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Sustainability for the rivers of the Lake Eyre Basin

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Introduction

The Lake Eyre Basin and its rivers are globally unique. Known for millennia in the minds of its many inhabitants as a place of magnificent booms and equally prodigious busts, the Basin's rivers are the most variable large rivers in the world (Puckridge *et al.* 1998). Its truly unique ecology thrives with this variability, where organisms continue to surprise us, with their astonishing adaptations. Given our desire to control water for human use, the future of all rivers across the world is precarious. The Lake Eyre Basin shares this uncertain future, which must impresses upon us our responsibility to safeguard it as the last and best of its kind in the world.

So, what is the path for sustainability of Lake Eyre Basin rivers? Where will the communities and the rivers of the Lake Eyre Basin be in 20, 50 or 100 years? Or even, if we were brave – thousands or tens of thousands of years? The Lake Eyre Basin's unpredictability and remoteness have shaped and governed the way humans use water in this landscape, through the millennia by Aboriginal Australians and today's regional centres, mining operations and pastoral stations. Despite its resilience during the Anthropocene, this great wonder of the natural world remains under pressure to contribute to food, fibre and energy security for our ever-increasing global population. Long-term sustainability of this amazing environmental system ultimately depends on us, more so now than at any other time in the Basin's history.

This final chapter integrates the other 21 chapters of this book by projecting the future of the Lake Eyre Basin against a global backdrop, incorporating its social, economic and environmental dimensions. It focuses on the threats, clearly identified in the chapters of this book, and also on solutions for a future, built on the successful partnerships that have so far protected, shaped and sustainably managed this unique environment (see Chapter 7). This synthesis is informed by local, Traditional Owner and scientific knowledge and community gatherings of people from different disciplines and all walks of life (e.g. the conference, 'Spotlight on Lake Eyre Basin' at Longreach – the basis for this book (Fig. 22.1). They have all provided strong support for the widely accepted vision developed by the Lake Eyre Basin community: Lake Eyre Basin – *Australia's unique, natural, desert river system: healthy environments, sustainable industries, vibrant communities, adaptive cultures*.

Threats to the rivers of the Lake Eyre Basin

We know much about threats to rivers, not just in Australia but around the world, and how much damage can be done directly and indirectly by people, in a relatively short period

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Fig. 22.1. Lively discussion of the future of the Lake Eyre Basin rivers involving people of the Basin who attended the 2013 conference, 'Spotlight on the Lake Eyre Basin', held in Longreach (photo, M. Turner).

(Lemly *et al.* 2000; Dudgeon *et al.* 2006). Threats to rivers of the world are ubiquitous, with those potentially affecting sustainability of Lake Eyre Basin rivers including water resource development, other habitat degradation, invasive species, pollution and climate change (see Chapter 1). Most chapters in this book focus on the potential impacts of water resource development for obvious reasons: known widespread ecological and socio-economic impacts, a history of attempts to develop Lake Eyre Basin rivers, and the ever-present potential for further development. This has local, regional and global dimensions because the political and economic rationale for the development of water resources often relates to water supply and food security for expanding global populations. Current national policy is to develop natural resources of northern Australia, including water (Australian Government 2015). There are ~7.5 billion people in the world, with about two people added every second, leading to a projected total of ~9.7 billion by 2050. We all need water. Not only is water essential for drinking, but also the damming of rivers and diversion of water for irrigation enables much of our food and clothing production. The dilemma is that water resource development degrades rivers and affects water security for people and communities (Vörösmarty *et al.* 2010).

Humanity seriously 'injures' rivers and their ecosystems by building dams and developing floodplains (Kingsford 2015; Kingsford *et al.* 2016). Dams allow river flows to be controlled and diverted, mainly for irrigation (Lemly *et al.* 2000), while irrigation and cropping on fertile floodplain can destroy a river's most productive areas of biodiversity (Kingsford 2015). These two impacts often go together: once river flows are controlled, it no longer floods as extensively or frequently, allowing intensive cropping on the floodplain. For the rivers of the Lake Eyre Basin, the spectre of mining exploration and development on floodplains is also a serious concern (see Chapters 19 and 20). This pressure to develop remains pervasive, despite a vibrant history of community opposition to such interventions (see Chapter 17).

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The debate about sustainability has become nuanced by discussions about small-scale versus large-scale irrigation, leading to the misguided assumption that 'small is good but large is bad'. Any diversion of water, big or small, impacts on the people who depend on these rivers – Aboriginal communities (see Chapters 8 and 9), long-term residents with deep connections to the river (see Chapter 12), those whose livelihoods depend on well-managed floodplain grazing (see Chapters 10 and 11) and others involved in tourism (see Chapter 13). The environment is also particularly sensitive to water diversions, with predictable negative impacts on native fish (see Chapters 3 and 4), turtles (see Chapter 5), terrestrial animals (see Chapter 6) and the many other forms of life (see Chapter 1). Simply, some part of the environment and people will always be affected when we develop the water resources of a river.

Three factors are clear in the ongoing discussion about water resource development. First, the environmental impacts are always underestimated because they occur over an entire river system and take decades to manifest (Kingsford 1999; Kingsford *et al.* 2011). Second, no governments have adequately been able to regulate water resource development, once started. The most recent example is runaway overdevelopment of the Condamine–Balonne river system in the Murray–Darling Basin (see Chapter 21), wreaking immeasurable social and environmental impacts (see Chapters 14 and 15). Indeed, many rivers in the Murray–Darling Basin exhibit a similar trajectory, where governments have failed to adequately manage development and prevent widespread environmental degradation (Kingsford *et al.* 2015). Finally, the economic costs of such development are rarely transparent. More often than not, private gain is underpinned by public cost. For example, governments often invest taxes in expensive dam construction (Kingsford 1999). Users of this water pay a licence fee, meant to cover costs of delivery, but it does not cover the capital or maintenance costs of infrastructure. As a consequence, a high proportion of the cost of 'running' the rivers (e.g. policies, water delivery, monitoring and restoration costs) is borne by government and communities, and is seldom accounted for. Restoration activities are particularly expensive. For example, Australian Government investment in the rehabilitation of the Murray–Darling Basin will cost Australian taxpayers more than $13 billion, and even this poorly accounts for substantial use and non-use economic values of the environment (see Chapter 18).

History shows that water development challenges lie ahead for achieving sustainability of the rivers of the Lake Eyre Basin. Twice, governments in Queensland have tried to stimulate or 'open up' the rivers for major water resource development (see Chapter 17). The legacy of the first attempt in 1995 persists in 'sleeper' (i.e. not activated) licences in both the Cooper Creek and the Georgina–Diamantina River catchments (see Chapter 20). Governments have tried to buy back the relatively large (10 000 ML total) licences in the Cooper Creek catchment, mostly near Windorah, but owners have resisted, presumably because of speculative economic value. Actual economic value is difficult to determine, given the absence of a market, inviting inevitable and inequitable comparison with active irrigation licences in the Murray–Darling Basin. For example, a 1000 ML general security licence in the northern Murray–Darling Basin varied in value in 2016 from $1 million (Macquarie) to $2.1 million (New South Wales Border Rivers) (Marsden Jacobs Associates 2016). However, water supply is more dependable and primarily regulated by large dams in the Murray–

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Darling Basin. In 2014, the Liberal National Party (2012–15) changed the water legislation to allow the sleeper licences in the Cooper Creek plan area in Queensland to be traded up the river, with adjustments depending on potential impacts (see Chapter 20).

Unallocated water in the Diamantina catchment could also be developed for irrigation. A current barrier to development is the prohibition of any large dams (off-river or on-farm storages) adjacent to the river, as well as limits on pump size and daily pumping volume (see Chapter 20). This means that water cannot be pumped from the main river channel (or flooded areas) into large off-river storages (e.g. Murray–Darling Basin; Kingsford 2004). Any relaxation of this policy could trigger large-scale water resource development, particularly now that irrigation licences can be traded.

Circuitously, this development potential returns the debate to the fundamental question: how much is too much development of the rivers or, as canvassed by the Queensland Liberal National Party Government (2012–15), small-scale *v* large-scale development? The implicit assumption is that small-scale development will have relatively minor ecological or socio-economic consequences. This assumption is flawed on two counts. First, many small-scale developments combined can have the same impact as a large-scale development in terms of the amount of water diverted from the river. Second, it is clear that small to medium floods are as critical to the ecological resilience of the rivers as large, episodic floods (Hamilton *et al.* 2005; Bunn *et al.* 2006). Minor river flows ensure that waterholes – the key refuges for many dependent animals – remain viable and carry through to the next flood period (see Chapters 4 and 5). Diversion of even small amounts of this water for small-scale irrigation could have dire ecological consequences, including causing death of fish and turtle populations in waterholes. The sensitivity of waterholes to minor hydrological changes will also be exacerbated by climate change, in particular by the projected higher temperatures and associated evaporation rates (Reisinger *et al.* 2014).

In addition, floodplain developments can change the course of distributary creek networks and the hydraulics of flow over the floodplain (Fig. 22.2), with potentially serious ecological and socio-economic consequences. Changes to flows in the myriad channels that criss-cross the floodplains may be caused by roads, farming or mining exploration and development. Up to now, the oil and petroleum industry has existed in reasonable harmony with the rivers of the Lake Eyre Basin (although there are examples on the Cooper Creek floodplain where roads or levees severed the floodplain from its water supply). Although there is an increased understanding and sensitivity to this potential problem, intensification of oil and gas mining on the floodplains of Cooper Creek is clearly possible, with gas wells on platforms serviced by road networks (e.g. Chinchilla, Queensland), potentially affecting flow paths (see Chapter 19).

Also, wherever there is mining exploration and development, pollution of rivers remains a potential lethal threat. The graphic example of the Lady Annie copper mine spillage in 2009, and the subsequent acidification and heavy metal pollution of the Buckley River (headwaters of the Lake Eyre Basin) remains a potent reminder (see Chapter 19). If the coal seam gas industry establishes in the Lake Eyre Basin, polluted water generated as a by-product of gas extraction may also pose a serious threat to the rivers of the Lake Eyre Basin (see Chapter 19).

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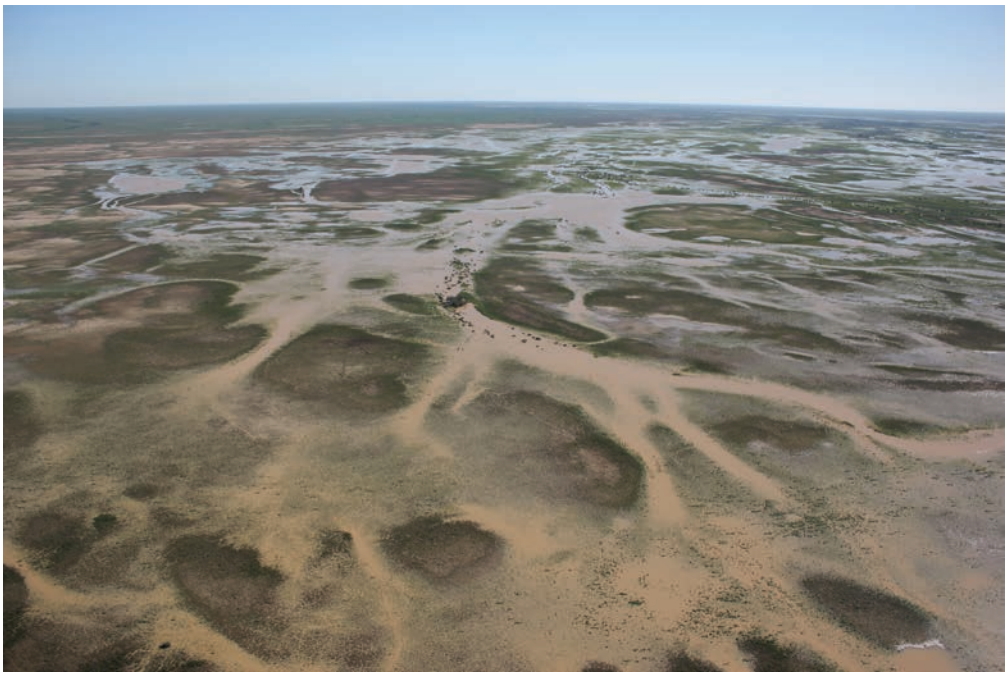

Fig. 22.2. Networks of complex channel systems that criss-cross the Channel Country of the rivers of the Lake Eyre Basin could be seriously affected by pastoral, farming, mining or road developments.

Floodplains can be degraded by intensive grazing of livestock. Large grazing animals can change the structure and composition of vegetation communities, with known impacts on some small mammals around the world (Schieltz and Rubenstein 2016). Our understanding of grazing impacts on floodplain environments remains relatively poor, but they are likely to be fairly minor (Silcock *et al.* 2013), compared with the impacts of water resource development (Lemly *et al.* 2000).

Other threats continually affect the sustainability of the rivers and their organisms. Climate change, particularly increasing temperatures (Reisinger *et al.* 2014), is already affecting socio-economic, cultural and environmental dimensions of the Lake Eyre Basin rivers. Increasing temperatures will increase evaporation, narrowing the window for the animals and plants to complete their life cycles as well as increasing the risk of premature drying of waterhole refuges. Further, Channel Country pastures on floodplains are likely to have a decreased duration of productivity while access to water for livestock may be problematic as the persistence of waterholes decreases. This may be partly offset by some evidence for increasing and more intense rainfall (Greenville *et al.* 2012).

Finally, the presence of numerous invasive species threatens the environmental and socio-economic values of the Lake Eyre Basin and demands considerable expenditure by governments and communities (Firn *et al.* 2015a; Firn *et al.* 2015b). Invasive or alien species include four fish species (see Chapter 3), cane toads (*Rhinella marina*), the introduced red claw crayfish (*Cherax quadricarinatus*) from the Australian tropics and various plant species, such as prickly acacia (*Vachellia nilotica*). One introduced plant species, buffel grass (*Cenchrus*

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ciliaris), favoured by some graziers, appears to have negative impacts on biodiversity and alters fire regimes, exacerbated by climate change (Fensham *et al.* 2015; Martin *et al.* 2015). Many introduced mammals (e.g. pigs, goats and rabbits) affect the sustainability of the rivers of the Lake Eyre Basin, and large animals such as camels can damage, drain or destroy waterholes during dry periods. Last, tourists can cause considerable damage to waterholes, sites of high attraction (Silcock 2010), through littering and collection of firewood (Schmiechen 2004), although this needs to be balanced against the local scale of this impact, the opportunities for education of the values of the rivers, engagement and tourism's contribution to the economy.

Policy, legislation and practice for sustainability

Much of this book has focused on the threat of water resource development and its associated demonstrated costs, as well as options for controlling deleterious development. Despite these known costs to Australians and our environments, governments continue to pursue water resource development, reflecting our history (Gibbs 2009). This is most clearly demonstrated by the current Australian Government's policy to develop northern Australia (Australian Government 2015), including expenditure of more than half a billion dollars (http://www.agriculture.gov.au/water/national/national-water-infrastructure-development-fund) and concessional loans of $2 billion. The Flinders River, just north of the Thomson River catchment in the Lake Eyre Basin, is a clear target for development, with cotton irrigation already established and a plan for a $200 million development of 15 000 ha of cotton near Normanton, pumping 150 000 ML of water from the Flinders River (Zonca 2015). These developments are in desert regions, similar to those previously proposed on the rivers of the Lake Eyre Basin. There is little discussion of long-term costs: development is driven by current policy and legislation. Unfortunately, environmental legislation, policy and political will are weak in the face of counterpart development instruments (see Chapters 20 and 21).

Ambition to develop water resources of the rivers of the Lake Eyre Basin has primarily originated in Queensland, the state with the most dependable supply of river water (see Chapter 20). Access to this water is governed by Queensland policy and legislation, principally water and mining legislation. Strong environmental protection was enacted through the Wild Rivers legislation and its associated policies and regulations, but was subsequently revoked, despite overwhelming support for the controls to remain in place (see Chapter 21). Current legislation and policy in Queensland leave the rivers and their sustainability highly vulnerable to development pressure. The community, its champions and partnerships continue to offer the most promising path to sustainable solutions, influencing legislation, policy and practice (see Chapter 7).

Institutionally, the Intergovernmental Agreement over the Lake Eyre Basin remains critically important, but is relatively weak on enforcing provisions for enforcement of sustainable river management (see Chapter 21). This legislative framework provides a high-level platform for sustainability discussions between participating states of Queensland and South Australia, the Northern Territory and the Australian Government. It makes sense to build on this legislation and policy for the Lake Eyre Basin as it aims, commendably, to

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protect the volume and variability of river flows, with a focus on environmental values (see Chapter 21). Better integration of cultural and socio-economic values could improve the agreement (Gibbs 2006). However, with an upcoming review in 2018, the agreement is vulnerable to any potential policy shift towards water resource or mining development.

The intergovernmental framework could be more strongly supported by specific water legislation in Queensland, South Australia and the Northern Territory, which protects both the volume of flows (allowing for development of water supplies for towns and communities) and the floodplain networks. This was briefly achieved in Queensland through Wild Rivers legislation, before its revocation (see Chapter 21). Other options could include a stronger role for the Australian Government, which developed the water management framework for the Murray–Darling Basin under the *Water Act 2007*, providing the framework for the Murray–Darling Basin Plan. A potential '*Lake Eyre Basin Act*', with an associated plan, would differ in that it would fundamentally protect the river basin and its cultural, environmental and socio-economic values. Such legislation could have limited power but have a degree of public commitment and potentially incorporate the Lake Eyre Basin rivers as a National Heritage River (Kingsford *et al.* 2005a; Kingsford *et al.* 2005b). This would recognise the intertwined environmental and cultural heritage values which support the Basin's adaptive communities. Legislation that protects the rivers must also be supported by policies that protect their values and foster appropriate practices for long-term sustainability. Currently development is linked to environmental degradation. Decoupling this relationship is essential: we need developments that are environmentally sustainable. Further, in terms of practice, decadal reviews of water resource plans in the Lake Eyre Basin potentially stimulate speculation and interest in water resource development and cause ongoing concern about sustainability. This could be replaced by assessing potential developments against the objectives of policy and legislation to protect the rivers of the Lake Eyre Basin.

In the absence of strong legislation and supporting policies that protect the rivers, the status quo remains: strong partnerships influencing current legislation, which tends to favour water and mining developments. Inevitably, pressure to develop deleterious water resources or establish mining developments will continue, either as single site developments or wide-ranging development policies. Signatory governments to the Lake Eyre Basin Intergovernmental Agreement could apply pressure, but this will largely depend on political will. Community organisations and champions can quickly alert the broad community to potential concerns and foster a debate that can exert pressure on governments, occasionally successfully (see Chapter 7). This remains an *ad hoc* approach which leads to less preferable, confrontational interactions between community and decision-makers.

Above this, development proposals should be objectively assessed against rigorous and transparent analyses of hydrological, ecosystem and socio-economic costs and benefits. Inherent uncertainties of such analyses need to also be transparently reported. Currently, there are relatively rudimentary hydrological models used to assess impacts on flow and ecosystems for Cooper Creek but not for the Georgina–Diamantina, largely because of the paucity of data and lack of development in this catchment (see Chapter 2). These hydrological models underestimate hydrological and ecological impacts, particularly on floodplains (Ren

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and Kingsford 2011). There also needs to be adequate assessment of the costs and benefits to economic environmental values of the Lake Eyre Basin, relative to the benefits of development (see Chapter 18). This includes direct costs to less ephemeral, stable industries, such as livestock grazing and tourism. Socio-economic analyses should also expose the largely invisible subsidies that underpin many large irrigation developments and extend over decades, as well as incorporate the long-term costs of rehabilitation.

Inevitably, this discussion sidesteps the consequences of 'sleeper' licence activation and the development of unallocated water in the Cooper Creek and Georgina–Diamantina catchments. Although there are considerable financial impediments to development (e.g. costs of infrastructure development, limitations of water access, proximity to markets and transport costs), the possibility remains that these licences may one day become activated when economic conditions are favourable. If the maxim for human health that 'prevention is better than the cure' is equally applicable to the environment, there remains a good case to resume the sleeper licences and remove unallocated water from the Queensland water plans in the Lake Eyre Basin, recognising and protecting its outstanding values. This would require compensation for irrigation licences, provided either by governments to current users, or through the purchase of licences by a third party (e.g. a non-government organisation), coupled with agreements that would prevent future development of the river basin. One criticism of this approach is that 'closing-off' such a river basin to water resource development abrogates our local, regional and global responsibility to provide for the food and fibre needs of the world. It is time that governments focus more on the demand side of the equation for food and fibre and improve the efficiency of existing water developments and systems in order to increase production. This includes the potential for urban centres, consumers of most food and fibre, to also engage in agricultural production within their footprint (Barthel and Isendahl 2013). Critically, the current policy instruments preventing construction of large off-river storages, increases in pump size or volume on floodplains are the most important barrier to rapid large scale development of irrigation and must remain in place.

Of the other threats to the sustainability of the rivers of the Lake Eyre Basin, climate change is potentially the most significant, although current understanding of the effects will depend on knowledge of changes to rainfall patterns and temperature. Temperature is increasing (Reisinger *et al.* 2014), which will mean increasing evaporation, partly offset by increasing rainfall (Greenville *et al.* 2012). Communities and governments should continue to develop policies that limit greenhouse gas emissions and stabilise temperatures. At a local scale, there may be a need for active policies to enhance the persistence of key refuge waterholes, with significant biodiversity value.

Solutions to avoid pollution disasters, such as spillage from Lady Annie copper mine (see Chapter 19), must involve rigorous assessment of the proximity of such mines to rivers and the risk of pollution. Further, if development proceeds, a realistic bond which adequately provides for restoration, must be negotiated.

Ubiquitous plant and animal invaders continue to wreak damage to industries and the ecosystems. Although there is generally a strong commitment to mitigating their impacts, levels of accountability and measurements of success or failure are often inadequate. Systems of strategic adaptive management can provide a more transparent and rigorous framework

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for implementation (see Chapter 7). If tourism continues to increase in popularity, it will need to be actively managed to protect the cultural and environmental values of the Lake Eyre Basin and its rivers (Schmiechen 2004).

Conclusion

The Lake Eyre Basin and its rivers have outstanding cultural and environmental values, enriched by Traditional Owner, local and scientific knowledge. It was no accident that the Lake Eyre Basin Partnership received the Australian Riverprize in 2014 and the International Riverprize in 2015. It is admirable that there is a Lake Eyre Basin community of formal and informal partnerships, developed over more than 20 years, which has brought together disparate stakeholders, all primarily committed to the sustainability of the Lake Eyre Basin rivers. Despite this track record, the sustainability of the rivers of the Lake Eyre Basin remains vulnerable to many current and future pressures.

Some state, national and international factors will inevitably drive lobbyists to call for development of water resources in the Lake Eyre Basin. This is most likely to manifest as irrigation or mining exploration and development on the floodplains. Current legislative protection measures, policy and practice would be relatively ineffective in preventing deleterious impacts to environmental and cultural resources, if water resource development escalated. The current Lake Eyre Basin Intergovernmental Agreement needs fresh affirmation from the member governments, through strong jurisdictional water legislation which takes a more protective, rather than the traditional exploitative approach to the rivers of the Lake Eyre Basin. This legislation needs to protect the variability of the river flows, including their volume and quality at natural levels. Vigilance at the more local scale is also critical to prevent deleterious cumulative impacts. Most of all, we need to considerably improve our cost benefit analyses by assessing risk on appropriate time scales, so communities and governments do not shoulder long-term costs of environmental, cultural and social damage. It is no longer an excuse to say we don't know if these will occur. The evidence is plain to see.

Sustainability for Lake Eyre Basin rivers is achievable, but it will be challenging. It will require considerable political and community will. It will require a change in attitudes to water and its function in Australia from development to protection. This might seem ambitious, but there are promising signs of support and, importantly, fundamental recognition of the unique values of the rivers of the Lake Eyre Basin by governments and communities. The historical record is filled with Basin champions and hard-won battles over the future of the rivers. Australia's profoundly ancient tectonic and geological journey, together with our most idiosyncratic of ecological trajectories, leave us as unlikely champions for a global icon that knows no equal. The sustainability of the Lake Eyre Basin's rivers is more than ever our responsibility and it must be shouldered, by current and future champions, with appropriate conviction and action.

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