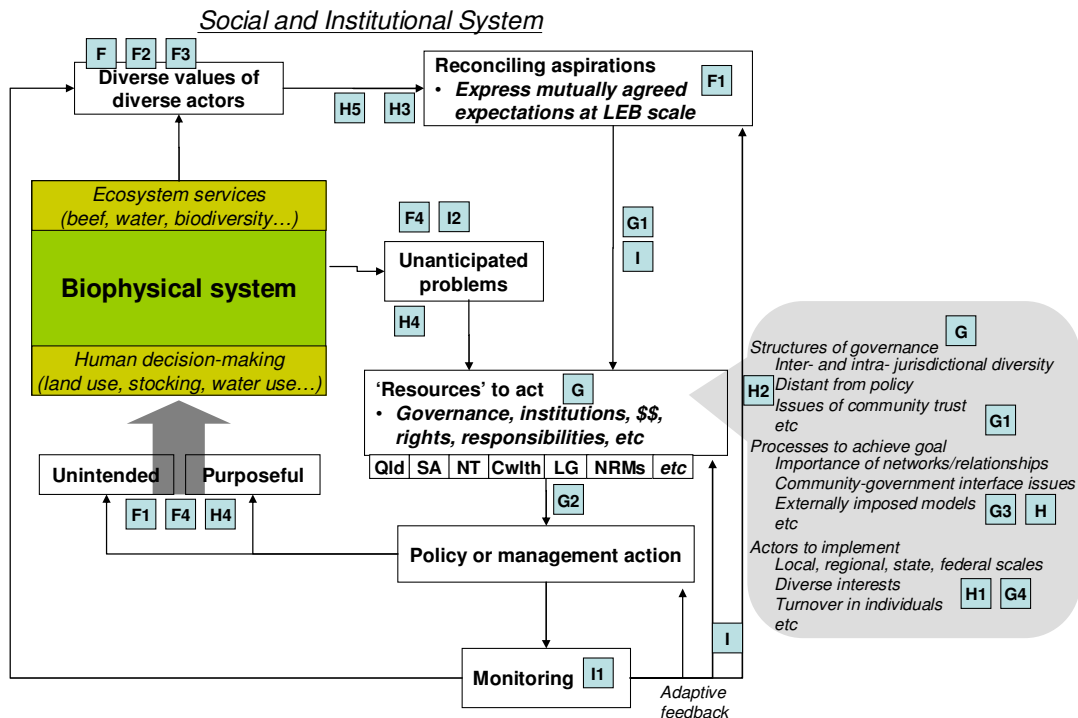


Fig.2: Conceptual framework for the institutional relationships in the LEB, expressed as an adaptive learning cycle. The biophysical system (Fig.1) is included on the left and numbers refer to questions and issues identified in the Knowledge Strategy



Knowledge questions

The overarching knowledge question facing Governments under the Lake Eyre Basin Agreement is:

What knowledge is required to improve our understanding of, and support informed decision making about the water and related natural resources of the Basin?

Specific knowledge requirements to achieve this are summarised as knowledge questions in Table 1. These questions have been grouped into two broad categories:

1. Biophysical systems and land use (questions A to E)
2. Communities (questions F to I)

This overview document lists the knowledge questions in summary only. A more detailed analysis of knowledge needs, highlighting the rationale, existing information and further research needs related to each of these knowledge questions, can be seen in the full document 'Lake Eyre Basin Knowledge Strategy'.



Table 1: Summary of Knowledge Questions

- A: What limitations on our understanding of surface and groundwater constrain our ability to manage the surface and groundwater resource of the Basin?**
- A1: How might climate change affect rainfall variability and temperature, & hence flow patterns and persistence of waterbodies?
 - A2: Where and how are groundwater & surface water systems connected? To what degree is the persistence of water holes dependent on surface flows?
 - A3: How should we manage waterholes – grazing, abstractions, groundwater linkages
- B: What are the impacts of present & future land use (e.g. land clearing, pastoral activities, mining) on quantity and quality of surface and groundwater?**
- B1: What are the changes in catchment & river health that are not yet evident but are likely to occur over the next 30 years from decisions already taken?
 - B2: What are the impacts of levees, road/rail links on water flow and the health of floodplains
 - B3: What are the impacts of present & likely future land use on run-off within the catchment?
- C: How do we measure the health of rivers, waterholes, terminal lakes/wetlands? Can trends be detected?**
- C1: Where are the key aquatic refugia, what are the processes that sustain them & what are the threatening processes?
 - C2: What threatened (aquatic) species & communities exist, where are they, & what are the threatening processes?
 - C3: What are the risks (to aquatic systems) from non-endemic species – present and potential? Where are they?
 - C4: What are the likely impacts of water use on aquatic biodiversity and river health ?
- D: What is the current catchment health (baseline assessment)?**
- D1: Where are salinity hazards & impacts of vegetation management on shallow groundwater?
- E: What are the implications of changes in ecosystem quality for human use of resources?**
- E1: What are the risks posed for human consumption by changes in water quality?
- F: What are the values and aspirations of key stakeholders across the LEB?***
- F1: How might these values and aspirations affect future landscapes and development in the Basin? Are these aspirations different from those outside the Basin?
 - F2: What are the values associated with water – particularly from an Indigenous perspective?
 - F3: What are the creation/dreamtime stories that are attached to Basin springs, water bodies and other waterways?
 - F4: How will different future scenarios affect LEB communities and how might communities respond?
- G: What institutional and governance arrangements will facilitate the best policy and management outcomes for LEB natural resources?**
- G1: What are the best mechanisms for ensuring that agreed aspirations guide future planning in the Basin?
 - G2: What are the best spatial, time and societal scales for planning and implementing different aspects of NRM?
 - G3: What institutional arrangements enhance, or detract from, community/government interactions relating to NRM in the Basin?
 - G4: What form of ‘actor’ (partnership, regional body, government etc) could best drive whole-of-Basin action?
- H: What are the best ways of engaging Basin communities in Basin-related NRM?**
- H1: What enhances/ diminishes the legitimacy of key players in the Basin in influencing change?
 - H2: What can be done to improve engagement between community, policy makers and industry in Basin-related NRM?
 - H3: How can Indigenous engagement in water planning be facilitated?
 - H4: How should tourism be managed around springs, waterholes and other waterways?
 - H5: How can tourists be best informed about the cultural history of the LEB and the management of cultural sites?
- I: What is the current ‘adaptive capacity’ of LEB actors in contributing to better NRM outcomes in the Basin, and how can ‘adaptive capacity’ be improved in the future?**
- I1: What are the best ways of monitoring critical elements of social change in the Basin?
 - I2: Are there socioeconomic costs that must be borne by the LEB community as a consequence of expected changes?



Assessment of scope against LEB Agreement Policies

Table 2 shows how the knowledge questions from Table 1 are linked to the six LEB Agreement Policies adopted by the LEB Ministerial Forum in 2002 and 2004 (the six Policies are shown at Appendix A)

Table 2: Links between the LEB Knowledge Strategy Questions and the six LEB Agreement Policies.

Knowledge Questions in this Knowledge Strategy	LEB Agreement Policies addressed by these questions (see Appendix A)
A: What limitations on our understanding of surface and groundwater constrain our ability to manage the surface and groundwater resource of the Basin?	1, 3, 4
A1: How might climate change affect of rainfall variability and temperature, & hence flow patterns and persistence of waterbodies?	1, 3, 4
A2: Where and how are groundwater & surface water systems connected? To what degree is the persistence of water holes dependent on surface flows?	1, 3, 4
A3: How should we manage waterholes – grazing, abstractions, groundwater linkages	1, 3, 4
B: What are the impacts of present & future land use (e.g. land clearing, pastoral activities, mining) on quantity and quality of surface and groundwater?	1, 2, 3
B1: What are the changes in catchment & river health that are not yet evident but are likely to occur over the next 30 years from decisions already taken?	1, 3, 4
B2: What are the impacts of levees, road/rail links on water flow and the health of floodplains	1, 3, 4
B3: What are the impacts of present & likely future land use on run-off within the catchment?	3
C: How do we measure the health of rivers, waterholes, terminal lakes/wetlands? Can trends be detected?	1, 2, 5
C1: Where are the key aquatic refugia, what are the processes that sustain them & what are the threatening processes?	1, 2, 3
C2: What threatened (aquatic) species & communities exist, where are they, & what are the threatening processes?	1, 2, 3
C3: What are the risks (to aquatic systems) from non-endemic species – present and potential? Where are they?	3
C4: What are the likely impacts of water use on aquatic biodiversity and river health ?	1, 3
D: What is the current catchment health (baseline assessment)?	3, 5
D1: Where are salinity hazards & impacts of vegetation management on shallow groundwater?	3, 5
E: What are the implications of changes in ecosystem quality for human use of resources?	1, 2, 3



Knowledge Questions in this Knowledge Strategy	LEB Agreement Policies addressed by these questions (see Appendix A)
E1: What are the risks posed for human consumption by changes in water quality?	2
F: What are the values and aspirations of key stakeholders across the LEB?	1, 2, 3
F1: How might these values and aspirations affect future landscapes and development in the Basin? Are these aspirations different from those outside the Basin?	1, 2, 3
F2: What are the values associated with water – particularly from an Indigenous perspective?	1, 2, 3
F3: What are the creation/dreamtime stories that are attached to Basin springs, water bodies and other waterways?	1, 2, 3
F4: How will different future scenarios affect LEB communities and how might communities respond?	1, 2, 3
G: What institutional and governance arrangements will facilitate the best policy and management outcomes for LEB natural resources?	6
G1: What are the best mechanisms for ensuring that agreed aspirations guide future planning in the Basin?	1, 2, 3, 6
G2: What are the best spatial, time and societal scales for planning and implementing different aspects of NRM?	6
G3: What institutional arrangements enhance, or detract from, community/government interactions relating to NRM in the Basin?	6
G4: What form of 'actor' (partnership, regional body, government etc) could best drive whole-of-Basin action?	6
H: What are the best ways of engaging Basin communities in Basin-related NRM?	1, 2, 3, 6
H1: What enhances/ diminishes the legitimacy of key players in the Basin in influencing change?	6
H2: What can be done to improve engagement between community, policy makers and industry in Basin-related NRM?	1, 2, 3, 6
H3: How can Indigenous engagement in water planning be facilitated?	1, 2, 3, 6
H4: How should tourism be managed around springs, waterholes and other waterways?	3
H5: How can tourists be best informed about the cultural history of the LEB and the management of cultural sites?	3
I: What is the current 'adaptive capacity' of LEB actors in contributing to better NRM outcomes in the Basin, and how can 'adaptive capacity' be improved in the future?	6
I1: What are the best ways of monitoring critical elements of social change in the Basin?	3, 6
I2: Are there socioeconomic costs that must be borne by the LEB community as a consequence of expected changes?	3, 6



Recommended knowledge priorities and opportunities

The questions identified in the above table are intended to capture the breadth of knowledge issues facing the Lake Eyre Basin. Clearly it will not be feasible for the LEB Ministerial Forum to address all of these and it is necessary to identify some specific topics that are considered to be of the highest priority. The SAP recommends that priority investments in knowledge gathering should focus on the following three issues in the short term:

- Waterholes:

Given the significance of waterholes to biodiversity and local communities, research to underpin sustainable management of waterholes is a priority. The issue of changes to low-flow hydrology (from water abstraction and climate change) and the importance of surface water – groundwater exchanges is a critical issue for ephemeral river systems across Australia (A1, A2, see also Actions no. 2 and 5 in the draft LEB 5-Year Action Plan). Opportunities for research links with the BoM, CSIRO Sustainable Yields work and the newly established Groundwater Research Centre should be explored. In addition, more detailed studies on the effects of tourism and other local scale impacts on waterholes are needed (A3; see also Action no. 11 in the draft LEB 5-Year Action Plan).

- Flow interception and infiltration

We are constrained by our ability to model and predict how changing vegetation cover and condition will affect the quality and quantity of surface run-off and infiltration (B3). In addition, we need to better understand the effects of levees, roads and culvert crossings on downstream flow conveyance and floodplain vegetation (B2). (See also Actions no. 2 and 5 in the draft LEB 5-Year Action Plan)

- Futuring or foresighting activities.

We need to better understand the aspirations and values of the broader community and how these may change in the face of a changing climate and economy. This is central to the LEB agreement and we would recommend that this should be given a high priority for funding by the LEB Ministerial Forum (F1; see also Action no. 8 in the draft LEB 5-Year Action Plan). The SAP believes this will be important over the next few years and is unlikely to get immediate interest from NRM. The activity needs to be scoped up and developed and an initial allocation of funding could be used to identify participants, the potential approaches, and how it might be funded.

The nomination of these topics as high priorities does not imply that the SAP believes that other knowledge issues identified in this document are not important and we encourage the broader research community to focus their efforts on addressing some of these questions.



Contact and further information

The full version of the Lake Eyre Basin Knowledge Strategy and information on the Lake Eyre Basin Scientific Advisory Panel, the Ministerial Forum and Intergovernmental Agreement is available at www.lebmf.gov.au.

Disclaimer

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Appendix A Lake Eyre Basin Agreement Policies adopted by the Lake Eyre Basin Ministerial Forum in 2002 and 2004

- 1. River Flows Policy** - ‘Flow regimes of river systems within the Agreement Area will be managed to protect and maintain the ecological integrity and natural function of in-stream and floodplain ecosystems, and the viability of economic, social, cultural and other activities which do not threaten these environmental values.’
- 2. Water Quality Policy** - ‘Water quality in the river systems within the Agreement Area will be managed to protect and maintain the ecological integrity and natural function of in-stream and floodplain ecosystems and the viability of economic, social, cultural and other activities which do not threaten these environmental values.’
- 3. Water and Related Natural Resources Policy** - ‘Water and related natural resources associated with the river systems within the Agreement Area will be managed to protect and maintain the ecological integrity and natural function of in-stream and floodplain ecosystems and the viability of economic, social, cultural and other activities which do not threaten these environmental values.’
- 4. Existing Entitlements and Water Resource Development Policy** - ‘Water resource planning, allocation and management arrangements, including the management of water entitlements, will be compatible with the Lake Eyre Basin Agreement. Efficient use of water will be a fundamental principle of water entitlements and utilisation. Water resource development proposals will be assessed to determine their potential impact on river flows and water quality, and compatibility with the Agreement and relevant water resource plans. These assessments will be based on the best available scientific information and local knowledge (including information from other regions in Australia and overseas).’
- 5. Research and Monitoring Policy** - ‘Management of water and related natural resources associated with the river systems in the Agreement Area will be guided by the best available scientific information and local knowledge, and by the results of ongoing monitoring and periodic assessment of the condition of these river systems. Targeted research may also be undertaken to address identified knowledge gaps.’
- 6. Whole of Basin Approach Policy** – ‘Water and related natural resources in the lake Eyre Basin Agreement Area will be managed through a whole-of-basin approach so as to achieve complementary outcomes, through the implementation of state/territory legislation and the plans and associated investment strategies of relevant regional bodies in Queensland, South Australia and the Northern Territory.’