

Water Policy Reform for Sustainable Development in the Murray-Darling Basin, Australia: Insights from Resilience Thinking



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Abstract This chapter explores how insights from Resilience Thinking (RT) can better inform efforts to reform water policies in directions required for sustainable development. The focus is on the Murray-Darling Basin (MDB) in Australia, and particularly on reforms seeking to achieve environmentally sustainable water use. We find that the reform process remains dominated by a conventional, command-and-control, management approach that asserts predictability yet repeatedly delivers uncertainty in its place. In contrast, the approach favoured in the RT tradition for water policy reform in the MDB would involve adaptive co-management. This approach would avoid those surprises arising from the conventional approach's misguided confidence in the predictability and controllability of the reform process, while being fit-for-purpose in dealing with the irreducible uncertainty of outcomes from intervening in the Basin's complex social-ecological dynamics. An RT perspective highlights that shifting to adaptive co-management of the reform process would require transformation of existing governance arrangements that evolved in support of the conventional management approach. The MDB experience suggests that it is possible for such transformation to emerge through the cross-level dynamics associated with the resilience approach's concept of panarchy. Local-level entrepreneurship by NGOs (as bridging organisations) in environmental water management has in this case established a foundation from which transformative governance of the Basin's sustainability-driven water reform agenda continues to evolve. We conclude that RT can make important contributions to understanding how longstanding challenges in reforming water policy for sustainable development might effectively be overcome.

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1 Introduction

Existing and looming water crises have prompted efforts around the world to reform policies in this sector. Limited success in these efforts means “the need to reform water policies is as urgent as ever” (OECD, 2012 p. 1). A key driver of water reform efforts in many countries is threats to sustainable development posed by the degradation of freshwater ecosystems arising from over-allocation of water to irrigation and other consumptive uses (Garrick, 2015). The slow progress achieved to date in reforming water policies for sustainable development has spurred various critiques of the methodology under which the dynamics of water management have conventionally been understood. The focus of this chapter is on the alternative methodology presented by Resilience Thinking (RT) (Walker & Salt, 2006).

Application of RT principles and approaches to water management practice has been impeded by existing governance structures (Benson & Garmestani, 2011; Stayner & Parsons, 2018). The chapter therefore explores how water governance might be transformed to enable the resilience approach to be embedded in water management and policy processes, and how this may facilitate effective reform of water policies onto the trajectories required for sustainable development. Given that “restructuring current institutions and governance systems for resilience is no small task” (Folke, 2016 p. 12), insights from RT into obstacles and opportunities in achieving such governance reform are considered.

These issues are explored through a case study of the Murray-Darling Basin (MDB) in Australia. Despite the efforts at sustainability-driven water policy reform that have been underway in this setting since the 1990s, and international recognition of these efforts as world-leading (Productivity Commission, 2017), implementation of the reforms agreed to by governments remains well short of what is required to return water extractions to environmentally sustainable levels (Grafton, 2019).

The remainder of this chapter is organised as follows. Aspects of RT relevant to the chapter’s focus are reviewed in Sect. 2. The context of the MDB case is described in Sect. 3. The history of efforts to implement sustainability-driven water policy reforms in the MDB is interpreted in Sect. 4 through an RT lens. In Sect. 5 the focus shifts to the governance challenges encountered in implementing these reforms and to an RT interpretation of responses to these challenges. In Sect. 6 conclusions are presented.

2 Resilience Thinking

2.1 *The Conventional Management Paradigm*

The conventional ‘command and control’ paradigm of environmental management to which RT presents an alternative assumes that the dynamics of all systems to be managed are mechanistic, with unchanging parts and relationships between parts (Marshall, 2010). It follows that behaviour of a system is predictable from the behaviour of its parts, and that any system will remain in equilibrium, or stable, until disturbed by changed external conditions. Any such disturbance is seen as leading to a new equilibrium for the system, which is predictable due to its unchanging cause-and-effect relationships. The prior equilibrium can be restored by reversing the disturbance (Walker & Salt, 2006).

The assumption of constant cause-and-effect relationships means also that relationships between particular elements of a system can be modelled in isolation from other system elements, at least when (as is common under the conventional paradigm) an assumption of ‘all else remains constant’ or ‘current trends continue’ is applied to the other elements. ‘Best management practice’ under the conventional paradigm thus came to involve optimising specified elements of a focal system by controlling a few of its other elements. Such control is understood as seeking to shift the system to an optimal equilibrium state which will persist until further external disturbance eventuates (Walker & Salt, 2006).

2.2 *Social-Ecological Systems and Complexity*

RT scholars argue that the assumption of social and environmental systems behaving mechanistically is flawed and became even less fit-for-purpose as a basis for environmental management as humanity’s increasing impact on the life-supporting biosphere moved it into the Anthropocene era (Folke, 2016). Arguing further that it is increasingly inaccurate in this era to characterise human and environmental systems as independent of each other rather than coevolving, they propose that the appropriate focus of management should be on social-ecological systems (SES) which are “intertwined systems of people and nature embedded in the biosphere” (Folke, 2016 p. 2) that behave as complex adaptive systems.

A complex adaptive system consists of multiple autonomous elements in ongoing interaction with one another and with the system itself. It is called complex because its patterns of behaviour are emergent; i.e., they cannot be understood by focusing only on the behaviour of its elements. In contrast to a mechanistic system, the parts of a complex adaptive system and the relationships between them are continually adapting to one another and the state of the system as it evolves due to these adaptations and external disturbances. Predictability of the consequences for the state of a complex adaptive system of any external disturbance, including efforts to

control system behaviour, is therefore low, and system response exhibits high levels of surprise (i.e., unforeseen events) (Berkes, 2017; Ison, Alexandra, & Wallis, 2018).

Aside from RT, the concept of adaptation pathways has emerged as a metaphor to help understand processes of adaptation and transformation in complex adaptive systems (Wise et al., 2014). This metaphor portrays “the state of a system [as] channelled within an evolving stability domain,¹ the resilience of which changes though time” (Abel et al., 2016 p. 4). Although resilience is not necessarily invoked in applications of the adaptation pathways concept (e.g., Gelcich et al., 2010), Abel et al. (2016) has argued that the concept is consistent with RT.

The approach to management favoured in the RT tradition is one of adaptive co-management, in which “institutional arrangements and ecological knowledge are tested and revised in a dynamic, ongoing, self-organized process of learning by doing” (Folke, Hahn, & Olsson, 2005 p. 448). This approach combines active adaptive management with co-management. The former involves an orientation towards “learning by doing” through iterations of assessing opportunities, designing policies as experiments, implementing actions, and adjusting course in light of monitoring and evaluation” (Plummer & Baird, [this volume](#) p. 11). The latter involves collaboration across organisational levels, which in turn requires problem-solving and decision-making powers to be shared across the levels. Adaptive co-management is thus a social learning process that requires collaboration among diverse stakeholders situated at multiple organisational levels (Folke et al., 2005). An analogous process of socio-institutional adaptive learning was identified by Pahl-Wostl (2007) as necessary for water resources management in a world of dynamic climate and social change.

2.3 Resilience

The state of a particular SES can vary within the boundaries of what RT scholars refer to as its stability domain without changing its structure and function. These boundaries are referred to as thresholds. While the state of the SES remains in a particular basin, it tends to gravitate towards an equilibrium state. This equilibrium shifts over time as the shape of the basin changes under the influence of external conditions, and the state of the SES tends to follow the shifting equilibrium, thus tracing an emergent development path (Walker & Salt, 2006). Stable patterns of vested interests and cognition emerge from the path traced, and these constrain opportunities to change the path’s trajectory through policy or governance reform. Institutional analysts associated with the RT tradition refer to such self-reinforcing sequences as institutional path dependence (Marshall, 2013).

RT scholars propose that multiple stability domains exist at any time for a particular SES. The feedbacks driving the dynamics of an SES change if its state

¹This concept is discussed in Sect. 2.3.

crosses the threshold bounding its current stability domain and enters one of the alternative basins. The new stability domain will have its own equilibrium state which will shift as external conditions influence the shape of that stability domain. The system will then have a new structure and function, and a new development path (Walker & Salt, 2006). The transition of an SES's state from one stability domain to another can be non-linear. Seemingly minor disturbances can 'flip' the system to an alternative basin, with major consequences for system structure, function and feedbacks. Such transitions are often surprising given that the alternative basin into which the system ultimately flips, and the timing of the flip, are rarely predictable with confidence (Berkes, 2002).

Resilience is understood in the RT tradition as the capacity of an SES to absorb disturbances and reorganise without its state crossing a threshold to an alternative stability domain. Progressively smaller disturbances are required to shift an SES into a different basin as its resilience diminishes. Assessment of whether resilience of a particular SES is desirable is value-laden. Adaptation refers in the RT tradition to human actions that sustain development on a current path. Those whose values indicate that the SES should move onto another development path may work towards preparing for its transformation (Folke, 2016).

2.4 Transformation

Transformation of an SES is understood in the RT tradition to become increasingly likely as its development path brings it towards the end of the fore loop of what is known as the adaptive cycle. This cycle is identified as a means of characterising the progression of an SES through different phases of organisation and function. Its fore loop comprises the phases of rapid growth and conservation. The back loop is normally much shorter and consists of the phases of release and reorganisation (Walker & Salt, 2006).

The adaptive cycle was proposed as a metaphor for understanding long-term dynamics of change in SESs and complex adaptive systems more generally, and it does not imply fixed, regular cycling. Walker, Holling, Carpenter, and Kinzig (2004) recognised that actual systems can move back from conservation to rapid growth, or from rapid growth directly to release, or back from reorganisation to release. Sundstrom and Allen (2019 p. 1) proposed more recently on the basis of their synthesis of research from a diversity of disciplines, including on evolution of social systems, that "adaptive cycle dynamics are ubiquitous in complex adaptive systems ... [A]daptive cycles are real dynamics of real systems and not just handy conceptual metaphors ..." (p. 1). Abel et al. (2016) have argued that the adaptive cycle is consistent with the adaptation pathways concept: "an adaptation pathway is ... likely to proceed through alternating incremental and transformational changes" (p. 5).

In the conservation phase the elements of an SES become more strongly interconnected, the system becomes increasingly less flexible, and its resilience

diminishes. The magnitude of disturbance needed to initiate the back loop, during which the SES may transform and thus commence a new development path, tends to become smaller the longer the conservation phase persists. The development path subsequently ‘chosen’ may be determined by small random events, as well as by the exercise of power. Those benefiting from the status quo and in positions of power often seek to ward off transformation given its potential to disrupt their agendas. Power can be employed to divert public resources to bolster the resilience of the existing SES. Nevertheless, RT scholars contend that an SES cannot be held indefinitely in the end stages of a conservation phase (Walker & Salt, 2006).

Rather than wait for transformation to eventuate, with all the uncertainty this involves, deliberate or intentional action can be taken to catalyse transformation in directions believed to be beneficial. RT scholars emphasise the importance of such efforts for transitioning onto a path of sustainable development, with Folke (2016) arguing that sustaining favourable biosphere conditions for humanity requires “transformations toward new ways of development, not just incremental tweaking of business as usual on current development pathways” (p. 8).

The RT approach to deliberate transformation focuses primarily on building transformability, which “is about ... having the ability to cross thresholds and move social-ecological systems into ... new, emergent, and often unknown development trajectories” (Folke, 2016 p. 5; see also Olsson, Galaz, & Boonstra, 2014). This ability includes preparing for and creating windows of opportunity, developing capacities to exploit these opportunities, enabling small-scale transformative experiments, and promoting learning and innovation across levels. The focus is on the relatively few slow-changing variables within an SES that determine the dynamics of the faster-moving variables of direct interest to managers. Crucial among these slow variables are mental models, social norms and values that influence social and political support for new approaches (Walker & Salt, 2006).

2.5 Transformative Governance

RT scholarship recognises that scope for deliberate transformation towards adaptive co-management is constrained by power relations embedded in existing governance arrangements established for the conventional approach to environmental management; i.e., by institutional path dependence (Plummer & Baird, *this volume*). The assumptions of system predictability and controllability underpinning this approach encourage confidence that management problems can be solved from afar by centralised authorities who are capable of controlling the actions to be implemented at lower levels (Marshall, 2010). In contrast, deliberate transformation requires the flexibility that adaptive co-management offers managers for self-organised ‘experimentation’ with, and learning from, novel development trajectories (Folke et al., 2005). More generally it requires transformative governance; i.e., governance with capacities to “actively shift a SES to an alternative and inherently more desirable

regime by altering the structures and processes that define the system” (Chaffin et al., 2017 p. 400).

Transformative governance is polycentric (Chaffin et al., 2017). Polycentric governance comprises multiple units of governance at multiple levels of organisation, with substantive autonomy from one another: “no one is in charge” (Abel et al., 2016 p. 2). These units function as a system “to the extent that they take each other into account in competitive relationships, enter into various contractual and cooperative undertakings or have recourse to central mechanisms to resolve conflicts” (Ostrom, Tiebout, & Warren, 1961 p. 831). While RT scholars have tended to focus on the potential for polycentric governance systems to enhance management of complex adaptive systems, the institutional design challenges in realising this potential are formidable (Stephan, Marshall, & McGinnis, 2019).

A system of polycentric governance is itself a complex adaptive system, its emergent behaviour and performance the outcome of its constituent governance units adapting to one another and the evolving behaviour of the system (Ostrom, 1999). Like any CAS, a polycentric governance system exists at any time in one of multiple possible basins of attraction. The contribution of a polycentric governance system to transformability of an SES depends on which of the possible basins the governance system actually inhabits. Ostrom (1999) argued that the challenge of steering polycentric governance systems onto paths conducive to sustained human wellbeing is too complex to be solved optimally; rather it must be pursued by ‘tinkering’ with combinations of institutions to find ones that work together more effectively in present conditions. It follows that polycentric governance systems with greater capacities for such institutional ‘experimentation’ are more likely to navigate successfully onto paths offering transformability when this is required.

The capacity within a polycentric governance system for such experimentation, and for institutional adaptation or transformation informed by the knowledge gained, will increase to the extent that governance units across the system have the autonomy they require to engage in such a process (Ostrom, 1999). A key to achieving and maintaining this autonomy of governance units is the principle of subsidiarity. This principle requires that responsibility for each governance function, together with corresponding decision-making rights, be assigned to the lowest level at which it can be exercised competently. Subsidiarity thus endows all governance units, progressively upwards from informal local groups, with as much decision-making autonomy as they can competently exercise (Marshall & Lobry de Bruyn, forthcoming).

In accordance with self-determination theory (Ostrom, 2005) and associated empirical research in the environmental management context (Marshall, Hine, & East, 2017), greater autonomy of governance units can in turn be expected to strengthen their motivations to cooperate voluntarily with one another in effecting the institutional collective action required for polycentric governance to perform successfully as a system (Marshall & Malik, 2019). While leadership at all levels of an SES has been identified in the RT tradition as important for its transformability (Folke, 2016), leadership effectiveness depends on how voluntarily it is followed.

Substantive autonomy of the units of a polycentric governance system also gives the system what RT scholars describe as a modular structure (Walker & Salt, 2006): while the elements of each governance unit (e.g., directors, staff and volunteers) are strongly interlinked, the units themselves are connected only loosely to each other. This structure facilitates transformability of a polycentric governance system by making the system's 'building blocks' smaller. The smaller these building blocks, and the more autonomous they are, the lower will be the transaction costs of reconfiguring the system (Marshall, 2010).

Transitions to transformative governance nevertheless face obstacles from "the inertia of embedded power relations that govern most SESs towards an unsustainable maintenance of the status quo" and the mental models and value systems that have coevolved with those patterns of power (Chaffin et al., 2017 p. 410); i.e., from institutional path dependence (Noble, Harris, & Marshall, 2017). Resistance by governments to such transitions stems not only from self-interested considerations (e.g., electoral success) but also from the greater tolerance of risk that would be required from them (Chaffin et al., 2017).

Chaffin et al. (2017) argued that the RT concept of panarchy is the key to understanding how such obstacles can be overcome. This concept refers to how the state of an SES at one level influences its states at other levels (Walker & Salt, 2006). Steps towards transformative governance at one level of SES governance can thus be triggered by disruptions at a higher or lower level. As with attempts at deliberate transformation generally, the RT approach to transforming governance is to prepare by building the capacities favouring its emergence when permitted by windows of opportunity.

Smaller initiatives at lower levels may be more effective in the early stages of navigating to transformative governance, and "larger-scale transformation may occur only as personal or individual transformations are scaled up to forge the collective capacity to drive change" (Chaffin et al., 2017 p. 403). Governance experiments at lower levels, beyond the scrutiny of powerful actors seeking to block transformation, can enable a shadow network of actors to erode the dominant governance paradigm by demonstrating the advantages of alternative approaches. Bridging organisations including NGOs can bring in resources and knowledge to support these lower-level transformative initiatives and disseminate their learnings more widely. Such organisations can also lower the costs of collaboration between these initiatives and like-minded parties. Governments can facilitate self-organisation at lower levels through enabling legislation and recognition of bridging organisations (Folke et al., 2005). More centralised and formal approaches will typically be needed later in a transformation process to legitimise the emergent new governance regime and strengthen enforceability of its institutions (Chaffin et al., 2017).

Olsson et al. (2006) used a metaphor of 'shooting the rapids' to highlight the possibility that attempts to beneficially transform governance may fail due to turbulence encountered along the way, including opposition from powerful actors. This possibility signals the importance of building redundancy into governance arrangements. Modularity in a polycentric governance system confers such redundancy: when a governance unit or level fails, there are other units or levels to call upon

(Ostrom, 1999). ‘Capture’ of an entire governance system by opponents to transformation is also more challenging when the system is polycentric, due to its dispersal of authority (Marshall & Alexandra, 2016).

Where transition to transformative governance is successfully navigated, and transformation onto a preferred development path is the eventual result, the challenge remains to consolidate the resilience of this path. At this point “the transformative capacity of governance is no longer necessary and becomes dormant, whereas processes of adaptive governance regain primacy” (Chaffin et al., 2017 p. 409).

2.6 Critique

Social scientists have raised a number of concerns about Resilience Thinking and the ambitions of its proponents. Olsson, Jerneck, Thoren, Persson, & O’Byrne (2015) criticized a tendency for RT scholars to discuss resilience as if it were universally desirable, although some such scholars (e.g., Olsson et al., 2014) working within the tradition had already acknowledged this tendency to be misguided. It is now recognised in this tradition that resilience of an SES can involve lock-in to an unsustainable (or otherwise undesirable) development path, and that efforts to weaken this resilience and enable transformation are appropriate in such cases.

The ambitions of RT scholars to integrate the natural and social dimensions of sustainable development have been identified by social scientists as “easily result[ing] in scientific imperialism – which is arguably how resilience theory has been perceived from the perspective of the social sciences” (Olsson et al., 2015 p. 9). A particular criticism of these integrative ambitions relates to methodological differences between the natural sciences and some social science disciplines. Olsson et al. (2015) remarked accordingly on the challenges of resilience becoming accepted as a unifying concept across all social science disciplines, and argued that the ambitions should be wound back from unifying the natural sciences with all social science disciplines to a “middle-range theory” that may be compatible with only some of these disciplines. RT scholars should in this view come to work more pluralistically within inter-disciplinary programs of research into sustainability challenges. While the present chapter focuses on RT as an alternative to the mechanistic methodology under which the dynamics of water management have conventionally been understood, it is acknowledged that this tradition does not offer a panacea for the shortcomings of this management and that insights from other scholarly traditions will also be important.

Olsson et al. (2015) argued also that RT tends to neglect core concerns of certain social science disciplines, including agency and power. Although such concerns were not central in the emergence of resilience thinking (Folke, 2016), they have received increasing attention in this tradition. For instance, agency has been analysed in terms of leadership and entrepreneurship, and power in relation to devolution of authority, co-management, and institutional path dependence (Olsson et al.,

2014). RT scholars have concluded that research into polycentric environmental governance will “be strengthened by incorporating power dynamics and addressing the analytic and practical challenges therein” (Morrison et al., 2019 p. 6). Power dynamics of this kind feature in Sect. 5 where the recent history of attempts to transform governance of the MDB’s water reform agenda is interrogated.

3 The Murray-Darling Basin

Rivers and their watersheds and floodplains have been identified as SESs (Parsons & Thoms, 2018), as has the MDB (Parsons, Thoms, & Flotemersch, 2017) and its regional subsystems (Marshall & Stafford Smith, 2010). The biophysical subsystem of the MDB SES encompasses the watersheds of two major rivers – the Darling and the Murray – and their many tributary rivers. These rivers flow from the Great Dividing Range across extensive floodplains before discharging to the Great Southern Ocean. There are around 30,000 wetlands within these floodplains, of which 16 are listed under the Ramsar Convention on Wetlands of International Importance. Most of the Basin’s area is naturally semi-arid, and it is one of the world’s most variable river basins in terms of stream flows and precipitation (Grafton & Horne, 2014).

The watercourses and wetlands of the Basin SES are a source of history, lore and succour for around 70,000 Aboriginal people (Australian Conservation Foundation, 2014). The SES is home more broadly for 2.66 million people. More than one-third of the nation’s agricultural production is sourced from the Basin in an average year, including from 9200 irrigated agricultural businesses (Murray-Darling Basin Authority, 2018). Irrigated agriculture typically accounts for around 70% of diversions from the Basin’s rivers (Grafton & Wheeler, 2018), but only 2% of the Basin’s agricultural area (Grafton et al., 2012). Extensive networks of infrastructure regulate flows in the Basin, with major storages on most rivers. Around 80% of the Basin’s wetlands are located on private lands (Office of Environment and Heritage, 2015).

Approved at federation in 1901, the Australian Constitution left state governments with primary control over water policy. The federal (Commonwealth) government nevertheless has leverage in this domain through its constitutional power to enforce international treaties, and from its tax base expanding much faster since federation than that of the states. The MDB is divided between the jurisdictions of four ‘Basin states’ upstream – Queensland, New South Wales (NSW), Victoria and the Australian Capital Territory – and one, South Australia (SA), at the end of its river system (Marshall, Connell, & Taylor, 2013).

Irrigation development in the MDB commenced in the late nineteenth century on a supply-driven path of controlling water through infrastructure. Like in many other nations, this path was championed by “hydraulic bureaucracies” on a mission described as “a celebration of technology and domination over nature” (Molle, Mollinga, & Wester, 2009 p. 336). This path was emblematic of the conventional

management paradigm: "... the future was imagined as a stable state in which pioneering hardship would cease and prosperity descend, with nature now tamed and beneficent" (Stayner & Parsons, 2018 p. 178).

State governments issued new water use licenses throughout most of the twentieth century to increase agricultural production, with most licenses issued during the relatively wet period from the 1950s to the 1990s. Serious problems of water over-extraction emerged when drier conditions returned, requiring the attention of policy makers to shift to managing demand for the Basin's water resources (Wheeler, 2014). By the end of the twentieth century these problems had led to "an alarming level of land and water degradation" (Musgrave, 2008 p. 41). River ecosystem health in 17 of the Basin's 23 valleys was rated as poor or very poor (Davies, Harris, Hillman, & Walker, 2010).

Abel et al. (2016) located the MDB's decision context in the conservation phase of the adaptive cycle, and it appears this context has entered the late stages of this phase wherein the fates of the biophysical and social subsystems of the MDB SES are deeply intertwined. Efforts to increase the Basin's agricultural productivity by tightening control of its surface water systems have led to numerous environmental surprises threatening the productivity and the legitimacy of the irrigation-dominated development path (Marshall & Lobry de Bruyn, 2019). The resilience of the SES has declined, making it increasingly vulnerable to transformation. This vulnerability has been exacerbated by panarchy dynamics, with stakeholders at higher – national and global – levels having come to value more highly the threatened ecosystem services provided by the MDB's rivers and wetlands (Garrick, 2015).

4 Water Policy Reform for Environmental Sustainability in the MDB

4.1 Ongoing Dominance of the Conventional Management Paradigm

Recognition of the consequences of water over-extraction for irrigation development and environmental sustainability led to a succession of attempts to address these consequences through water policy reforms, starting with the national water reform framework agreed to by the Council of Australian Governments in 1994 (Marshall & Alexandra, 2016). For the most part, governments have continued to perceive the dynamics of such reform through the lens of the conventional management paradigm. The effect of such reform has been assumed accordingly to shift water management in the Basin from an existing state to a predictable new, optimal equilibrium. Transition to this optimal state has been assumed to be achievable through controlling a limited number of policy instruments.

This assumed in turn that policy makers could, and would, rationally and comprehensively control implementation of their decisions. However, the degree to

which this assumption has been violated in the practice of conventional environmental management led Dovers (1999), in a paper written for the MDB's natural resources policy community, to characterise the norm in this practice as "ad hocery and amnesia. Initiatives are not persisted with and are not firmly institutionalised, policy fashions are changed unthinkingly, and the potential lessons of both success and failure are not sufficiently pursued, absorbed and acted on to improve our capabilities over time" (p. 3).

4.2 *The National Plan for Water Security*

The most recent round of attempted water policy reform within the Basin was initiated in 2007 by the nation's then Prime Minister announcing a National Plan for Water Security (NPWS) (Australian Government, 2007), subsequently known as Water for the Future. The Commonwealth proposed in this Plan that, with the consent of the Basin states, it would take over responsibility for the MDB's water reform agenda.

The NPWS was intended to overcome inaction by the Basin states on the National Water Initiative which they, with other states and the Commonwealth, had agreed to 3 years earlier. With this Initiative influenced by neoclassical economic theory, environmentally-unsustainable water extraction was understood essentially as a problem of economic inefficiency arising from environmental externalities (Hussey & Dovers, 2006); the solution would involve internalising these externalities through regulation and assigning property rights to the environment, preferably the latter. With this achieved, the Initiative's dominant agenda of establishing a Basin-wide water market to strengthen adaptability within the irrigation sector could be claimed to proceed in the name of both economic efficiency and environmental sustainability.

The grounding of the NPWS in the conventional paradigm's assumption of system controllability was evident from the then Prime Minister's assurance that it would "once and for all" solve the Basin's problem of water over-allocation (Howard, 2007 p. 2). The NPWS led to major reforms: the Water Act 2007 which mandated the Murray-Darling Basin Plan, enacted in 2012, to achieve its objects. These reforms have been hailed internationally as world-leading, with the MDB Royal Commission (Walker, 2019 p. 17) instigated by the SA Government observing that "if the core achievement of the Water Act was preceded by anything similar anywhere else in the world, or for that matter emulated since, this Commission did not discover it".

This core achievement, according to the Royal Commissioner, included a requirement for the Basin's water extraction to be returned to environmentally-sustainable levels. However, the assumption in the conventional management paradigm that such a legislated requirement would be faithfully implemented was overly optimistic. The Royal Commissioner acknowledged the gap between assumed and actual implementation when he expressed "deep pessimism whether the objects and

purposes of the Act and Plan will be realized” (Walker, 2019 p. 11). This gap is evident also in Grafton’s (2019 p. 135) finding that “little has been achieved to date in terms of Basin-scale environmental improvements” (p. 135).

4.3 Surprising Outcomes of Reform Efforts

Surprise is experienced relative to assumptions of how the world works (Folke, 2016). The gap between assumed and actual implementation of the MDB water reforms can be characterised accordingly in terms of surprise. It is the outcome more precisely of a succession of surprises arising from ad hocery and amnesia in implementing the reforms, as well as from positive-feedback dynamics of institutional path dependence that the mechanistic approach of conventional management assumes away.

These positive-feedback dynamics are driven by actors within the social domain of the MDB SES adapting to (a) the attempts at policy reform, (b) each other’s adaptations to these attempts, (c) consequent changes in the ecological domain, and (d) the evolving state of the whole system. The propensity of such dynamics to yield surprises is indicated by Thelen’s (1999) observation that adaptation by those disadvantaged by a new institution “may mean biding their time until conditions shift, or it may mean working within the existing framework in pursuit of goals different from – even subversive to – those of the institution’s designers” (p. 385). Adaptation of this kind in the MDB case can be understood through an RT lens as concerned with maintaining the Basin’s SES in the end stage of its conservation phase by subverting policy reforms that would enable transformation onto an environmentally-sustainable path.

As a first instance of such surprising adaptation in the MDB case, the undertaking in the National Water Initiative for environmental externalities of water extraction to be internalised prior to activation of markets for surface (river) water was soon sidelined by strong advocacy from the farmers’ lobby and irrigators’ councils (Hussey & Dovers, 2006). Existing surface water rights that could have been reduced without compensation were ‘gifted’ to irrigators as secure entitlements. Notably, existing rights that had never been exercised, or long been unexercised, were converted fully to entitlements despite persistent warnings that the resulting increased extractions would exacerbate environmental degradation. Moreover, entitlements to surface water were established prior to regulating alternative (e.g., ground) water sources on which interlinked riverine ecosystems also depended. Together with a ‘cap’ on further MDB surface water extractions agreed by Basin governments in the mid-1990s, the opportunity cost of entitlements arising from their tradability created incentives for irrigators to shift to these alternative water sources, thus further limiting flows to the environment (Marshall & Alexandra, 2016). Crase, O’Keefe, and Dollery (2009) lamented how “the water market that had been so heavily promoted by economists as the vehicle for encouraging water

reform played a significant part in exacerbating the over-allocation problem” (p. 444).

The incentives that market activation created for water to be traded to the most profitable enterprises generated surprise also in terms of unforeseen changes in the Basin’s pattern of irrigated agricultural production. A former senior officer of the MDBA has reported how water reform in the MDB “resulted in the dominance of two crops – cotton and nuts – replacing a more diverse agricultural base that included fodder, dairy, fruit, vegetables, flood plain grazing and rice. Large, often foreign-owned, agribusinesses are replacing family farms” (Slattery, 2019). Given that collective action by members of a group in lobbying for their common interests tends to be more effective the fewer their number and the more focused their interests, this concentration of economic power within fewer members and industries of the Basin’s irrigation sector can be expected to have further increased the sector’s influence over implementation of reform initiatives.

It is arguable that the surprises identified above have transformed the MDB SES into a new stability domain from which transformation onto an environmentally-sustainable path has become appreciably more challenging. It can be argued also that these surprises are traceable to the irrigation sector’s ongoing success in ‘capturing’ at least some of the government agencies responsible for ensuring implementation of the water reform agenda. Despite the then Premier of NSW claiming at the outset of water reform deliberations that “the resource departments have largely accepted that they have a wider brief than just promoting the industry sectors for which they are responsible” (N. Greiner quoted in Wettin, 1991 p. 4), there were warnings soon after that state-level authorities responsible for administering water policy had been captured by irrigation interests (Australian Conservation Foundation, 1992).

In response to apparent regulatory capture of significant elements of the earlier phases of the water reform agenda, lobbying by environmental groups resulted in the current, Commonwealth-led, phase of implementing the agenda. This reassignment of responsibility created strong incentives for irrigation interests to broaden their efforts at regulatory capture to encompass the Commonwealth, including the MDB Authority (MDBA) now primarily responsible for implementing the agenda. Success in these efforts is indicated *inter alia* by the 2015 transfer of Ministerial responsibility for the MDBA, and the Basin Plan, from the Commonwealth’s environmental portfolio to the agricultural portfolio over which irrigation interests have much greater influence (Horne, 2015). A prompt outcome of this increased influence was the Commonwealth’s passing of legislation that placed a 1500 gegalitre (GL) upper limit on acquiring water entitlements for the environment through market purchases, despite such purchases being at least 2.5 times more cost effective, on average, in acquiring a given volume of water than the infrastructure-based water-saving projects (e.g., pipelined irrigation supply systems) favoured by the irrigation lobby (Grafton, 2019).

The NPWS included a commitment “to preserve the integrity of the entitlement system” by establishing “an effective metering, monitoring and compliance system” (Australian Government, 2007 p. 11). Ongoing regulatory capture in at least one

Basin government is suggested by accusations of illegal water extractions in the northern zone of the Basin that only became public due to investigative journalism televised nationally in July 2017. The MDB Royal Commission (Walker, 2019) reported that “perceived lack of enforcement action has produced considerable mistrust in the law and its administration, as well as within communities and amongst Basin States” (p. 67).

Loss of legitimacy of the Commonwealth’s water reform agenda is the last surprise to be considered here. In launching the NPWS the then Prime Minister claimed this legitimacy on the basis that Commonwealth was offering to assume responsibility for a water over-allocation problem in the MDB “created entirely on the watch of state governments around Australia ... This is our great opportunity to fix a great national problem. It can only be solved if we surmount our parochial differences” (Howard, 2007 p. 6). In contrast, the MDB Royal Commission (Walker, 2019) found that key decisions made by the MDBA in the process of developing and implementing the Basin Plan had been unlawful and/or involved maladministration. It observed also that unchecked non-compliance with the Water Act 2007 and the Basin Plan “brings the law and its administration into disrepute and is likely to hinder its widespread observance. Its largest impact on a Basin-wide scale is on public confidence in the competent management of the Basin’s water resources” (p. 51).

Despite Commonwealth claims that implementing the NPWS would overcome the ‘parochial differences’ of the Basin states, the Royal Commission was left with “concerns about [the MDBA’s] genuine commitment to holding Basin States accountable” (ibid., p. 67). The Productivity Commission (2018) found accordingly that implementation of the Basin Plan would be at risk if the compliance functions of the MDBA were not assigned to a new, independent Commonwealth statutory entity. Meanwhile, the Basin Plan has been described as “on a knife edge”, with possibilities in play that irrigators or environmental groups will challenge the Basin Plan in the High Court on constitutional grounds, or one or more Basin states will withdraw from its implementation (Keane, 2019).

5 Transforming Governance of the Water Reform Agenda

5.1 Constraints on Adaptive Co-management from Existing Governance

The foregoing account reveals how attempts by MDB policy makers to effect a transition to environmentally sustainable water use in accordance with the conventional approach to natural resources management have repeatedly, and seriously, underestimated the complexity of this undertaking. It is consistent with identification of a need in the RT tradition for an alternative management approach – adaptive co-management – that is predicated on this complexity and its accompanying

uncertainty, rather than on conventional assumptions of predictability and controllability.

This alternative approach appears at first glance to have been accommodated in more recent iterations of the water reform agenda, at least in respect of the adaptive management dimension of this approach. Commonwealth and state governments agreed when establishing the National Water Initiative that their frameworks for water property rights and planning would provide for adaptive management of surface and groundwater systems (Council of Australian Governments, 2004). The ‘operational’ focus for adaptive management that was agreed to is nevertheless distinct from the ‘institutional’ focus in this chapter on adaptive management of the policy reform process. In any case, what governments have called adaptive management in the MDB has for the most part varied little from conventional management (Allan, 2008). This is despite the resilience concept having been invoked in both the NPWS and the Basin Plan. The outcomes to be achieved by the latter include “productive and resilient water-dependent industries” and “healthy and resilient ecosystems” (Commonwealth of Australia, 2012, clause 5.02(2)).

Status quo governance arrangements have been identified as a key source of the institutional path dependence that continues to constrain management of the MDB water policy reform process in transitioning from the conventional approach to one of adaptive co-management. Stayner and Parsons (2018) argued that for the MDB and northern Australia “substantial shifts in governance and legislation will be required to embed the resilience approach into water management practice, because resilience is not a blanket that can be overlain onto existing structures” (p. 184).

5.2 Proposals for Basin-Wide Transformation of Water Governance

There has been a series of proposals since at least 2003 for MDB water governance arrangements to be transformed in the direction of subsidiarity. These proposals were renewed upon the passage of the Water Act 2007 when primary responsibility for the water reform agenda was centralised to the Commonwealth. Young (2010) argued that a system of environmental water governance designed in accordance with the subsidiarity principle, with regional environmental trusts (non-profit bodies independent of governments) allocated environmental water entitlements they could manage with considerable autonomy, would provide more cost-effective and innovative management of Commonwealth-acquired environmental water than the centralised approach of the Commonwealth Environmental Water Holder (CEWH, responsible under the Water Act 2007 for managing the Commonwealth’s environmental water holdings).

Release in 2010 of the *Guide to the Basin Plan* for public consultation brought to a head criticism of what was widely characterised as a centralised approach to developing the Plan. This approach reflected a strong centralising tendency within

the Commonwealth that had been evident in its increasing control over the operations of regional natural resource management (NRM) organisations that it had funded on a purchaser-provider basis since at least 2000 (Curtis et al., 2014); there are about 14 such organisations within the MDB (Alexandra, 2019). Proposals to counter centralisation of the water reform process by establishing regional environmental water trusts continued to be argued; e.g., with Campbell (2010) arguing that

locally-driven environmental watering [i.e., water delivery] plans can more easily capture opportunities, better meet environmental needs, and better manage third-party impacts. Working with Landcare and catchment groups, environmental water managers can complement activities such as weed and pest control, or revegetation works, to deliver multiple benefits for river health, biodiversity and salinity management. (para. 23)

In contrast, the Commonwealth's Productivity Commission (2010) recommended that any devolved governance arrangements for environmental water management build on the regionalised arrangements for NRM governance. Although this strategy may have been less risky for the Commonwealth, its contribution towards effective subsidiarity would have been much less than envisaged by Campbell given the limited autonomy of regional NRM organisations (Ryan, Broderick, Sneddon, & Andrews, 2010), and the limited autonomy they typically allowed Landcare and other local action groups that depended on them for funding (Campbell, 2016). Power relations and mental models embedded in status quo governance thus served to dilute proposals for transformative devolution of environmental water management such that the outcomes would have been adaptive at best. In any case, the Productivity Commission's proposal was not implemented, at least partly due to concerns regarding the technical capacities of regional NRM organisations to take on responsibilities for environmental water management (Cummins & Watson, 2012).

5.3 Bridging Organisations, Panarchy, and Emergence of Transformative Governance

Transformation of MDB environmental water governance nevertheless appears to be underway as a result of a series of small, lower-level transformations that commenced over a quarter of a century ago. The NSW Murray Wetlands Working Group (MWWG, later becoming the Murray-Darling Basin Wetlands Working Group or MDWWG) was established in 1992 as an local initiative of the Murray and Lower Murray Darling Catchment² Management Committees (Nias, Alexander, & Herring, 2003). Its purpose was to develop and implement technically-sound and community-endorsed plans to improve management of wetlands in these catchments "by linking community involvement with best scientific understanding" (MDWWG, 2017). Its

²Synonymous with 'watershed'.

20 members included representatives from community, industry, government, catchment management committees, science, and the former MDB Commission.

Over 2000–2009 the NSW Government entrusted the MWWG with responsibility for managing two environmental water licenses amounting to 32 GL that this government had created from water-saving projects in the area of operation of Murray Irrigation Limited (Murray Irrigation) (Bowen & Nias, 2008). In a trial project to support rehabilitation of remnant wetland areas within that area, the MWWG worked with Murray Irrigation, its shareholders (irrigators supplied through its infrastructure), and the NSW Government to deliver water via irrigation infrastructure to wetlands on voluntarily-participating private properties. Prior discussions had identified that “some landholders were nervous at the idea of working with ‘greenies’ and were concerned that we may start dictating how they might manage their properties” (Nias et al., 2003 p. 7). However, numerous Murray Irrigation irrigators contacted the MWWG, after the trial, to ask about participating in a similar project. Over 2000–2006 it managed projects which engaged 131 private landholders and diverted 82.5 GL into wetlands on private properties within these catchments (Nias & Jones, 2012).

In 2009, with environmental water acquisition being massively scaled up under the Water for the Future program, responsibility for the environmental watering programs established by the MWWG was taken over by the NSW Government’s environmental agency. Like other NGOs that had become involved with environmental water, the MWWG had to reconsider its role given the escalation of government activity in that domain. It was one of six NGOs that established the Water Trust³ Alliance in 2010 to “build constructive associations between water trusts and governments, landowners, business and community groups to optimise the effectiveness of environmental water management” (Siebentritt, 2012 p. ii). Other Alliance members were: Australian Conservation Foundation; Environmental Water Trust; Healthy Rivers Australia; Murray-Darling Association (of local governments); and the Nature Foundation SA.

A workshop convened by the Alliance in late 2011 found that although NGOs had successfully achieved community buy-in to environmental water programs, they faced irrelevance unless they focused on “how to increase their maturity and capacity for commercial and legally recognised operations ...” (Siebentritt, 2012 p. 24). This need had been anticipated by the MWWG when in 2009 it started to work under a corporate structure, and by its successor the MDWWG which acquired the Environmental Water Trust to partner with The Nature Conservancy in establishing the MDB Balanced Water Fund.

The Environmental Water Trust was established in 2007 as a national non-government charitable organisation to facilitate investment in the long-term health of Australia’s wetlands and rivers. The Balanced Water Fund “enables traditional, capital market investors to support large-scale, long-term conservation works while

³ ‘Water trust’ referred loosely to NGOs involved in acquiring or managing water for environmental purposes.

diversifying their portfolio and earning income through investment in the Australian water market” (Carr, Nias, Fitzsimmons, & Gilmore, 2016 p. 269). It is anticipated that 20% of the water assets acquired by the Fund will on average be donated to the Environmental Water Trust for environmental watering in the MDB, primarily of wetlands on private land. The Fund also donates cash to the Trust to cover the MDWWG’s costs in conducting environmental watering on its behalf. A representative of The Nature Conservancy quoted in Marshall (2017) viewed its role as catalytic, intending that after 10 years “things like the Balanced Water Fund are a matter of course, and there’s no longer a need for us to be involved” (p. 200).

Recognising the challenges faced by the CEWH in delivering water to wetlands on private lands, the MDWWG approached it with a proposal to manage a portion of its water similarly to its prior arrangement with the NSW Government. The CEWH was interested but the idea stalled in the absence of a commitment to covering the MDWWG’s costs in performing this role. As explained by a representative of the Nature Fund SA quoted in Marshall (2017), this NGO was prepared to “take the water and then bargain after the event” (p. 196). This strategy paid off, with the CEWH ultimately agreeing to a five-year partnership agreement with the Nature Fund SA (CEWH & Nature Fund SA, 2012) under which they would deliver up to 50 GL of the CEWH’s water to smaller wetlands and floodplains along the lower Murray River (CEWH & Nature Fund SA, 2012).

The Nature Fund SA’s strategy of starting small and building trust incrementally was successful: “From fighting every step of the way initially ... there [has been] a huge change in the level of trust, and therefore the level of flexibility that we have” (Nature Fund SA representative quoted in Marshall, 2017 p. 197). During this process the Nature Fund SA mentored other NGOs also based in the lower Murray region of South Australia – the Ngarrindjeri Regional Authority (the peak organisation of the Ngarrindjeri Indigenous Nation) and the Renmark Irrigation Trust – that were looking to develop their own capacities for environmental water management. The CEWH subsequently instituted partnership agreements, similar to that established with the Nature Fund SA, with each of these two other NGOs. The then incumbent in the CEWH position⁴ envisaged partnerships of this kind being replicated across the MDB:

My longer-term ambition would be to have examples of those agreements across the Basin, across all the jurisdictions. ... Things will change in ways that we can’t predict, so that’s why we’re trying to be very open to approaches from non-government organisations and individuals in this. I see these things, with appropriate limitations imposed by legislative responsibilities and resourcing implications, growing in spread and value. ... My understanding is evolving with my experience of it; so I’m seeing it already being more powerful than I thought it could be. ... I just want a system that allows that evolution, builds the capacity of the non-government groups, gets us to the point where we’re not so risk averse. (Marshall, 2017 p. 200)

We see in this account how cross-level dynamics of panarchy have enabled transformation of a significant and growing share of environmental water governance in

⁴David Papps.

the MDB despite constraints on all-at-once Basin-wide transformation arising from institutional path dependence. Local entrepreneurship by NGOs, as bridging organisations, established a foundation for higher-level governance innovations in raising funds for NGO involvement in environmental watering and managing such watering. Grounded in the subsidiarity principle, the emerging governance arrangements are conducive to the informed experimentation and power-sharing of adaptive co-management. Success of this management approach in expanding the reach and effectiveness of environmental watering programs, and strengthening their legitimacy, is weakening the hold of the conventional management paradigm. This effect is not limited to the CEWH; for instance, a representative of the NSW Government agency responsible for environmental water management stated:

We're starting to loosen the reins a little bit. Particularly ... in engaging with environmental trusts and conservancies and the like, because they often have the ability to do more than just play with the water; they can do revegetation programs, or fencing, or stock removal or whatever. And in some instances they can have better relationships with the landholders as well ... (Marshall, 2017 p. 204)

The emergent transformation that has occurred in governance of CEWH-held water is particularly significant in the present context of increasing doubts that governance arrangements for the Basin Plan will be capable – with the MDBA's legitimacy diminished by recent events, and support from some Basin state governments remaining questionable – of securing its implementation (Alexandra, 2019). Marshall et al. (2013) anticipated this scenario when predicting that CEWH-held water would come to supplant the Basin Plan as the centrepiece of the MDB's high-level water policy and management system:

The Commonwealth is likely to acquire sufficient water entitlements under its direct control ... to be able to achieve most of the environmental targets of the Basin Plan even if the states withhold their support. ... It is likely therefore that in coming years the CEWH will emerge as the most important water management institution in the MDB. (p. 210, 212)

If this prediction holds true, then the transformation occurring in governance of CEWH-held water has significance not only for management of environmental water across the MDB but also for higher-level processes of water policy reform. The spread of adaptive co-management of environmental water under such a scenario may normalise the approach to a degree that policy makers come increasingly to acknowledge its advantages in their realm over the conventional approach assuming predictability and controllability.

6 Conclusion

This chapter explored how insights from RT can better inform efforts to reform water policies consistently with requirements for sustainable development. The focus was on the Murray-Darling Basin (MDB) in Australia, and particularly on reforms seeking to achieve environmentally sustainable water use. We found that

this reform process remains dominated by a conventional, command-and-control, management approach that asserts predictability yet repeatedly delivers uncertainty in its place. In contrast, the RT approach to water policy reform in the MDB would involve adaptive co-management. This approach would avoid those surprises arising from the conventional approach's misguided confidence in the predictability and controllability of the reform process, while being fit-for-purpose in dealing with the irreducible uncertainty of outcomes from intervening in the Basin's complex social-ecological dynamics.

An RT perspective highlights that shifting to adaptive co-management of the reform process would require transformation of the governance arrangements that evolved to support the conventional management approach. The MDB experience reveals that it is possible for such transformation to emerge through the cross-level dynamics associated with the resilience approach's concept of panarchy. Local-level entrepreneurship by NGOs (as organisations bridging governments and local communities) in environmental water management has in this case established a foundation from which transformative governance of the Basin's sustainability-driven water reform agenda continues to evolve. We conclude that RT can, working pluralistically with other scholarly traditions, make important contributions to understanding how ongoing challenges in reforming water policy for sustainable development might effectively be overcome.

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