

Natural resources governance for the drylands of the Murray-Darling Basin

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Abstract

Recent years have seen rapid expansion in the critique of arrangements for the governance of natural resources in Australia. Concurrently, there has been a growing assertion internationally that drylands share features that justify a specific ‘desert syndrome’ conceptualisation of how to manage them. These issues come together in the drylands of the Murray Darling Basin (MDB). We explore in this article the insights that this convergence provides for designing governance arrangements for the natural resources of the MDB. We argue that the characteristics of the MDB drylands justify transformation of these arrangements to those of adaptive governance; and more specifically that this model of governance should be founded on the related concepts of polycentricity and subsidiarity. We explain how three aspects of polycentric governance contribute to the robustness of social-ecological systems and identify the particular relevance of each to the MDB drylands. Even so, transformation to polycentric governance would face formidable obstacles from vested interests and mental models that have adapted to the status quo. Acknowledging the reality that hurdling such obstacles requires strategic preparation to exploit windows of opportunity, we propose a number of pragmatic steps to be followed in strategically pre-adapting the MDB drylands for this transformation. Although transforming to adaptive governance comes with risks, we contend that the risks of inaction for the MDB drylands are greater.

Additional keywords: adaptive governance, cost-effectiveness, desert syndrome, polycentricity, robustness, subsidiarity, transformation.

0. Introduction

Recent years have seen rapid expansion in the critique of arrangements for the governance of natural resources and the environment in Australia (Curtis, Shindler *et al.* 2002; Lane, McDonald *et al.* 2004; Marshall 2008; Marshall 2009a), where governance involves the ‘formation and stewardship of the formal and informal rules that regulate the public realm, the arena in which the state as well as economic and societal actors interact to make decisions’ (Hyden, Court *et al.* 2004 p. 16). Concurrently, there has been a growing assertion internationally that drylands may share features around the world that warrant a specific conceptualisation of how to manage them (Reynolds, Stafford Smith *et al.* 2007; Stafford Smith 2008a). These issues come together in the drylands of the Murray Darling Basin (MDB).

43 In this article we explore the extent to which this convergence provides new insights
44 into future NRM governance arrangements for the MDB. The remainder of this article
45 proceeds in seven sections. In the next section we explore the particular challenges the
46 social and biophysical context of the MDB drylands poses for NRM governance. In
47 section 2 we discuss recent innovations in the theory of natural resources governance,
48 relating to the concepts of adaptive and polycentric governance, relevant to these
49 challenges. The process of transforming to a polycentric governance model for the
50 MDB is then considered in section 3. Although this transformation may be expected to
51 strengthen the robustness of social-ecological systems in the MDB, it might also be
52 expected to reduce their short-term performance. In deciding whether to transform to a
53 polycentric model and, if so, what form that model should take, trade-offs between
54 long-term robustness benefits and short-term performance costs need to be considered.
55 In section 4 we consider these trade-offs and propose an appropriate economic
56 framework for thinking about them. In section 5, we then explore the development of
57 polycentric governance in an MDB ‘green field’ setting (i.e., without pre-existing NRM
58 governance arrangements). In section 6 we recognise that the MDB drylands are far
59 from a blank slate in this respect, and that the population of this zone would be unlikely
60 to embrace an immediate change from current NRM governance arrangements to
61 polycentric arrangements. We therefore propose a number of practical steps preparatory
62 to shifting to polycentric governance that could be advanced in the near future within
63 the current configuration of NRM governance in the MDB. Our conclusions are
64 presented in section 7.

65 **1. Challenges in the MDB rural drylands**

66 Whilst a large proportion of the productivity of the MDB depends on its water
67 resources, by far the largest proportion of its land area is drylands (i.e., with an aridity
68 index between 0.05 and 0.65; see Middleton and Thomas 1997), with average annual
69 rainfall varying from over 1000mm on parts of the western slopes of the Great Dividing
70 Range to less than 350mm in its more arid western plains (MDBA 2006: Fig.3). This
71 rainfall gradient is paralleled by a gradient in settlement intensity, denser in the
72 irrigation districts to very sparse away from the rivers with concomitant increase in
73 remoteness (Figure 1). In 2006, only about 59,000 people lived in the extensive
74 ‘remote’ and ‘very remote’ parts of the Basin, 0.5m in ‘outer regional’ and 1.4m in the
75 ‘inner regional’ and cities categories of the Accessibility and Remoteness Index of
76 Australia (ABS 2008: Table 2.7). Seventy-three per cent of the MDB was devoted to
77 livestock production in 2001, much of it by area under drylands grazing (MDBA 2006);
78 this area produced two fifths of Australia’s livestock revenue, though only \$4.2bn of the
79 MDB’s total \$15bn in 2005/06 agricultural revenue (ABS 2008: Table 4.21).

80 *Governance background and issues*

81 Rights, responsibilities and resources for natural resources management (NRM) in the
82 MDB are currently spread in complex ways across many scales. Management and
83 planning occurs at all scales from the individual property, through local collective or
84 common-property groups (e.g., landcare, bushcare, sustainable production, salinity
85 action, Indigenous rangers, water watch, etc.), to NRM groups at a catchment or
86 regional level up to the Murray-Darling Basin Authority (MDBA) at a river basin level;
87 across these are layered the governments of the four states (Queensland, New South
88 Wales (NSW), Victoria and South Australia) and one territory (Australian Capital
89 Territory, ACT) with jurisdiction over parts of the MDB, as well as the federal
90 government and multiple local governments (Connell 2007; Papas 2007; Figure 1).

91 This already complex governance landscape is not working very well. Until 2008, when
92 the MDBA was established as a federal government agency to take over responsibility
93 for managing the water resources of the Basin, responsibility for coordinating the
94 activities of the state and territory governments in this domain was assigned to the MDB
95 Ministerial Council (MDBMC) which comprised relevant ministers from these
96 governments and the federal government. This body sought to pursue an integrated
97 catchment management (ICM) approach to managing natural resources across the whole
98 of the Basin, recognising the need for horizontal and vertical collaboration throughout
99 the governance system given the cross-scale interdependence of water and other natural
100 resources. Aside from integrating the management of different natural resources across
101 different parts of the Basin, it was recognised that decisions arising from the ICM
102 approach would need to be well-adapted to local context and ‘owned’ by local
103 stakeholders in order to obtain the high levels of voluntary cooperation needed for their
104 successful implementation. A need was thus perceived to devolve collective decision-
105 making rights to the appropriate level, including to community-based bodies where
106 capacities to effectively exercise these rights were evident.

107 However, the MDBMC’s success in actually delivering ICM was limited considerably
108 by the states and the ACT using their veto powers to obstruct decisions threatening their
109 partisan interests, including decisions to strengthen the decision-making autonomy of
110 regional NRM bodies. The MDBMC was frustrated in these efforts also by a lack of
111 financial leverage with which to motivate compliance with its ICM approach, given that
112 the major public funding program for NRM in the Basin became the National Action
113 Plan for Salinity and Water Quality (NAP) over which it lacked administrative
114 influence (Connell 2007).

115 The MDBA was established by the federal government to overcome the obstacles to
116 management of the Basin’s water resources caused by state and territory vested interests
117 (Bhat 2008). Although the Water Act 2007 (Commonwealth of Australia 2007) that
118 shapes MDBA programs focuses primarily on managing water resources in the national
119 interest, it requires this management to account for its consequences on the MDB’s
120 other natural resources (over which the state and territory governments retain
121 responsibility under the federal constitution). The MDBA’s ability to implement its
122 plans remain heavily dependent on cooperation from the states and the ACT which have
123 the knowledge, experience and supervisory capacity needed to effectively audit
124 compliance with its management decisions in the context of institutional arrangements
125 unique to each jurisdiction (Connell 2007).

126 This ability will also continue to depend heavily on obtaining high levels of local
127 engagement and cooperation given the reliance on private landholders to undertake
128 much of the needed on-ground activity. This has become more challenging, however,
129 given that the move from the NAP to its successor program – Caring for our Country –
130 has left regional NRM bodies with even less autonomy to adapt their investment
131 decisions to their unique circumstances.

132 Meanwhile, the MDB drylands have continued to face massive natural resource
133 challenges in recent decades due to soil degradation, salinity and acidification,
134 compounded by overallocation of water and consequent distortion of markets for land
135 and water (Young and McColl 2009). The Basin has also experienced step changes in
136 rainfall and water flows and increases in temperature which are consistent with further
137 challenges that may be expected from climate change in the future (e.g., Potter, Chiew
138 *et al.* 2010).

139 These types of challenges are very much the unexpected emergent issues which arise in
140 complex social-ecological systems (Chapin, Kofinas *et al.* 2009). An extended
141 literature on resilience (e.g., Walker and Salt 2006) has proposed a variety of strategies
142 to enhance system preparedness to what are largely unpredictable impacts. Connell
143 (2007) drew on this literature to argue for a fundamental rethink of how NRM
144 governance in the MDB is structured. 'Resilience thinking' has also informed a growing
145 literature about NRM in general (e.g., Chapin, Kofinas *et al.* 2009) and for drylands in
146 particular (Reynolds, Stafford Smith *et al.* 2007; Stafford Smith, Abel *et al.* 2009).
147 Given these challenges and developments, it is timely to consider whether the recent
148 advances in theory and practice in drylands governance hold any lessons for the MDB
149 drylands.

150 *Developments in drylands theory*

151 There have been numerous recent developments in the analysis of how sparsely
152 inhabited drylands may function in ways that differ profoundly from urban centres
153 (Reynolds, Stafford Smith *et al.* 2007; Stafford Smith 2008a). These authors argue that
154 a 'desert syndrome' of interlinked characteristics of dryland regions appears to underpin
155 many of the features that various researchers have identified in compartmentalised
156 studies of the biophysical and social functioning of outback Australia. These linked
157 desert drivers are biophysical unpredictability, scarce and patchy resources, sparse
158 populations, mobility, remote markets, isolation from political power, cultural
159 differences, local knowledge and social uncertainty. The hypothesis is that these are
160 causally linked in deserts in ways that they are not in other environments that may
161 otherwise share some of the features, and that, because this occurs over a very large area
162 (and proportion) of the continent, their effect is especially magnified in Australia
163 (Stafford Smith and Cribb 2009; Stafford Smith and Huigen 2009). Many of the
164 conjectures may apply equally well to other types of remote regions, given whatever
165 other drivers may cause low population in the first place.

166 These authors observe that a number of trends are correlated with increasing
167 remoteness:

- 168 • remoteness from centres of governance can mean that local problems can
169 become more easily forgotten or neglected by these centres, increasing the need
170 for lower levels of governance to take on added responsibilities when this
171 happens;
- 172 • centres of governance have increasing difficulty appointing and retaining
173 suitable staff with the capacities needed for managing remote regions, so that the
174 performance of these centres in managing remote regions is more 'brittle' relative
175 to other regions; and
- 176 • the greater scarcity of leadership and other human capacities in remote
177 populations (exacerbated by the heightened 'stretching' of those limited
178 capacities if government services are rolled back) can render the performance of
179 local governance arrangements particularly fragile.

180 A core role of governance is provision of public goods and services. Here we
181 particularly focus on NRM services, but we couch the discussion in broader services
182 terminology since at times collaboration between sectors (education, health, stores, road
183 provision, policing, etc.) may be important. The authors above argue that the sparseness
184 of remote populations means that, whilst governance needs to be tuned to local
185 conditions in this vast country, some services need to be delivered at a regional scale to

186 make them economic. Even then, delivery organisations need to combine different types
187 of services to be efficient, thus exploiting economies of scope rather than of scale.
188 Economies of scope arise ‘when the cost of a given set of services being produced by a
189 single organisation is lower than the cost of those services being produced by a number
190 of specialised organisation’ (Dollery, Crase *et al.* 2006, p. 147). Attempts to have the
191 governance and the delivery of services at the same scale (as is common in more settled
192 regions) therefore generally fail. Those discussing the desert syndrome argue that
193 successful case studies of regional governance in sparsely inhabited drylands are based
194 on autonomy at the most local scale (‘subsidiarity’), linked with (but separate from)
195 flexible regional organisations to deliver the services; this combination seems especially
196 important for sparse, remote populations. This idea is exemplified by the arrangements
197 of the Ngaanyatjarra Council in Western Australia (Ngaanyatjarra Council 2003). This
198 non-government, regional organisation combines road maintenance with centralised
199 stores purchasing, fuel delivery and health services among other activities that are
200 delivered more efficiently at a regional than individual settlement scale. Even though it
201 is almost geographically coincident with the Ngaanyatjarraku local government body, it
202 is able to achieve economies of scope not permitted under local government legislation,
203 and it delivers some services (e.g., fuel distribution) across a much larger region than
204 the elected local government area (see Stafford Smith and Cribb 2009, Chapter 9).

205 These ideas undoubtedly apply in some measure to the drier parts of the MDB but, more
206 importantly, they highlight the fact that different parts of the settlement gradient –
207 remote, marginal rural, core agricultural, even peri-urban – within the MDB are also
208 likely to be functionally differentiated. This leads to two implications. First, approaches
209 to the governance of service delivery (including NRM services) in remoter parts of the
210 MDB are likely to require a different conceptualisation to those of core farming regions.
211 Second, though, by extension, it is likely that different approaches may be needed even
212 across the diverse range of settlements densities of the MDB itself. Given the pressures
213 on administrators to find universally consistent (or ‘one-size-fits-all’) policies as much
214 as possible, this begs the question of whether there is any basis for such differentiation
215 in governance theory.

216 **2. Recent innovations in governance theory**

217 The source of pressures on Australian administrators to find one-size-fits-all solutions to
218 NRM problems can be traced to the Progressive Conservation Movement in the USA.
219 The emergence of NRM governance in Australia was influenced strongly by this
220 movement, although the Progressive model translated to Australian conditions as a
221 unique variant of the US prototype (Bradsen 2000; Frawley 1994). ‘Progressive’ NRM
222 governance was founded on the premises of modernist science, and natural and social
223 (including administrative) systems were believed accordingly to behave mechanistically
224 in accordance with a small number of universal principles (Hays 1959; Norgaard 1994;
225 Marshall, forthcoming). By providing confidence that experts and administrators could
226 optimally control natural systems by universal (one-size-fits-all) solutions designed
227 from afar, these premises offered intellectual legitimacy for a centralised top-down
228 (‘monocentric’) model of NRM governance (Nelson 1987).

229 This confidence was reasonably appropriate in frontier societies predominantly
230 experiencing slow, steady progress. It became less appropriate, however, when progress
231 reached the stage of pushing against thresholds of natural systems beyond which they
232 responded much less predictably. Degradation of natural systems as a result of crossing
233 these thresholds became popularised by Hardin (1968) as ‘tragedies of the commons’.

234 With at least the threat of such tragedies arising with increasing frequency, the social
235 and political problems of managing them escalated also. An era of slow, steady
236 development in the subject matter of NRM governance had given way to one of rapid,
237 abrupt and turbulent change (Folke, Hahn *et al.* 2005).

238 Recognition of this quantum shift in the circumstances of NRM governance led to a
239 variety of searches for, and ‘experiments’ with, alternatives to the Progressive model as
240 it continued to evolve in response to Australian conditions. For instance, localism and
241 regionalism were reflected in early experiments with decentralising functions to
242 participatory NRM bodies; in NSW these included pasture protection boards dating
243 from 1912 and river improvement trusts from 1948 (Dovers 2000). More recently, these
244 searches have led to an emerging consensus that social and natural systems are often
245 now closely coupled, and, where this is the case, they should be managed jointly as
246 ‘social-ecological systems’ (SES) (Folke, Hahn *et al.* 2005; Brunckhorst 2010).
247 Included in this consensus is an acceptance that SES are not mechanistic systems but,
248 rather, complex adaptive systems prone to abrupt, turbulent and surprising change.
249 Attempts to control an SES to stabilise its provision of desirable attributes are
250 understood in this consensus as increasing its vulnerability to such kinds of change by
251 weakening its capacities for adaptation and transformation (Olsson, Gunderson *et al.*
252 2006). There is recognition too that the behaviour of SES is ‘emergent’ rather than
253 reliably predictable from the behaviour of their parts, so that system governance to
254 succeed must be based on cross-scale collaboration and learning that enables as
255 complete an understanding of the whole system as possible (Berkes 2007; Folke, Hahn
256 *et al.* 2005).

257 The risk of SES shifting unpredictably into unsustainable or otherwise undesirable
258 states highlights the value of investing in their ‘robustness’ (Anderies, Janssen *et al.*
259 2004). This term has been defined as ‘the maintenance of some desired system
260 characteristics despite fluctuations in the behavior of its component parts or its
261 environment’ (Carlson and Doyle 2002, p. 2538). An important way of investing in the
262 robustness of an SES is to invest in the robustness of the governance system it relies
263 upon to solve its problems of collective action in managing natural resources. As
264 applied to a governance system, robustness refers to the system’s ability to adapt and
265 transform in response to disturbances in order to continue performing its core functions.
266 The term ‘adaptive governance’ describes governance systems with such ability (Dietz,
267 Ostrom *et al.* 2003; Folke, Hahn *et al.* 2005; Olsson, Gunderson *et al.* 2006; Nelson,
268 Howden *et al.* 2008; Moran and Elvin 2009).

269 Adaptive governance has become closely identified with the concept of ‘polycentricity’
270 (Folke, Hahn *et al.* 2005; Marshall 2005; Moran and Elvin 2009), and discussions of
271 robust forms of governance (e.g., Ostrom 1999; Lebel, Anderies *et al.* 2006; Marshall
272 2008; Marshall 2009b; Walker, Abel *et al.* 2009; Stafford Smith and Cribb 2009;
273 Marshall, forthcoming) often refer to this concept rather than to adaptive governance
274 *per se*. Polycentric governance comprises multiple decision-making centres, each with
275 substantive autonomy. The centres are located across multiple levels of decision making
276 (Ostrom 1999). This structure is consistent with the eighth of Ostrom’s (1990, p. 90)
277 design principles for robust NRM governance, which focuses on governance at larger
278 scales: ‘... governance activities are organized in multiple layers of nested enterprises’.
279 The substantive autonomy of the system’s multiple centres gives it a modular structure:
280 while the components of each centre (e.g., staff, community representatives, etc.) are
281 strongly inter-linked, the centres themselves are connected only loosely to each other
282 (Walker and Salt 2006). System performance depends on the multiple centres

283 collaborating with one another, including across the various levels, to: minimise conflict
284 and unproductive competition; share and make sense of information; define problems,
285 solutions, responsibilities and rights; and develop and maintain social capital.

286 A polycentric governance system is itself a complex adaptive system, its emergent
287 behaviour the outcome of the multiple centres self-organising by adapting to one
288 another and the evolving structure of the whole system (Ostrom 1999). As with any
289 complex adaptive system, attempts to control the behaviour of the system or its
290 constituent centres reduce the system's robustness against abrupt and turbulent change.
291 In any case, it is unrealistic to expect to be able to design a polycentric system of
292 governance optimally at the outset. If an optimal design could be identified for a
293 particular context, moreover, its optimality would soon end with changes in the context
294 and in the emergent behaviour of the system. Design of a polycentric governance
295 system should therefore proceed adaptively, seeking to influence self-organising
296 processes with a 'nudging hand' rather than with a 'heavy hand' or 'invisible hand'
297 (Arthur 1999).

298 Where to start? Ostrom (2005) observed that the quality and speed of a search process
299 for a well-performing polycentric governance system is substantially affected by where
300 one starts, and argued that the search in any context should start from lessons or
301 principles distilled from institutional research. (Institutions are commonly distinguished
302 in this research from organisations, with North (1990) referring to institutions as the
303 'rules of the game' and organisations as the teams playing.) There is now, for example,
304 a good understanding of the seven categories of rules that organisations require,
305 implicitly or explicitly, to function effectively (Ostrom 1999; see also Stafford Smith
306 and Cribb 2009, footnote 211 for the peculiar importance of each in drylands), which
307 provides a sound starting point for designing individual organisations. Here, however,
308 we are more concerned with multi-level organisational systems.

309 The principle of subsidiarity has been proposed by institutional researchers as an
310 appropriate starting point for designing polycentric systems of environmental
311 governance in Australia (e.g., Reeve, Marshall *et al.* 2002; Reeve 2003; Lane,
312 McDonald *et al.* 2004; Marshall 2008; Robins 2008; Marshall 2009a; Moran and Elvin
313 2009). Associated most often with European governance where various authors (e.g.,
314 Collier 1997; Jordan 2000; Marks and Hooghe 2004) have discussed its application to
315 environmental management, this principle prescribes that the various responsibilities
316 (e.g., biosecurity, land use planning, environmental monitoring, regulation, research,
317 extension, etc.), and corresponding rights, of environmental governance each be
318 assigned to the lowest level of the system at which they can be exercised effectively
319 (Marshall 2008). From this vantage, higher-level organisations are subsidiary to lower
320 ones, not the reverse as conventionally presumed (Stafford Smith and Cribb 2009).

321 From a polycentric perspective, the subsidiarity principle applies equally when
322 assigning responsibilities and rights for deciding whether and how higher-level
323 governance organisations should be established when responsibilities exceed lower-
324 level capacities to fulfil; i.e., organisations at any level should participate as far as their
325 capacities allow in deciding whether higher-level governance structures are required and
326 in designing them (Marshall 2008; Marshall 2009a; Stafford Smith and Cribb 2009).
327 Wagner (2005) observed how this polycentric perspective differs from that of
328 economists working in the field of fiscal federalism (e.g., Oates 1999) who view
329 subsidiarity as a top-down administrative exercise in decentralising tasks as appropriate
330 to lower levels of governance. This perspective is reflected by how the Australian states

331 agreed to cede certain of their powers to a federal government when negotiating a
332 national constitution. It accords also with how the ‘MDB states’ agreed in recent years
333 to refer their water management powers under Section 100 of the national constitution
334 to the federal government in order that the MDBA could assume sole responsibility in
335 this sphere. We are concerned in this article with extending this perspective to sub-state
336 levels of the governance system.

337 The contributions of polycentricity, as pursued following the principle of subsidiarity,
338 towards governance system robustness can be differentiated in accordance with what we
339 distinguish as three aspects of polycentric structure: the decentralised aspect; the multi-
340 level aspect; and the modular aspect. Each delivers particular benefits in terms of being
341 more locally attuned, allowing more rapid and local innovation and learning, better
342 matched responsibilities, reduction in some transaction costs (even as others are
343 increased), and greater robustness against failure (Table 1). Nevertheless, the positive
344 contributions of polycentricity to governance system robustness may be
345 counterbalanced to some extent by adverse impacts. A decision to assign certain tasks to
346 a lower-level governance unit may sometimes, for instance, be difficult to reverse if
347 uncertainty unfolds in ways that render the decision no longer optimal. This may follow
348 from local interests having adapted to the decision and thus resisting its reversal, and
349 from the advantages of local groups vis-à-vis the general public in acting collectively to
350 pursue their respective interests (Olson 1982).

351

352

[TABLE 1 ABOUT HERE]

353 **3. Transforming towards adaptive NRM governance in the MDB**

354 Polycentric governance systems differ fundamentally from conventional monocentric,
355 or top-down, governance systems, so any shift to the former represents transformation
356 rather than adaptation. Effecting transformation of this kind is no simple matter given
357 the propensity of vested interests and people’s mental models to adapt to status quo
358 institutional arrangements, and thus for these arrangements to become ‘locked in’
359 (North 1990; Challen 2000). Studies of NRM cases where transformation has been
360 needed demonstrate that the transition to polycentric governance is a turbulent process
361 that can only be navigated adaptively. They reveal also that it is not uncommon for
362 NRM stakeholders to choose the easier path of incremental adaptation when
363 transformation is needed, thus leaving their social and ecological systems increasingly
364 vulnerable to shocks (Folke, Hahn *et al.* 2005).

365 Olsson, Gunderson *et al.* (2006) distinguished three phases of transformation towards
366 polycentric governance from these case studies. The first of these involves preparing the
367 relevant SES for change. The second entails navigating the transition to a polycentric
368 system. The third involves consolidating the robustness of the new regime. Progress
369 from the first to the second phase is possible, but far from guaranteed, when a ‘window
370 of opportunity’ opens. Echoing earlier insights from Kingdon (1995), they found that
371 such openings occur when a problem is recognised, a transformative solution becomes
372 available, the political climate is opportune, and policy entrepreneurs appear to link the
373 former three elements. Windows of opportunity can be waited for (e.g., arising from
374 environmental crises, policy failures or fiscal crises) or they can be created (e.g.,
375 through lawsuits, environmental activism or convening expert panels). In any case, they
376 typically remain open for only a short period.

377 A key to preparing for these transient windows of opportunity is the emergence of a
378 clear and convincing vision that is capable of directing, framing and motivating the
379 activities of the individuals, organisations and networks preparing for transformation.
380 An important role of leadership is to articulate such a vision (Folke, Hahn *et al.* 2005).
381 During the 1980s and into the 1990s, a vision of a collaborative alternative to the
382 longstanding top-down approach to Australian NRM governance crystallised. This
383 vision arose from a vanguard of soil conservationists, extension agents and farmers
384 adapting emerging theories of rural development (e.g., Chambers 1983; Esman and
385 Uphoff 1984) to a developed economy. The vision was of a bottom-up approach to
386 NRM governance to be built from voluntary cooperative efforts of local communities
387 and supported by complementary actions of governments (Curtis, Lucas *et al.* 2008).
388 Although this ‘collaborative vision’ was considered novel, Dovers (2000) observed that
389 not too dissimilar thinking had inspired earlier decentralised, participatory initiatives in
390 NRM such as the pasture protection boards and river management trusts mentioned in
391 the previous section. He lamented that disparagement of these earlier initiatives as ‘old
392 paradigm’ meant that few efforts had been made to draw lessons from them despite
393 these participatory bodies having acquired decentralised statutory and rating powers that
394 few contemporary bodies of this kind have been granted.

395 This collaborative vision for NRM governance seems at first glance to have been
396 pursued actively by Australian governments at the national and state/territory level since
397 the early 1990s. The rhetoric used by governments in promoting new NRM programs
398 has remained largely consistent with this vision. On closer inspection, however, it is
399 evident that the governance model that has evolved in Australia over the last two
400 decades remains strongly centralised (Marshall 2008; Marshall 2009a; Stafford Smith
401 and Cribb 2009). The collaborative ‘partnerships’ referred to in this rhetoric are in effect
402 purchaser-provider relationships that have become increasingly tightly controlled from
403 the top down, leaving community-based ‘partners’ diminishing autonomy with which to
404 adapt their modes of operation to local circumstances.

405 The actual evolution of Australian NRM governance arrangements during this time has
406 been influenced strongly by neo-liberal ideology and accompanying political
407 opportunism, even if this evolution has been influenced also by other ideologies
408 including localism and ecocentrism (Lockwood and Davidson 2010). The neo-liberal
409 agenda involves reducing the role of the state in solving citizens’ problems of collective
410 action, at least relative to the role of citizens in self-organising solutions to these
411 problems. Kingwell, John *et al.* (2008) observed how public funding of community-
412 based NRM bodies had, in significant part, been a politically-opportune response by
413 governments to the adverse consequences of ‘smaller government’ for rural
414 communities (e.g., reductions in government protection of agricultural industries,
415 withdrawals of local agency offices). Watson (2010 p. 29) argued that the federal
416 government’s enthusiasm for so-called partnerships with community-based NRM
417 bodies has been driven ‘[o]ften through a base desire to outmanoeuvre the states in
418 garnering local political support through grants-based funding...’.

419 Neo-liberal thinking leans heavily for its intellectual credibility on mainstream
420 economic arguments that decentralised interactions among individuals within perfectly-
421 competitive markets will lead to collectively-optimal (equated with Pareto-optimal)
422 outcomes. The ideal role of the state from this standpoint thus came to be understood as
423 one of intervening, at least where benefits therefrom are expected to exceed the costs, as
424 little as possible to remedy any ‘market failures’ transgressing the conditions of perfect
425 competition. The focus is accordingly on intervening via economic instruments like

426 purchaser-provider contracts that are perceived to harness at least some of the self-
427 organising capacities of markets. The sway of neo-liberalism thus led the nation's NRM
428 governance arrangements to shift markedly in many areas from an exercise in
429 administrative rationalism (i.e., confidence in centralised experts optimally designing
430 administrative solutions) to one in economic rationalism (i.e., confidence in centralised
431 experts optimally designing economic instruments). Nevertheless, administrative
432 rationalism continues to thrive in areas of NRM like water management where the
433 engineering profession retains strong influence over policy discourse (Crase, O'Keefe *et*
434 *al.* 2009).

435 In summary, current Australian NRM governance arrangements fall far short of what
436 recent innovations in governance theory would prescribe. Developments in these
437 arrangements over recent decades have added additional levels to NRM governance
438 arrangements bringing them closer to the local level. This has opened up opportunities
439 for a more diverse array of stakeholders to participate in the governance process. Some
440 benefits may have flowed from these developments, but the system as it stands remains
441 predominantly monocentric with its design and key collective decisions largely
442 determined from the top down. The multiplication of levels and organisations in the
443 system has not been accompanied by any significant transfer of collective-decision-
444 making powers away from central government. This may not be an outcome of neo-
445 liberalism *per se* but rather of how this ideology has come to be applied through the lens
446 of mainstream economics and the mindsets of federal and state government actors with
447 vested interests in maintaining, and preferably extending, their own powers.

448 Indeed, it can be argued that the net effect of national NRM-funding programs over
449 these decades has been to further centralise decision-making powers. The federal
450 government has, in this account, capitalised on the dominance of neo-liberal ideas in
451 public discourse to obtain considerable influence over NRM policy despite the
452 Australian Constitution having assigned policy-making powers in this sphere to the
453 states. This influence has been achieved by employing purchaser-provider arrangements
454 to buy cooperation from state governments and non-governmental stakeholders that
455 could not be otherwise have been obtained. In any event, the autonomy of regional and
456 other community- or industry- based organisations in adaptively managing natural
457 resources under their jurisdictions, or in transforming their governance arrangements as
458 their unique circumstances evolve in unforeseen ways, remains heavily constrained by
459 policy decisions decided centrally.

460 We observed above that a key to preparing for windows of opportunity is a clear and
461 convincing vision. However, the collaborative vision for NRM governance was far from
462 clear and convincing for much of the Australian NRM policy community that had been
463 persuaded by economic theories of public goods (Samuelson 1954, 1955) and collective
464 action (Olson 1965), and by Hardin's (1968) influential parable of the 'tragedy of the
465 commons', that voluntary cooperation in solving NRM problems is not to be expected.
466 The idea of collaboration between individual parties leading them to cooperate more
467 voluntarily in solving such problems seemed therefore more a hallucination than a
468 vision (Marshall 2005). Government-community 'partnerships' in NRM thus came to
469 evolve largely on the presumption that significant cooperation from community
470 members would not occur without paying them to cooperate.

471 Meanwhile, an extensive body of evidence from multi-disciplinary international
472 research demonstrates that it is possible under certain conditions for collaboration in
473 NRM governance to strengthen voluntary cooperation in implementing the decisions

474 agreed to (van Laerhoven and Ostrom 2007). The significance of this evidence is
475 demonstrated by the 2009 Nobel Prize in Economic Sciences having been co-awarded
476 to Elinor Ostrom for her leading role in the contributing research effort. Consistent with
477 this evidence, Quiggin (2001) identified common-property regimes, dependent for their
478 success on high levels of voluntary cooperation from their constituents, as an essential
479 complement to individual- and state- property regimes in responding optimally to the
480 uncertainties faced in managing the MDB's water resources. Given these developments,
481 the prospects of windows of opportunity opening for authentic transition towards the
482 collaborative vision, and thus towards polycentric NRM governance, have become
483 considerably more hopeful.

484 Even so, the barriers to commencing such a transition, imposed by vested interests and
485 mental models allied with the Progressive model, remain formidable. Much work in
486 preparing the present NRM governance arrangements for transformation therefore
487 remains to be done. Walker, Gunderson *et al.* (2006) proposed that determinants of
488 transformability include awareness, incentives and experimentation. Leaders are needed
489 to spread awareness of the collaborative vision clearly and convincingly, and challenge
490 the cognitive hegemony of the Progressive vision – both within governments and civil
491 society. Incentives for stakeholders to favour incremental adaptation when
492 transformation is required need to be identified and remedied. Olsson, Gunderson *et al.*
493 (2006) suggested, for instance, that the community of the Goulburn-Broken Catchment
494 in Victoria missed an opportunity to transform its SES because government had created
495 conditions that biased local incentives towards pursuing adaptation of their existing
496 production and social systems rather than transformation. Confidence-building
497 'experiments' with polycentric NRM governance should be undertaken where willing
498 partners exist.

499 The fiscal dominance of governments in Australia, and particularly the national
500 government, relative to non-government stakeholders in NRM (for which government
501 funding for NRM activities is often 'the only game in town') represents a particularly
502 challenging barrier to a transformative process that would loosen these governments'
503 control over governance in this domain and thus reduce their capacity to support the
504 vested interests reliant upon this control. Part of the solution to this dominance may lie
505 in developing networks better able to keep governments downwardly accountable for
506 rent-seeking of this kind. However, measures that increase the financial autonomy of
507 community-based organisations and other stakeholder organisations seem ultimately
508 necessary if the barrier of governments' fiscal dominance is to be hurdled.

509 **4. Resolving trade-offs between short-term performance of governance** 510 **options and their robustness**

511 The advantages of polycentric governance arrangements for the robustness of SES have
512 been highlighted above. Along with these advantages often come disadvantages by way
513 of reductions in short-term performance. In deciding whether to transform to a
514 polycentric model and, if so, what form that model should take, it is important to
515 consider the trade-offs between these advantages and disadvantages in each unique
516 context (Anderies, Janssen *et al.* 2004). Increasing the number of levels in a governance
517 system, for instance, will not always enhance long-term robustness sufficiently to justify
518 the opportunity costs in terms of reduced short-term performance (e.g., higher short-
519 term transaction costs of multi-level, modular governance arrangements). The greater
520 the perceived vulnerability of an SES to rapid, abrupt and/or turbulent change, all else
521 equal, the more justified is investment in the long-term robustness of its governance

522 system – and the less should short-term performance be prioritised at the expense of
523 such robustness.

524 The economics discipline is well-known for its methods of analysing trade-offs, but its
525 standard method of benefit-cost analysis is ill-suited for resolving trade-offs between
526 long-term robustness and short-term performance of governance systems. This is
527 because benefit-cost analysis is based on neoclassical welfare economics which
528 conventionally assumes all systems under analysis to be mechanistic. This method
529 cannot therefore account for the benefits of robustness in a complex adaptive
530 governance system without contradicting the logic on which it is based. Even if this
531 logical inconsistency were overlooked, application of conventional benefit-cost analysis
532 would still encounter considerable uncertainties in predicting benefits from
533 strengthening the robustness of a governance system. This high degree of uncertainty
534 arises because the benefits for an SES of robustness in a governance system relate
535 primarily to those of general robustness rather than specified robustness. Unlike
536 specified robustness which offers ‘insurance’ against particular kinds of disturbances
537 which can be anticipated in advance, general robustness offers insurance against all
538 kinds of unspecified disturbances including those that are completely novel. While it
539 may be reasonably straightforward to identify the costs of investing in general
540 robustness, the benefits from such investment are normally much harder to predict
541 because the disturbances on which it focuses remain unspecified. (Walker and Salt
542 (2006) make a similar point about estimation of benefits from general resilience.)

543 Recognising the problems in using conventional benefit-cost analysis to analyse trade-
544 offs between robustness and short-term performance in governance, Marshall (2005,
545 chapter 4) proposed a ‘political economy’ framework as an alternative. Consistent with
546 the collaborative vision, this framework assumes SES and their governance systems to
547 be complex adaptive systems. It seeks to compare the cost-effectiveness of alternative
548 governance options in achieving defined NRM goals. The costs accounted for in
549 assessing the cost-effectiveness of an option relate to its implications for both:

- 550 • short-term performance in pursuing the goals – in terms of transaction costs
551 incurred in establishing and administering the option, and transformation costs
552 incurred by private individuals and organisations in adapting their behaviour to
553 the option; and,
- 554 • long-term robustness in pursuing the goals – in terms of additional transaction
555 and transformation costs arising from irreversibility (or ‘path dependency’)
556 consequences of the option which make it more costly to adapt or transform
557 subsequently to alternative options than it would have been to implement those
558 options at the outset. These ‘lock-in’ costs are relevant given the likelihood in a
559 complex adaptive SES of unforeseen disturbances arising that reveal another
560 (e.g., more robust) governance option to be superior. The negative implications
561 of path dependency for NRM governance in the MDB have been discussed by
562 Challen (2000) and Heinmiller (2009).

563 Despite the difficulties of predicting lock-in costs given the uncertainties surrounding
564 unspecified and novel disturbances that may arise in the future, the political economy
565 framework for comparing governance options with different degrees of robustness (e.g.,
566 monocentric and polycentric governance models) has considerable practical value. This
567 value derives from the framework prompting decision makers to consider more
568 consciously and comprehensively the trade-offs that exist between the short- and long-
569 term implications of alternative governance options when choosing between them. Use

570 of the framework will not avoid the need for decision makers to apply the Precautionary
571 Principle or some other heuristic in resolving these trade-offs, but it does provide a basis
572 for applying such heuristics in a more structured and transparent manner.

573 **5. Implications of theory across the remote-rural-periurban gradient**

574 Table 1 shows how many of the benefits that a polycentric governance system can
575 deliver are particularly important for drylands given their typical (but not universal)
576 attributes of biophysical and social *uncertainty* in time, *sparseness* and patchiness of
577 resources and population in space, and *remoteness* from markets and centres of
578 governance (Stafford Smith 2008a).

579 To the extent that realising the benefits of polycentric governance systems for the
580 robustness of SES involves opportunity costs in terms of reduced short-term
581 performance, such systems should be adopted only where the total benefits are likely to
582 exceed these costs. Given that the relative advantages of polycentric systems are likely
583 to increase with remoteness and unpredictability, we may expect that these tradeoffs are
584 most likely to favour transformation towards polycentric governance at the remoter end
585 of the spectrum of settlement. In this section we therefore explore how a polycentric
586 system might ideally be set up then turn to the question of how universally appropriate
587 even a theoretical system would be in the MDB. In the following sections we consider
588 the practicalities imposed by history and current structures. Consequently, we begin
589 here by being deliberately abstract with respect to these practicalities.

590 *Development of polycentric governance systems*

591 The theory of collective action offers useful insights into the development of
592 polycentric systems of governance. This perspective begins by recognising the ‘free-
593 rider’ problem faced by members of a large group in addressing a problem they jointly
594 share; i.e., the problem of credibly assuring one another they will reciprocate each
595 other’s efforts rather than free ride on them. Olson (1965) proposed the solution of a
596 large group reorganising itself as a federated system, or as a small group of small
597 groups, where ‘small’ refers to a low enough number that the assurance problem
598 becomes manageable. However, this proposal lacked an explanation of how members of
599 a large group could overcome the free-rider problems they face in establishing a multi-
600 level system of governance.

601 Ostrom (1990) closed this gap by observing that a free-rider problem faced by large
602 groups can often be broken into a series of small-group problems. Once an
603 organisational base is established for some small-group problems, opportunities arise to
604 ‘piggy back’ on this base to address larger-group problems. A multi-level governance
605 system can in this way evolve upwards through ‘the incremental self-transformations
606 that frequently are involved in the process of supplying institutions’ (Ostrom 1990, p.
607 190). The multi-level system is ‘the eventual result of larger, more inclusive
608 organisational units emerging from, and then ‘nesting’ – in the sense of complementing
609 rather than absorbing or sidelining – smaller, more exclusive units that manage to self-
610 organize sooner. Smaller organisations thus become part of a more inclusive system
611 without giving up their essential autonomy’ (Marshall 2005 p. 47). Various examples of
612 such a process in rural development settings are provided by Uphoff, Esman *et al.*
613 (1998). One relates to the Gal Oya irrigation project in Sri Lanka. The process of
614 establishing a governance system ‘started with informal groups at the field channel
615 level. Their representatives formed a management committee at the next higher level,

616 for the distributary canal, and an area assembly at the branch canal level, with an overall
617 project committee at the level of the main canal' (Uphoff, Esman *et al.* 1998, p. 68).

618 The preceding analysis suggests that, in a 'green field' setting (i.e., without pre-existing
619 governance arrangements), the development of a polycentric governance system in
620 accordance with the principle of subsidiarity would tend to proceed through the
621 following three steps.

622 Step 1. Small groups, initially based on families and extended families or on a strong
623 common livelihood interests, form to share resources for dealing with their own issues,
624 where the benefits of doing so normally outweigh the costs. This may include pooling
625 labour at critical times, sharing equipment, or agreeing on the use of some communally
626 available resources. Whilst some agreements will develop rapidly (as has been shown
627 in experiments – see Ostrom 1999), more complex arrangements and rules may take
628 generations to work out. In general, the shared interests of these groups will be related
629 to their livelihoods and their local geography, and there may be multiple such groups in
630 one community, separated by livelihood or proximity, as in farmers sharing harvest
631 labour and equipment, whilst traders might share storage space or guard duties.
632 Naturally, the groups will evolve with a diversity of ways of operating, each suited to its
633 own purpose.

634 Step 2. Over time the local groups will identify a series of issues or problems that they
635 cannot manage on their own. The main causes of these will be that the issues: (i)
636 operate across the livelihood (or sectoral) boundaries of groups (e.g., interactions
637 between farmers and pastoralists, or fishermen and traders); (ii) operate across the
638 geographies of groups even in the same sector (e.g., weed dispersal and up- and down-
639 stream water use), or (iii) simply need a greater critical mass of people to respond to
640 them (e.g., to attract banking services or build a church, more-or-less regardless of
641 sector or geography). For these issues they will start to explore alliances with other
642 groups to resolve these issues.

643 Step 3. Small groups agree conditionally to cede power on certain matters to some form
644 of overarching governance body, usually in exchange for some sort of representation on
645 that body. Over time this body may be able to handle a class of such issues more
646 efficiently than separate bodies set up for each one, and thus a form of local government
647 may be born. However, there would almost certainly be multiple bodies above the
648 individual group level, suiting themselves to the scale and style of problems to be
649 addressed. The small groups might be linked non-uniformly to these, creating more of a
650 complex network than a strictly hierarchical structure.

651 Of course, real systems come with history and existing governance arrangements, an
652 issue we will return to for the MDB in section 6. However, inasmuch as the history of
653 landcare and subsequent developments has been one of trying to introduce a new layer
654 of governance between state governments and individual producers in rural Australia –
655 a layer which had been largely missing since settlement compared to other rural regions
656 of the world (Balent and Stafford Smith 1993) – it is useful to compare the story of
657 landcare with these abstract steps.

658 In essence, the initial investment in landcare sought to promote a more formal effort
659 around Step 1 above, aimed at the scale of groups of farmers with shared NRM issues
660 that required action mainly at a scale greater than the individual farm. A considerable
661 degree of leeway was permitted in the detailed structure of these groups, although to
662 receive funding they had to meet incorporation standards, and their scope was generally
663 fairly tightly focused on NRM. Sobels, Curtis *et al.* (2001) among others suggest that

664 there is good evidence that state-sponsored facilitation of these groups has had some
665 success achieving Step 1 above in ways that would otherwise have been slow to emerge
666 universally (of course, the first landcare activities were not necessarily driven by
667 government – e.g., Campbell 1991).

668 However, Natural Heritage Trust arrangements introduced by the Commonwealth in
669 1997 served to sponsor (and require) the formation of regional groups through a process
670 completely at odds with Steps 2 and 3. Although the Commonwealth allowed States to
671 devise their own approaches, these were nonetheless imposed from above from the
672 perspective of the local landcare groups. A useful experiment has emerged from the
673 different ways this was done in different states (Keogh, Chant *et al.* 2006, p.47; Larson
674 2007), with Queensland allowing most regional autonomy and keeping the groups
675 formally outside legislated structures, whilst in South Australia and NSW, for example,
676 the regional bodies largely took over the roles of government departments at a regional
677 scale. Particularly in Queensland, some regions attempted to structure themselves to be
678 representative of the local catchment or land care groups (e.g., catchment groups in
679 Desert Channels Queensland: Larson 2007), but even then in no sense could the process
680 be said to be guided by the subsidiarity principle.

681 The problem of governments designing and imposing NRM governance arrangements
682 from the top down is fairly universal in recent programs, although it may have had
683 particular consequences in more remote regions (Measham and Brake 2009). In these
684 remoter regions, however, other aspects play out in response to the ‘desert syndrome’.
685 In particular, the three reasons for ceding power to a higher scale mentioned above in
686 Step 2 are often conflated in more settled regions – that is, a slightly larger region
687 encompasses a greater diversity of interests and a greater critical mass of people. In
688 remoter regions, however, these three factors often vary independently. Increasing
689 geographic area may only very slowly increase critical mass of population (at a lower
690 rate than costs of transport and communications increase, so that economies of scale
691 cannot be realised). Additionally, given that groups already tend to cover a large area
692 with rather homogeneous stakeholders, expanding the area just tends to bring in new
693 sub-catchments with unrelated issues rather than a greater diversity of views on the
694 same issue (e.g., catchment weeds or erosion). It is thus important not to misconstrue
695 which issue is driving the need to link groups in remote regions. It becomes much more
696 important that local groups in these circumstances be able to organise themselves to suit
697 their conditions. It is also true that it is often more important to encourage economies of
698 scope rather than economies of scale (Dollery *et al.* 2006; Stafford Smith and Cribb
699 2009); and that it is crucial to distinguish the scale of services governance from the
700 scale of delivery for different services with different efficiencies of delivery (Stafford
701 Smith and Cribb 2009).

702 *Polycentric governance systems in a ‘green field’ MDB*

703 Given this description of the MDB context, how might steps 1-3 outlined above for
704 ‘green field’ development of polycentric governance play out in this context if we could
705 rewind the clock? The following account allows for the use of public funds to catalyse
706 processes that could otherwise take generations to occur. An appropriate public agency
707 with a clear understanding of, and commitment to, polycentric governance would
708 facilitate these processes.

709 Step 1: Form local (e.g., Landcare) NRM groups as they were, with some national
710 guidelines related to ensuring that they are accountable downwards to their members for
711 whatever purposes they come together (e.g., controlling pest plants and animals, or

712 protecting local biodiversity), and some incorporation requirements ensuring reasonably
713 minimal upwards accountability for expending public funds. These guidelines would
714 promote a strong sense that the group is mainly there to coordinate its members' private
715 investments to their collective benefit, and only secondarily to access public funds in
716 return for providing additional benefits to the wider public.

717 Step 2: Once the local groups are well established, they would be encouraged to think
718 about issues extending beyond their immediate interests or capabilities. Depending on
719 each group's capabilities, these issues might include inter-group coordination of efforts,
720 filling knowledge gaps, sharing information and experiences, resolving intractable
721 conflicts, enforcing compliance with group decisions, raising and providing governance
722 over funds, and so on. Some public funds would be made available to allow them to
723 meet up with one another and other bodies (e.g., local governments) to discuss
724 complementarities in their interests and capabilities and how they might prioritise and
725 coordinate their actions, or perhaps even merge to form multifunctional bodies
726 achieving economies of scope, to better achieve their common goals. Such economies
727 may become especially evident when the focus of groups is on the robustness of their
728 SES as a whole rather than narrowly on managing natural resources. The different
729 reasons for why local groups might want to 'join forces' with one another and other
730 organisations in this manner would be promoted to them, with the decision whether to
731 proceed in this direction left to each local group. Local groups in remoter areas would
732 particularly be empowered to explore economies of scope by working with local
733 governments and other groups operating outside the NRM sector.

734 The financial focus of any higher-level structures formed endogenously in this manner
735 would primarily be on providing governance over funds and other resources pooled by
736 lower-level groups to deliver NRM (and wider) services by contractors as appropriate at
737 scales broader than covered by those groups. (A diversity of such contractors can be
738 envisaged including local governments, regional NRM groups, Indigenous
739 organisations and private contractors.) It might be possible, however, for these
740 structures to also satisfy eligibility criteria for receiving investment funds from state and
741 federal governments. Accordingly, the exploration by local groups of higher-level
742 governance options would be informed, but not constrained, by preferences of NRM
743 investors for extra-local governance structures with certain characteristics (e.g.,
744 consistency with pre-specified geographic boundaries, capacity to satisfy standard
745 accountability requirements, etc.). In any case, the public agency facilitating the process
746 of establishing polycentric governance would seek to ensure that investor preferences
747 are informed by an understanding of, and shared commitment to, this form of
748 governance.

749 Where local groups prefer a governance structure that does not immediately satisfy
750 investor preferences (e.g., a district-level structure when investors prefer to invest in a
751 regional structure), ways of nesting the 'bottom-up' structure within the investor-
752 preferred structure would be explored. In cases where there is a large difference in
753 geographic scale between the extra-local governance structure that is preferred locally
754 and the structure preferred by investors, effective engagement of local group members
755 with the investor-preferred structure may not be possible unless local groups establish
756 additional bottom-up levels of governance (e.g., district- and catchment- level) to bridge
757 what would otherwise be an alienating social distance.

758 An independent (of government investors and the groups involved) organisation (*cf.*
759 Steffen, Burbidge *et al.* 2009, p.164) would be established to assess whether bottom-up

760 proposals for groups to receive outside investment satisfy investor preferences and meet
761 basic guidelines (of subsidiarity, and sufficient definition of scope and breadth of
762 engagement for that scope). The panel would ensure that the proposed groups have
763 considered at what scale the services they are concerned about are best governed, and at
764 what scale they are best delivered, and hence what the relationship between governance
765 and delivery bodies would be.

766 Step 3: The groups designated through this process as eligible for government
767 investment would be established with (again) required standards of downwards
768 accountability to the groups they represent and reasonable openness to their
769 involvement. They would also need to satisfy minimum necessary standards of upwards
770 accountability (focused as far as possible on outcomes rather than expenditures,
771 activities and outputs). The aim would be to leave these groups as autonomous as
772 possible in responding adaptively to the unique circumstances each faces, and thus to
773 engender local ownership of, and voluntary cooperation with, the decisions made by
774 these groups. A major role of higher levels of governance (e.g., regional groups and
775 government agencies) would be to ensure that learning is transmitted horizontally
776 among groups at lower levels. To minimise constraints on the autonomy of these
777 groups, investment funds should be provided as far as possible on a 'block grant' basis
778 (i.e., with recipient groups allowed considerable leeway in allocating those funds
779 between possible projects subject to a mutually-agreed investment strategy) as
780 envisaged originally for the regional NRM delivery model (Agriculture Fisheries and
781 Forestry Australia 1999). Emphasis should be given to providing the groups with
782 opportunities to gain the confidence they need from investors for a block-funding model
783 to be introduced.

784 Of course the above steps are not likely to be undertaken *de novo* in the foreseeable
785 future, a reality we shall respond to below. However, this idealised process helps
786 highlight some of the most important failings of the current arrangements. These relate
787 to (i) the inability to tailor arrangements to different circumstances, (ii) a lack of clarity
788 in separating governance from delivery of NRM services, and consequent scale
789 problems in some places on the remote-to-urban spectrum, (iii) a lack of ownership
790 from the bottom up of the investment-fund-receiving structures (currently the regional
791 NRM bodies), and hence (iv) a sense that these structures are simply there to deliver
792 government services rather than to entrain an authentic and powerful public-private
793 partnership in reinvesting in Australia's natural capital.

794 Would a process such as that outlined above result in homogeneous arrangements along
795 the remote-to-urban spectrum? We think not. Even within the range of conditions to be
796 found in the MDB, we suggest that the more densely populated irrigation districts
797 would support specialised investment-receiving structures with a rightful focus on
798 sustainable production; in the sparsely populated hinterland, these structures would be
799 more generalist, encompassing matters such as tourism and mining as well as grazing,
800 and quite likely spill over into other areas of services altogether, such as roads, health
801 and even education. There would, consequently, be issues about geographic boundaries
802 and relative power of the players concerned, in the resolution of which a strong
803 requirement for equitable downwards accountability and the role of the independent
804 panels noted above would be crucial.

805 **6. Practical steps towards an adaptive governance model for the MDB**
806 **drylands**

807 Of course the MDB drylands are no blank slate, and locals would be distinctly
808 unimpressed if an immediate and uncertain change to the current NRM groups were
809 proposed. As a starting point, therefore, we take as given that the existing set of 56
810 regional NRM bodies (i.e., eligible for investment funding by governments) will remain
811 at least into the medium term (see Figure 1 for the NRM group areas in the MDB). For
812 the reasons advanced in earlier sections, however, it seems transformation towards an
813 adaptive governance model for at least the remoter areas of the MDB drylands will
814 ultimately be justified given that the benefits from bolstering the robustness of SES in
815 these areas are likely to exceed any costs arising from reduced short-term performance.

816 Given the challenges of navigating transitions towards adaptive governance noted in
817 section 3, it is important then to embark without delay on the first phase of this
818 navigation to a polycentric system: preparing the various SES within the Basin and
819 ensuring they are poised to manoeuvre through windows of opportunity when these
820 briefly open. Inasmuch as there are many new ideas and ways of operating to absorb,
821 the theoretical endpoint described above provides a number of pointers, listed below,
822 towards this end which could all be progressed with little disruption. Actions on these
823 pointers that entail transfers of responsibilities from governments to non-governmental
824 bodies need of course to be legally defensible within the ways that existing laws assign
825 particular responsibilities to specific governments or agencies thereof. Beyond the short
826 term, however, it may be possible to loosen at least some of these legal constraints by
827 reforming the relevant laws.

828 *Prepare for a clearer multi-levelled structure.* In some NRM regions (particularly in
829 Queensland) some semblance of subsidiarity already exists in so far as catchment
830 groups, local governments and other intra-regional organisations have
831 representatives, formally or informally, on the regional body. In all areas the
832 existing regional body should support and even sponsor genuine community-based
833 governance arrangements (involving multiple levels where appropriate) among
834 more local groups, and develop flexible guidelines for ensuring representation and
835 downwards accountability that would make intra-regional groups eligible
836 eventually to have some formal representation on the regional body. Fostering
837 such a bottom-up process of governance-building would help regional bodies
838 become truly community based and reap the benefits of greater legitimacy and
839 citizen cooperation therefrom. It may also lead eventually to bottom-up proposals
840 for replacing existing regional bodies with alternative structures that build
841 organically on what has emerged within regions. Evaluation of such proposals
842 should take into account their respective merits in meshing with higher-level
843 institutional arrangements administered by the MDBA, other federal government
844 agencies, and state governments.

845 *Work towards different arrangements in sub-regions and locales with different*
846 *population densities.* In sponsoring this bottom-up process of governance-
847 building, the regional body could promote the development of different
848 arrangements in sub-regions and locales with differing population densities.
849 Essentially this would involve allowing experiments in running different styles of
850 local organisations (many of which already exist but without formal arrangements)
851 under the existing regional bodies. The role of these intra-regional organisations
852 would be to motivate and coordinate community self-reliance in NRM at least as

853 much as to attract and invest funds from governments and other external investors.
854 The regional body would ‘nest’ these intra-regional organisations, leaving them
855 substantive autonomy in accordance with the principle of subsidiarity, and not
856 presume to direct their activities in a conventional hierarchical manner. The
857 regional body could experiment with block grants to such lower-level
858 organisations to facilitate real devolution of the responsibilities and rights they
859 need to manage effectively their natural resources and encompassing SES.

860 *Recognise the potential for some regional groups to foster economies of scope.*
861 Although the initial focus is inevitably NRM, the regional bodies could encourage
862 local groups to explore opportunities for economies of scope by looking beyond
863 NRM to deliver or locally govern other types of services. Such opportunities may
864 be particularly important in sparsely settled areas where models, such as that of
865 the Ngaanyatjarra Council noted above, already exist. In doing so, groups would
866 clearly delineate service governance from service delivery, with delivery
867 contracted to organisations with an appropriate scale for the services concerned.
868 The regional bodies would also help local groups to recognise and reinvigorate
869 local private and community investment in NRM (local contributions to NRM
870 projects alone are estimated at three times the governmental input – Keogh, Chant
871 *et al.* 2006, p.7) and other community-scale activities: an investment that has long
872 occurred through volunteers, local race and tennis clubs, and entities such as the
873 Country Women’s Association.

874 *Promote greater autonomy of regional groups from formal government processes.*
875 Aside from supporting regional bodies in these moves, government could work
876 towards allowing the regional bodies to be more autonomous from central
877 government, even where they are currently statutory bodies. One way this could
878 occur in practice (if not legal reality) would be to provide more resources as block
879 grants to be governed regionally, but matching local contributions of funds and
880 other resources more clearly. Of course the risk here is that central government
881 withdraws altogether and the gains from prior initiatives in community-based
882 NRM are undone; this must be guarded against through a central commitment to
883 long-term resources and on-going interest in how the regions are proceeding.

884 *Reduce the dependence of regional groups on government funding.* As discussed in
885 section 3, the current fiscal dominance of Australian governments over regional
886 NRM groups poses a formidable obstacle to transition towards polycentric NRM
887 governance. Experience suggests that governments ‘paying the piper’ are normally
888 unable to resist the temptation to ‘call the tune’, so that the prospects of moving
889 towards a block-funding model as proposed above may be limited. Hence, a
890 search for additional ways to lessen the financial dependence of regional groups
891 on government funding seems necessary for transition to polycentric arrangements
892 to occur. Philanthropy and corporate sponsorship may be available as alternative
893 sources of funding in some regions, but it is hard to imagine most regional bodies
894 achieving the requisite financial autonomy without levying their constituents
895 (perhaps via the rating systems of local governments within their jurisdictions)
896 and/or those parties accruing economic rents from their use of a region’s natural
897 resources. Convincing constituents of the merits of a new levy will not be easy, so
898 the advantages of this levy – by way of strengthening local autonomy and
899 effectiveness in solving the natural resource problems they share – would need to
900 be well communicated. In respect of levying economic rents accruing to natural
901 resource users within the MDB drylands, Stafford Smith (2008b) proposed for the

902 Australian rangelands the establishment of an Outback Capital Trust, modelled on
903 the Alaska Permanent Fund (Hickel 2002), with powers to set and receive
904 resource-use rents on all natural resources within this zone. He proposed that a
905 range of public investments be funded from the Trust, including investments in
906 NRM and nature conservation.

907 Into the medium term while the regional bodies are likely to remain in their current
908 configuration, state and national governments could support new thinking about
909 arrangements below the regional bodies – including their relationships with local
910 government. Probably the first step of all is to build capacity to think about these
911 changes in the MDB drylands. Indeed, all these steps imply an evolving relationship
912 between the community of the Basin and the MDBA also, as one integrated
913 representative of state and federal governments. In this, the entire thesis of this paper
914 should caution government, MDBA and regional bodies against imagining that one size
915 will fit all, or that a complex governance system will come together to work perfectly
916 first time. Instead, experimentation coupled with varying levels of diverse change in
917 different places and over time characterises robust adaptive governance in the face of
918 uncertainty. In all of this, an important role for government should be to facilitate the
919 public discourse needed to bring about awareness of the need for transition to adaptive
920 governance and an understanding of what this might look like, and to nudge moves in
921 this direction while ensuring that such attempts are not captured by vested interests and
922 the powerful at the cost of successful outcomes at the Basin scale. A further key role
923 for governments, and higher levels of governance generally, will be to represent those
924 individuals, groups and organisations at lower levels that are insufficiently represented
925 in the existing governance system, at the same time as developing their capacities to
926 represent themselves.

927 **7. Conclusions**

928 Climate change is expected to increase markedly the uncertainties faced in governing
929 the drylands of the MDB. Meanwhile, governance across this zone will continue to be
930 challenged by interlinked characteristics of dryland regions that have become known as
931 a ‘desert syndrome’. We have argued in this article that these future features of NRM in
932 the MDB drylands justify transformation of existing NRM governance arrangements for
933 at least the remoter areas of this zone to those of adaptive governance. Explicitly
934 designed into governance arrangements of this kind would be capacities to adapt
935 structures and processes to the unique circumstances of dryland regions and to maintain
936 the robustness of SES within these regions as uncertainty unfolds in the form of
937 increasingly turbulent, abrupt and surprising change. We argued more specifically that
938 arrangements for adaptive governance should be founded on the related concepts of
939 polycentricity and subsidiarity. We explained that three aspects (i.e., decentralised,
940 multi-level and modular) of polycentric governance contribute robustness. We also
941 identified in Table 1 the particular relevance of such contributions for the MDB
942 drylands context.

943 Shifting to adaptive governance from existing Australian NRM arrangements, which
944 remain tightly controlled from the top on a one-size-fits-all basis, involves much more
945 than incremental adaptation; it requires *transformation* of those arrangements.
946 Experience demonstrates that transformations of this kind typically face formidable
947 obstacles due to vested interests and people’s mental models having ‘locked in’ to the
948 status quo. For instance, the benefits of adding robustness to an SES normally do not
949 come without trade-offs by way of reduced short-term performance (e.g., increases in

950 some kinds of transaction costs), and existing mental models tend to resolve such trade-
951 offs in favour of short-term performance. Nevertheless, experience also indicates that
952 such obstacles can be surmounted strategically by preparing to manoeuvre through
953 windows of opportunity when they open either randomly or through concerted action.
954 This is not to deny that the process of transition towards adaptive governance will itself
955 be turbulent, testing the public's trust in its leaders.

956 We have proposed a number of pragmatic steps to be followed as part of such a strategic
957 process of preparing for transformations towards adaptive NRM governance in the
958 MDB drylands. We envisage these steps as pre-adapting the governance arrangements
959 for this zone to take advantage of transformative opportunities when they do arise.
960 Although pragmatic, these steps are substantial in so far as they require governments to
961 loosen their control over governance of this zone, including devolving more rights and
962 resources to lower levels of governance – even though one significant purpose is to
963 reinvigorate recognition of the role of individual and community investment in
964 conserving natural capital. Such steps would need to be complemented by development
965 of the kinds of leadership and 'shadow networks' that have been identified as critical for
966 transformations to adaptive governance (Olsson, Gunderson *et al.* 2006).

967 Although transforming to adaptive governance comes with risks, we contend that the
968 risks of inaction for the social-ecological systems of the MDB drylands are greater.
969 Meanwhile, scholars and policy makers need urgently to progress the thinking, research
970 and learning-by-doing that is required to reduce the perceived risks of transformation, in
971 order that politicians and the public become persuaded that the risks are worth taking.
972 We offer this article as a start in this direction.

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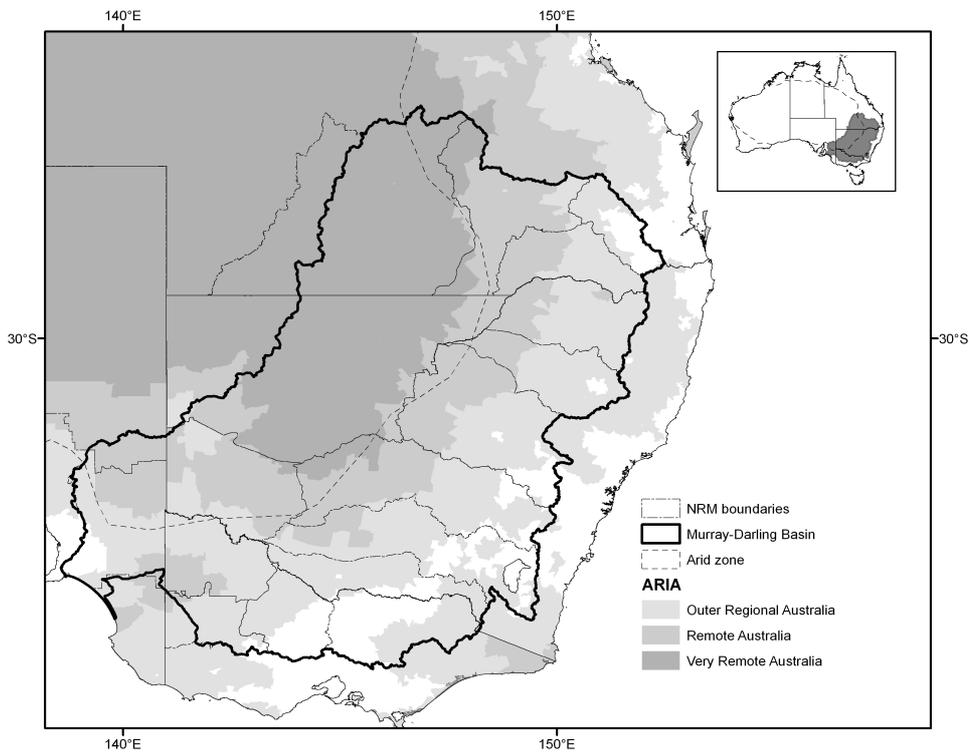
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1217 Figures

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1219 **Figure 1: Location of the Murray Darling Basin in relation to the state boundaries**
1220 **in Australia, also showing the Natural Resource Management regions,**
1221 **the boundary of the arid zone, and the more remote categories of the**
1222 **Accessibility and Remoteness Index of Australia (ARIA). There are 4**
1223 **States (Queensland, New South Wales, Victoria and South Australia)**
1224 **and one Territory (Australian Capital Territory) that intersect with the**
1225 **MDB, and 18 NRM regions (not including a small part of the South**
1226 **Australian arid region).**

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1231 **Table 1. Key benefits under the three aspects of polycentric structure identified in the text, and their relationships to drylands**
 1232 **attributes which render them particularly important there.**

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Aspects of polycentric structure	General benefits	Relationship to drylands attributes
decentralised	<ul style="list-style-type: none"> ▶ better-adapted citizen mental models due to stronger engagement in public discourse 	Variable environments and rapid turnover of some key people highlights need for well-embedded local knowledge. Thinner social networks and distance from populations centres can mean less direct engagement in public discourse and a greater need to find ways of testing received wisdoms against changing biophysical and social pressures.
	<ul style="list-style-type: none"> ▶ increased access to local knowledge 	Limited formal research and distance from centres of research and development means greater reliance on local knowledge. Tendency for greater biophysical uncertainty increases importance of timely local feedback.
	<ul style="list-style-type: none"> ▶ closer adaptation of rules (e.g., laws, regulations, policies, program settings, etc.) to local context 	Diverse areas with sparse populations and distant centres of governance makes sensitivity to local conditions particularly important
	<ul style="list-style-type: none"> ▶ strengthened social capital and voluntary cooperation, and thus reduced transaction costs 	Geographic and cultural distance from centres of government increases the difficulties of establishing mutual trust and cooperation between remote populations and governance arrangements, and thus increases the transaction costs of achieving governance outcomes.
	<ul style="list-style-type: none"> ▶ increased number and diversity of policy ‘experiments’ (with benefits for learning and ‘insurance’ against abrupt change) 	The tendency for greater uncertainty in dryland regions increases the need for learning and for ‘insuring’ against surprises through diversity in approaches. The need to avoid undesirable change is acute because they are usually harder to reverse in remote areas due to low capital investment
	<ul style="list-style-type: none"> ▶ increased innovation due to lower risks and costs of experimenting at smaller scales 	The tendency for greater uncertainty and turbulent change in dryland regions increases the need for ongoing innovation.
	<ul style="list-style-type: none"> ▶ better capturing of local feedback from the experiments undertaken 	Remoteness from centres of government makes governments less able to capture local feedback in the absence of ‘grass roots’ participation in the governance system.
multi-level	<ul style="list-style-type: none"> ▶ better matching of each responsibility to the level where economies of scale or scope exist 	Critical mass in numbers, stakeholder diversity and physical area are less likely to be correlated in remoter than more settled areas
	<ul style="list-style-type: none"> ▶ overlap of multiple lower-level organisations 	Greater distances between local networks within remote regions makes information-sharing less likely

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	by fewer higher-level organisations facilitates sharing of information among the former	without higher-level support.
	▶ strengthening of ‘vertical’ social capital by breaking the social distance from the top and bottom of the system into less alienating steps	Remoteness from centres of governance can make dryland populations feel particularly alienated, and thus make it especially difficult to gain their ownership, trust and voluntary cooperation.
	▶ increased dynamic efficiency as a result of the competition arising from citizens having a choice between public-service providers at different levels (Ostrom, Tiebout <i>et al.</i> 1999)	The smaller and sparser markets for public services in remote areas make it harder to avoid monopolies. Tendencies to focus on static efficiencies (i.e., not accounting for benefits from competitive discipline and innovation) add to the likelihood of monopolies arising and persisting. Hence, the benefits of the multi-level aspect for competitive discipline can be particularly valuable in dryland regions.
modular	▶ reduced transaction costs of adapting or transforming the governance system, given that a system with smaller and more autonomous building blocks is more easily reconfigured	It is hard to find the re-investment to adapt or transform SESs that cross thresholds in low productivity remote regions. Hence, it is particularly valuable in such regions to have access to governance arrangements that can be adapted or transformed with relatively low cost in order to drive broader adaptation and/or transformation in the broader SES.
	▶ substantive autonomy of the centres means that failure by some centres can be compensated by other centres (e.g., at a higher or lower level) covering for them	The ebb and flow of key people in small populations in remote regions means that local failure (in business, governance, community) from time to time is inevitable and the broader system needs to be resilient.

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