

# Open Research Online

---

The Open University's repository of research publications and other research outputs

## Jumping Off the treadmill: transforming NRM to systemic governing with systemic co-inquiry

### Journal Item

#### How to cite:

Allan, Catherine; Ison, Ray L.; Colliver, Ross; Mumaw, Laura; MacKay, Moragh; Perez-Mujica, Luisa and Wallis, Philip (2020). Jumping Off the treadmill: transforming NRM to systemic governing with systemic co-inquiry. *Policy Studies*, 41(4) pp. 350–371.

For guidance on citations see [FAQs](#).

© 2020 Informa UK Limited, trading as Taylor Francis Group



<https://creativecommons.org/licenses/by-nc-nd/4.0/>

Version: Accepted Manuscript

Link(s) to article on publisher's website:

<http://dx.doi.org/doi:10.1080/01442872.2020.1726312>

---

Copyright and Moral Rights for the articles on this site are retained by the individual authors and/or other copyright owners. For more information on Open Research Online's data [policy](#) on reuse of materials please consult the policies page.

---

[oro.open.ac.uk](http://oro.open.ac.uk)



**Jumping off the treadmill: transforming NRM to systemic governing with systemic co-inquiry**

Journal:	<i>Policy Studies</i>
Manuscript ID	Draft
Manuscript Type:	Research Paper
Keywords:	systemic co-inquiry, natural resource management, systemic governance, deliberative policy analysis, post-positivist practitioners

SCHOLARONE™  
Manuscripts

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

For Peer Review Only

## Jumping off the treadmill: transforming NRM to systemic governing with systemic co-inquiry

While there is continued interest in Deliberative Policy Analysis (DPA) its practice element appears to have been underappreciated. We reflect on our experience of using a systemic co-inquiry to provide new insights into operationalising DPA that may assist it to speak more immediately to issues related to governing in the Anthropocene. Natural resource management (NRM) in Australia embraced the global turn to governance, but demonstrated how difficult it is to achieve systemic, collaborative approaches to management policy. The treadmill of our title symbolises the experience of community and organizational stakeholders in the case area, who were constantly in motion but achieving no forward movement in collaborative governance. A systemic co-inquiry into how decision making and action taking in NRM could be improved began in 2015. Systemic co-inquiry is a facilitated process that enables emergence of ideas and opportunities for transforming a situation. We describe this process, present how it was used in the case area, then critically reflect on its contributions for governance and practice, and its theoretical and political implications. Describing and critiquing our use of systemic co-inquiry provides new insights to address challenges for future DPA.

Keywords: systemic co-inquiry; natural resource management; systemic governance, deliberative policy analysis

### Introduction

This paper focuses on innovation in governance by considering how systemic, relational policy and practice development could be operationalised as part of a shift towards systemic/adaptive co-governance. The domain for this consideration is Australian natural resource management (NRM), where it is understood as “the integrated management of the natural resources that make up Australia’s natural landscapes, such as land, water, soil, plants and animals”.<sup>1</sup> While use of the term is not limited to Australia, this framing has become widely institutionalised there. An appreciation of the constraints and possibilities of an NRM framing is needed when seeking to innovate and

1  
2  
3 foster meaningful change. The paper leads, then, with an exploration of the initial  
4 starting conditions created by NRM. We then report on an ongoing attempt at  
5 transformative reframing in this domain using systemic co-inquiry. Systemic co-inquiry  
6 is a form of collaborative investigation; it involves processes of social learning within  
7 which opportunities emerge and are pursued into action (Foster et al. 2019). Systemic  
8 co-inquiry can therefore be a way of governing, in which on-going inquiry and action  
9 between people in situations of concern is built into the institutional ecology of on-  
10 going human-biosphere relations (Ison and Straw 2020).<sup>ii</sup> Presenting and reflecting on  
11 our experience of this on-going inquiry within NRM, we describe our understanding  
12 and use of systemic co-inquiry. We conclude with critical reflections on our experience  
13 of using systemic co-inquiry and their relevance to, and implications for, Deliberative  
14 Policy Analysis (DPA).  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31

### 32 **Starting conditions: The pendulum swing of NRM governance in Australia**

33  
34 NRM is enacted in situations of complexity and uncertainty, where multiple human  
35 interests converge in dynamic biophysical landscapes. While NRM seeks to manage  
36 human activity and support ecological processes, the predominant disciplinary base of  
37 NRM has been the biophysical sciences. In the NRM tradition, science sits inside an  
38 administrative regime of scientific management, in which scientific knowledge and  
39 expert opinion guide policy decisions, which in turn guide efficient and effective action  
40 on environmental degradation, administered through an impartial public service  
41 (Brunner and Steelman 2005), and more recently, neo-liberal smaller government.  
42 Historically this regime has involved little social science, even less social systems  
43 science, given scant legitimacy and capacity for reflection and deliberation, and has  
44 limited focus on governance to the administrative sense. Given anthropogenic pressure  
45 on natural resources such as land, soil, freshwater and biota (Rockström et al. 2009),  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 approaches to future NRM policy making and implementation are part of the response  
4  
5 shaping how humans will be sustained (or not) in the future. As the M in NRM implies,  
6  
7 management has been the focus of concern; our work contributes to the shift of concern  
8  
9 from managing to governing.  
10  
11

12           There have been many proposals for collaborative management processes and  
13  
14 research into how collaborative managing and adaptation works, and the conditions  
15  
16 under which it works. In fact, as we outline below, Australia was a pioneer in  
17  
18 community-based, participatory managing (but not necessarily governing). Despite a  
19  
20 great deal of activity, and initial optimism of community members, NRM is still  
21  
22 predominantly a top-down activity. Little is known about how to shift existing  
23  
24 governance regimes towards improvements in arrangements and practices that are  
25  
26 determined collaboratively. The problem can be framed as: top-down attempts to  
27  
28 improve governance fail to connect to the on-going self-organising of  
29  
30 participants/stakeholders in the governance system. We thus need ways to rapidly  
31  
32 transform governance and to insitutionalise relevant understandings and practices  
33  
34 (Foster et al. 2019).  
35  
36  
37  
38  
39

40           The Australian continent had been occupied and managed by people for at least  
41  
42 60,000 years before it was claimed by Britain in 1788. The colonisers brought with  
43  
44 them the policy, history, and practices of England specifically, and Europe more  
45  
46 generally. During the 1800s, colonial governments sought to increase the population by  
47  
48 developing agriculture and exporting commodities such as wool. Government agencies  
49  
50 soon arose within the colonies to support the management of, and production from,  
51  
52 land, forests and water. Upon Federation in 1901, the Australian States assumed  
53  
54 primary responsibility for NRM (Bates 2006). Agriculture and related agencies in each  
55  
56 Australian State developed issue-based programs targeting threats to productivity such  
57  
58  
59  
60

1  
2  
3 as soil erosion, weeds and salinity, and these programs continued to be developed by  
4 technical experts and delivered by technical extension agents through to the mid 1980s  
5 when fundamental reforms began (Head 2009). Through the 1970s, a vanguard of  
6 Australian soil conservationists, extension agents, and farmers were influenced by new  
7 rural development theory that emphasised self-help and cooperative community effort  
8 supported by change agents (Curtis 1998). In the 1980s, the agencies for agriculture,  
9 soil conservation, wildlife and rivers began to be integrated within each State, in an  
10 attempt to manage landscape processes holistically. New alliances formed across  
11 government and non-government sectors. In 1985, a new approach, based on local  
12 farming community groups, called 'Landcare', rapidly into a nation-wide 'Decade of  
13 Landcare' program funded by Federal and State governments (Curtis and Lockwood  
14 2000). Landcare focused on local participatory action and capacity building for  
15 sustainable management of natural resources, mostly on privately owned land (Youl et  
16 al. 2001). While technical experts provided support, farmers were the key actors,  
17 working in local groups to assess degradation on their properties, improve practices and  
18 remediate damage (Lockie 1998).

19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40 In the 1990s, a perceived failure of locally-organised projects to create the extent  
41 of landscapes change desired by governments converged with mobilisation of the  
42 interests of Indigenous people, declining economic viability for rural producers,  
43 rationalisation of infrastructure spending and withdrawal of government services,  
44 increasing diversity in rural economies and communities, and a trend to collaborative  
45 planning, to raise interest in regional scale catchment planning (Morrison and Lane  
46 2006). This belief in the possibilities of regional governance accorded with enthusiasm  
47 for regional level decision-making in environmental management worldwide (Jennings  
48 and Moore 2000).

1  
2  
3 Stakeholder participation was (and remains) an objective for NRM in numerous  
4 pieces of State legislation and Federal policy (Marshall 2008), but there was always a  
5 gap between the rhetoric and practice of participatory governance in the regional  
6 delivery model (Lockwood and Davidson 2010; Prager 2010). More than 50 NRM  
7 regional bodies were created as a level of organization between Government (State and  
8 Federal) and community based groups, initially under the shelter of a Natural Resource  
9 Management Ministerial Council (Robins and Dovers 2007). For example, in the State  
10 of Victoria, regional Catchment Management Authorities (CMAs), were formed as  
11 statutory authorities responsible to a Minister, with Ministerial-appointed boards. The  
12 regional bodies were created to link local communities, State-based planning and  
13 Federal policies and investment (Head 2009). They became the main route for funding  
14 on-ground work (Lockwood et al. 2009). Local community organizations such as  
15 Landcare groups had informal links with regional bodies, however, with regionalisation  
16 came more rules and accountability. Neo-liberal economics and new public  
17 management created a system of administration organised around the needs of  
18 governments acting as purchasers of outputs, which regional NRM bodies delivered  
19 (Marshall 2009). From 2000, Federal programs required that regional priorities guide  
20 funding allocations, strengthening the role of regional bodies at the expense of local  
21 decision making (Curtis et al. 2014). By the mid-2000s regionally devolved governance  
22 had peaked, and centralised decision began to return (Robins and Kanowski 2011).  
23 Local Landcare groups and networks in Australia now have their reach and  
24 effectiveness constrained by the dominance of State and Federal targets and by gradual  
25 reduction in funding (Tennent and Lockie 2013; Colliver 2012).  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



1  
2  
3 With the clarity of hindsight, NRM in Australia has felt a pendulum swing from  
4 top-down government control, to the privileging of local community participation and  
5 empowerment, and back to top-down control (Stephens 2013). In the 1980s, policy  
6 makers delegated power for communities to decide, through participation and  
7 deliberation, what action would be supported locally, enabling local solutions that fitted  
8 the complexity and uncertainty of landscape-scale change. In the 1990s the growing  
9 focus on regionalism devolved central power to the regional bodies, but this undermined  
10 existing relationships between local and regional level (Lockwood et al. 2009). The  
11 operating assumptions at this time appear to be that causes can be known, there are  
12 linear relationships between actions and outcomes, and that technically-generated data  
13 are facts. There appears to have been no sense that development of values, knowledge  
14 and discourse involves a dynamic relationship between a biophysical system and human  
15 culture, (Norton 2005), and no appreciation of the relational capital that underpins  
16 effective NRM (Wallis and Ison 2011). The regional approach continues to structure  
17 NRM, but the regional bodies and community organizations have not created forums for  
18 critique and redesign of institutional arrangements and practice based on an  
19 epistemology that understands and values knowledge creation and problem solving in  
20 diverse stakeholder settings as shared experiences (Mackay, 2018). Instead, regional  
21 and local practitioners have accepted and adapted to each new set of funders' priorities  
22 and protocols, and funders and policy makers have not supported inquiry into  
23 governance.

24  
25  
26 The treadmill of our title is this: each swing of the policy pendulum is imposed  
27 from above, with a new framework for practice, new measures of legitimacy and new  
28 understandings of what knowledge is legitimate (Figure1). The imposition occurs  
29 without reflection on current institutional arrangements and practices, and without  
30

1  
2  
3 sensing and building on what is already working. Each swing brings a new set of  
4 arrangements, and a scramble to reconfigure practices while addressing on-going  
5 changes in ecologies, economies and communities. Governance arrangements change,  
6 but each change undermines what has been built in the last swing, such that people must  
7 run just to stand still. Different ways of designing and enacting governance of natural  
8 resources are urgently needed (Ison 2018; Ison, Allan, and Collins 2015; Mackay 2018).  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21

22 Figure 1. The pendulum swing of governance and the constant treadmill of activity that  
23 achieves little  
24  
25

## 26 27 **Systemic co-inquiry of NRM governance in Victoria**

### 28 29 *Overview*

30  
31  
32 In the State of Victoria, the pendulum swings have produced a cohort of community and  
33 government stakeholders who have tasted and tested local, regional and centralised  
34 approaches to NRM decision making and action. They are attuned to the rhetoric that  
35 attends each promise of a new approach, but remain committed to collaboration and  
36 deliberation at the interface of the social and the biophysical. The systemic co-inquiry  
37 presented in this paper began as an invitation to some of these capable and attuned  
38 NRM stakeholders to improve governance. Could they step off the treadmill and  
39 develop a contextually situated, collaboratively constructed practice of innovation in  
40 governance (Ison 2018; Steyaert and Jiggins 2007; Mackay 2018)? This is not as bold  
41 as it might seem- action research in the Port Philip and Westernport and Corangamite  
42 regions of Victoria in 2014-15 had demonstrated the potential of systemic co-inquiry to  
43 re-think roles and practices between local and regional levels of governance (see  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 Mackay et al. 2014; Mackay 2018).  
4

5 A network of researchers coalesced into a consortium, the authors of this paper,  
6 to create a co-inquiry process between local, regional and State level practitioners. The  
7 researchers are part of a wave of empirically-grounded post-positivist practitioners, in  
8 the tradition of those described by Hajer and Wagenaar (2003), strongly anchored in  
9 action research/inquiry traditions, and largely interpretivist and constructivist in  
10 orientation (e.g. Ison, Røling, and Watson 2007; Colliver 2012; Allan and Curtis 2005;  
11 Mackay 2018; Wallis and Ison 2011). Researchers from other traditions joined and  
12 remained as the inquiry progressed (e.g. Mumaw and Bekessy 2017). The consortium  
13 members bring their understandings and practices to the inquiry; we each have unique,  
14 embodied histories out of which we think and act (Russell and Ison 2007). Our focus on  
15 collaboration and co-design mean we strive to bring these histories into awareness, and  
16 this demands reflexivity (Ison 2018). Together, we accept complexity, and assume  
17 change and unknowability rather than stable states (e.g. Schön 1973). We encourage  
18 thinking systemically and collaboratively, favouring deliberating and co-designing over  
19 solving, and testing in action over extended planning. We also embrace talking and  
20 listening over time (see Innes and Booher 2016, on collaborative rationality) and seek to  
21 expose and value multiple partial perspectives (Churchman 1971). We focus on starting  
22 conditions and institutional support, and build collaboration around these (Ansell and  
23 Gash 2007). We understand innovation in governance as an emergent property of  
24 changes in understandings and practices enacted in contexts of concern (Collins and  
25 Ison 2010) and interest (Mackay 2018), with systems and second-order cybernetic  
26 scholarship (Ison 2002; Ison et al. 2004; Ison 2017) fundamental to the design and  
27 conduct of our work.  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

### *Undertaking the systemic co-inquiry*

Systemic co-inquiry builds on co-operative inquiry (Heron and Reason 2001); participants as co-researchers contribute to the design, implementation, monitoring and evaluation of research. It is a specific type of collaborative inquiry which draws on systems theories, methodologies and techniques (Dewey 1933; Churchman 1971; Checkland 2002; Blackmore 2009; Ison 2017; Mackay 2018). Systemic co-inquiry is underpinned by acknowledging that much is not known, and focuses on processes of social learning and the emergence of opportunities, rather than on pre-defined timelines, blueprints and outputs common to projects and programs (Ison 2002). The process of systemic co-inquiry is purposefully designed and facilitated, bringing people together around a situation of concern to understand possibilities and constraints, and to design and test alternative institutional arrangements and practices. It creates a safe space for inquiry, embedded in networks and hierarchies, where investigation and reflection are valued. Systems thinking brings attention to the context of concerns, to multiple rather than single causes, and to patterns that repeat. A facilitated process, framed as an inquiry, enables people to encounter their differing points of view, to maintain momentum when there is difference and uncertainty, and to design ways for improving governance. Figure 2 illustrates systemic co-inquiry as a process purposefully designed for the circumstances-to-hand. In the following section we show how this general approach was used to explore NYM governance.

Figure 2. The design for the systemic co-inquiry, adapted from Mackay (2018)

### ***Implementation of systemic co-inquiry of NRM governance***

The implementation of our systemic co-inquiry is unusual, in being convened by and for practitioners in NRM governance. It was initiated not as part of a government program, but by a Landcare facilitator undertaking PhD research (Mackay 2018; Mackay et al. 2014). In investigating participatory process in NRM, Landcare networks in the Corangamite region said they wanted to understand why their community-based approach to improving land management and restoring landscapes was so little understood by staff in regional and State level programs. Six workshops with the Corangamite network used systemic co-inquiry to build relationships and understandings between local and regional levels, but participants concluded that most of the opportunities they developed needed State level support to prosper.

Building on that PhD research the systemic co-inquiry moved to the State capital, Melbourne, targeting NRM practitioners who sensed systemic failure and wanted to step off the treadmill and re-think governance. State and Federal-level practitioners were invited to join local and regional practitioners (some from the Landcare network-based inquiry) in a new round of inquiry titled the Systemic Inquiry into NRM Governance in Victoria. Over 14 months, five workshops drew together practitioners from Landcare groups and other community environmental volunteer networks, CMAs, State government agencies, local government, philanthropic trusts and universities. Numbers grew from an initial 23 to 45.

Through the inquiry participants settled on four opportunities for improving NRM governance (Figure 3). *Operationalising the Victorian Biodiversity Strategy* looked to strengthen local level agency in relation to State goals for biodiversity.

*Integrating NRM planning across local, regional and State scales* considered how each level of governance could understand and work with the imperatives driving other

1  
2  
3 levels. *Creating a common language for measuring NRM* tackled the failure to measure  
4 outcomes in a way that spoke simultaneously to Treasury, program designers and the  
5 practitioners delivering programs. *Co-designing the partnership between community*  
6 *and government* investigated how to turn the rhetoric of partnership into decision  
7 making that actually considered community priorities. To these, the consortium itself  
8 added a fifth opportunity: development of a platform to sustain innovation in NRM  
9 governance.  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24

### 25 Figure 3. Five opportunities in the Systemic Inquiry into NRM Governance

26  
27 Throughout the five workshops, the research consortium documented workshop  
28 outcomes, so that participants could hold their thinking as it developed, and introduce  
29 ideas to colleagues and managers. From Workshop 2, some working groups began to  
30 pursue their opportunity outside the formal workshops, with the consortium assisting  
31 with introductions, facilitation and guidance on how to keep thinking systemically. A  
32 ‘meta-inquiry’ by the consortium explored how systems thinking and action was  
33 maintained in each of the working groups.  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44

#### 45 ***Analytical/deliberation tools***

46  
47 The activities of any particular systemic co-inquiry will vary to fit the context; here we  
48 describe the methods used in three stages of this inquiry: *framing the inquiry*; *focusing*  
49 *in* to select opportunities for improving governance; and, *moving from what is to what a*  
50 *system could be*. Our systems thinking tools and activities drew from documented  
51 methods (Armson 2011; Blackmore et al. 2017) and from our collective facilitation  
52 practice. The tools are similar to those used in systemic co-inquiry into implementation  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 of the Water Framework Directive in England Foster et al. (2019). The activities and the  
4  
5 workshop sequence were built as we progressed, with the consortium meeting to review  
6  
7 the previous workshop and plan the next, supported by feedback from participants.  
8  
9

10 *Framing the inquiry* began with an invitation, distributed through the  
11  
12 professional networks of the consortium, and then of those who joined the Inquiry, to  
13  
14 people in NRM known to be dissatisfied with business-as-usual, and had a track record  
15  
16 of innovating in governance in their institutional locale. The invitation spoke directly to  
17  
18 practitioners' dissatisfaction and their desire to 'do NRM better', but did not attempt to  
19  
20 define what 'better' meant. Nor did the invitation promise solutions, only inquiry. It  
21  
22 named the pressure to deliver results within projects and programs as part of the  
23  
24 problem of improving NRM governance, in that this squeezed out opportunities for  
25  
26 critical reflection and discussion of practice. We left it to participants to negotiate space  
27  
28 in their schedules to attend the workshops, but noted we expected a commitment to the  
29  
30 full process once people had decided they wanted to be involved.  
31  
32  
33  
34

35 The majority of those who responded came as practitioners, from local and  
36  
37 regional levels of governance, with no mandate to improve governance other than their  
38  
39 own interest. The workshops did not begin with a set of concerns but with a collective  
40  
41 inquiry into people's experience of NRM governance and a search for opportunities to  
42  
43 do NRM better. Those opportunities provided a starting point for investigating how  
44  
45 governance was currently organised around each opportunity, drawing on the differing  
46  
47 perspectives of participants interested in that situation, then on their reading of the  
48  
49 experience and interests of those not in the workshops who also had a stake in the  
50  
51 situation. Many participants were unknown to each other until the day they assembled,  
52  
53 so inquiry processes were designed to allow people to get to know each other as  
54  
55 practitioners, with perspectives that flowed from their personal history and  
56  
57  
58  
59  
60

1  
2  
3 organizational context. All of this we understand as *framing the inquiry*, with these  
4 elements: the invitation to inquiry, opening the experience of being in a system, and  
5  
6 investigating what is at issue for individuals and groups with different stakeholdings.  
7  
8  
9

10 The guiding intent in framing the inquiry was to displace solution-seeking based  
11 on assumptions of linear cause and effect, and put in place systemic and collaborative  
12 inquiry. The invitation created a space dedicated to inquiry. The first formal activity  
13 sought to open the experience of being in a complex system. We invited participants to  
14 draw their experience of a system, using coloured pens and images, diagrams, words or  
15 numbers to capture what the system seemed like to them. These diagrams are known as  
16 rich pictures (Armson 2011). Participants shared their pictures, and found themes  
17 together. Drawing is an alternative to talking, sidestepping the tendency to go to  
18 established interpretations and connecting people to their embodied experience of being  
19 in a system. Considering others' pictures reveals differences in perspective, rooted in  
20 where a person sits within governance arrangements (Mackay 2018). People at regional  
21 level, for example, experience NRM governance differently from people at local or  
22 State level. Finding themes rather than issues or problems is a way to think holistically  
23 about complexity, without getting overwhelmed by detail or alternatively, breaking the  
24 mess into small pieces and treating the situation as a series of difficulties.  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48

49 Figures 4a & 4b. Rich pictures from Workshop 1.

50  
51 The rich pictures are mostly messy affairs (see Figure 4a), but are sometimes loosely  
52 structured through use of metaphor (Figure 4b). Drawing then discussing the rich  
53 pictures activates three kinds of inquiry: first-person inquiry, as I attempt to represent  
54 what I experience; second-person inquiry, as I notice how others have represented my  
55  
56  
57  
58  
59  
60



1  
2  
3 role in relation to their role and we begin to examine our relationships; and third-person  
4 inquiry, as we jointly look at the institutional or organizational context in which our  
5 relationships are embedded (Torbert and Taylor 2008).  
6  
7  
8

9  
10 The next stage of the inquiry, *Focusing in*, was a search for the points in current  
11 governance arrangements and practices where there was an opportunity to improve  
12 governance. This was an iteration between a first guess at an opportunity, analysis of  
13 patterns of behaviour, and a search for interventions where change might bring  
14 improvement. We introduced participants to multi-cause diagramming (Armson 2011;  
15 Open University 2019) as a way to track intended and unintended consequences through  
16 networks of cause and effect, and thereby to understand practices and institutional  
17 arrangements that either locked in ineffective governance or could open up effective  
18 governance. Sometimes these were two sides of the same coin. Possible intervention  
19 points were contested, and people worked through their differing perceptions of  
20 potential for change in different aspects of governance, and their differing assumptions  
21 about change. When a possibility petered out, discussion returned to the opportunity and  
22 to analysis of how governance played out around that opportunity. This search for  
23 intervention points also took account of what was happening at policy and operational  
24 levels. For example, was now the right time to pursue a particular pathway? Was there  
25 readiness amongst practitioners, policymakers and politicians? As an example of the  
26 focusing in process, Figure 5 maps the thinking around the opportunity '*Co-designing  
27 the partnership between community and government*'.  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53

54 Figure 5. Alternative ways to strengthen the community-government partnership.

55  
56  
57 Regarding this opportunity, community Landcare participants said they were locked  
58 into partnerships where they were informed and educated, but still essentially told what  
59  
60

1  
2  
3 to do by government programs. They wanted partnerships where they had an equal say  
4 in decisions and an equal share in the risks associated with programs and projects. But  
5  
6 how could this be achieved? For thirty years, Landcare groups and networks had taken  
7  
8 local action, and assumed (along the right-hand loop in Figure 5) that Landcare would  
9  
10 be taken on by regional level as partners in planning. This had not happened.  
11  
12

13  
14 Marshalling evidence of the impacts of community action might be a way forward: on  
15  
16 the left-hand loop, gathering evidence of Landcare's impacts and telling that story better  
17  
18 might strengthen advocacy for people-centred policies that would compel government  
19  
20 programs to do more than consult on their terms, when it suited them. This, however,  
21  
22 was a long road, with many possible points where influence would fail. As the group  
23  
24 struggled with this, a third pathway (shown by the arrows through the centre of the  
25  
26 diagram) appeared: to take on the way priorities are set and projects designed—the nuts-  
27  
28 and-bolts of NRM planning—and co-design these between local and regional levels.  
29  
30  
31 The concept of 'co-design' had recently come into policy thinking in NRM in Victoria,  
32  
33 and might prove attractive to funders and regional players—this was the pathway this  
34  
35 group pursued.  
36  
37  
38  
39

40 *Moving from what is to what could be* began with *systems maps* that showed the  
41  
42 structure of, and relationships between, parts of a system operating around a focal  
43  
44 situation. Systems maps delineate a boundary, and internal structure of sub-systems, and  
45  
46 an environment outside the boundary. By diagramming the systems and sub-systems  
47  
48 that belong together, systems maps make it easier to understand what is happening  
49  
50 (Armson 2011). *Systems definitions* then gave shape to what could be, in the form: 'A  
51  
52 system to do <What> by means of <How> in order to contribute to achieving <Why>'.  
53  
54 This template is disarmingly simple, with only one *What*, the primary activity that  
55  
56 defines the purpose, and one *Why*. The '*What*' must contribute directly to the '*Why*' in  
57  
58  
59  
60

ways that are readily understandable. Verb forms are used for *What*, *How* and *Why*. Arriving at a systems definition is a deliberative process, moving between analysis of what is and what could be (Armson 2011; Checkland and Poulter 2006).

If the systems definition sets an aspiration, a human activity system (HAS) (Checkland and Poulter 2006; Armson 2011) is a design for how to shift existing players towards a new system. The notion of an activity system displaces the assumption of predictable cause-and-effect implicit in a program logic approach to project design. Systemic co-inquiry assumes that governance can change when human actors engage creatively in reshaping practice through design, action and learning. Figure 6 reproduces the systems definition and HAS developed by the ‘*Operationalising the Victorian Biodiversity Strategy*’ co-inquiry group. Protection of biodiversity is affected by many different government agencies, businesses and individuals, but most act without knowledge of what others are doing or intending, particularly in urban areas. The experiences of the group were that government set priorities using different criteria and different data to those used by urban communities active in local nature stewardship. The urban environment was a ‘blank spot’ in State agency planning and activities, despite 90% of Victoria’s population living in urban areas.

Figure 6. A system definition and human activity system for connecting Victorians with nature

Participants felt that what was needed was change in the linkages between strategy-making, decision-making and community involvement. The *Operationalising the Victorian Biodiversity Strategy*’ co-inquiry group decided it was necessary to shift the

1  
2  
3 system from government-led planning disconnected from community members who are  
4 active in caring for nature, to a system that involves all Victorians working together to  
5 take care of nature. This would require programs co-designed by citizens and local  
6 government agencies, working collaboratively to engage their local communities in  
7 nature stewardship. A project was developed and funded to initiate a network in which  
8 innovators co-designing stewardship programs would share what they were doing,  
9 supporting development of other co-designing citizen-local government collaborations  
10 who would join the network and share their learnings and resources. This network has  
11 moved knowledge and inspiration rapidly across multiple locations and organizations in  
12 municipalities in and around Melbourne, and continues as an expanding self-organizing  
13 governance network based on hub and spoke relationships (Gardens for Wildlife  
14 Victoria 2019; Mumaw, Gaskell, and Leskovec 2018).

### 31 **Critical reflections on the systemic co-inquiry design and conduct**

32  
33  
34 The systemic co-inquiry described above is dynamic, and exciting, and some practice is  
35 changing. We now reflect on what we learned through this systemic co-inquiry in  
36 relation to governance and practice, and its theoretical and political implications.

#### 41 ***Governance***

42  
43  
44 The design led beyond articulating what was wrong in a situation of concern to a focus  
45 on the opportunities perceived by those participating. Over time all members of the  
46 consortium began to think of themselves as both facilitators and researchers. They  
47 framed their role as providing a platform that would support autonomous teams around  
48 each (sub) co- inquiry. The platform conducted a meta-inquiry into how systemic co-  
49 inquiry could be sustained, institutionalised and contribute to capacity and capability-  
50 building. The consortium developed a case, alongside the four pilot proposals, for  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 funding support for such a platform, that is for moving towards and institutionalising  
4 systemic governance or co-governance. Foster et al. (2019) conceptualised this function  
5 in another, similar, program as inquiring into governing; a second-order, reflexive  
6 institutional and praxis space capable of mediating between the arms of vertical (i.e.  
7 state driven) and horizontal (i.e. civil society-driven) governance. But who, other than  
8 government, might fund inquiry into governance? And if they do, are the dangers of  
9 being co-opted by government outweighed by the opportunity to inquire - this is in itself  
10 an area for more innovation and inquiry.  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21

### 22 *Methodological*

23  
24  
25 We have seeded an approach to improving governance rooted in social learning, that  
26 brings together innovators from different organizations (government and civil) at  
27 different levels (local, regional and State). Beyond the first two workshops we were not  
28 able to sustain participation of Federal government personnel. We set aside the  
29 traditional approach to improvement of governance, in which agendas, models,  
30 processes and priorities are set by government actors and opened to community actors  
31 for 'consultation', often within a rigid timeframe that precludes meaningful  
32 contribution. Two aspects of the case study are worth comment: the creation of a 'safe  
33 space' for inquiry embedded in, but not constrained by, networks and hierarchies, and  
34 the use of systems thinking in practice (STiP) to support inquiry in the context of  
35 practice.  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50

51 The case study describes systemic co-design as a process, but the systemic  
52 inquiry in NRM governance was also a 'safe space' for the creative work of systems  
53 thinking. The support and imprimatur of a key, high-level government actor early on  
54 assisted to validate the process, but essentially our approach was driven by an invitation  
55 to people frustrated with limitations in the practices and institutional relationships of  
56  
57  
58  
59  
60

1  
2  
3 NRM, who nonetheless believed that things could be done better. Systemic co-inquiry  
4 provided those people with a way to work with others to learn how to move from  
5 problems to possibilities, in conditions of complexity and uncertainty, and then shape  
6 their ideas into the form of ‘pilot project’ proposals which NRM organizations and  
7 philanthropic funders could understand and to which they could respond.  
8  
9

10  
11  
12  
13  
14  
15 Participants were recruited from networks across NRM governance, then formed  
16 as teams that linked these networks, and continued to test their ideas, influence opinion  
17 and broker connections within their networks, harnessing the potential observed for  
18 networks in systems change (Moore and Westly 2011). Some came from positions  
19 within hierarchies, negotiating support from those hierarchies for their participation, and  
20 lobbying for support for the proposals that emerged. Others came as interested civil  
21 actors, linked to volunteer networks without organizational constraints. In mobilizing  
22 support within networks and hierarchies, participants acted as organizational  
23 entrepreneurs (Huitema and Meijerink 2010; Davidson and de Loe 2016). Systemic co-  
24 inquiry was therefore *a place for inquiry*, connected to, but not assimilated by, networks  
25 and hierarchies. The presence of a team of practitioners and researchers to sponsor and  
26 facilitate systemic co-inquiry legitimized that place for learning and delivered the  
27 guidance and practical support needed for inquiry. However, the inquiry was treated by  
28 some of these hierarchies as a ‘project’ (sensu Allan 2012), supported within the period  
29 of its initial resourcing but not beyond, precluding its effectiveness as an ongoing  
30 iterative approach.  
31  
32

33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51 The inquiry applied systems thinking in the context of practice. Rather than  
52 seeking a perilous certainty, we encouraged engagement with differing points of view  
53 that generated deeper understanding of what was possible, and commitment to pursue  
54 this. By approaching systems as constructs of human purposefulness, rather than as hard  
55  
56  
57  
58  
59  
60

1  
2  
3 objects, the inquiry supported design for change. The use of novel formulations of  
4 possible systems to articulate a vision left open the realization that ongoing articulation  
5 of purpose is always a matter for further inquiry and design. The use of Human Activity  
6 Systems set up action as a system of influence within a complex institutional context,  
7 rather than positioning action as implementation of a known program logic separate  
8 from uncertainty and human agency. Understanding any situation as a manifestation of  
9 practices and institutional arrangements underpinned by values and ways of thinking  
10 gave participants many different entry points to bring about change. Framing change as  
11 learning-in-action helped to engage people who were unfamiliar with theoretical  
12 language and suspicious of imposed approaches.

### 27 *Theoretical*

30 Current NRM practices are habits of hand and mind, and current arrangements reflect  
31 where power sits. Even when all parties are dissatisfied, it takes more than a good idea  
32 to shift long-established patterns; that requires strategic action in the 'whole system'.  
33 We have demonstrated that players from civil society can continue to act, and not be  
34 immediately oppressed by extant institutions. The creation of a space aligned with, but  
35 not within, existing organizations and power structures provided both legitimacy and  
36 freedom. Participant designers/facilitators able to foster a fractal like (or polycentric)  
37 praxis network of 'systemic (co)inquiring' groups may be one pathway to  
38 transformative social change. Effective monitoring and evaluating and adaptive  
39 designing of the inquiry should become an essential part of the ongoing process.

53 The systems co-inquiry framing also re-unites, to some degree, interpretation of  
54 action, practice-orientation and deliberation. Systems thinking provided a way to enter  
55 into uncertainty that produced insights in support of ongoing concerted action. In this  
56 regard systemic co-inquiry can be seen as a further development in the action

1  
2  
3 research/systemic action research lineage of scholarship to which the authors have  
4  
5 contributed.  
6  
7

### 8 9 *Political*

10  
11 The platform enabled collaborative action that led to modest investment from numerous  
12 sources, around three emergent co-inquiries, although to date it has not been possible to  
13 fund the meta-inquiry. This is an ongoing challenge in a field that has been plagued  
14 over many years by on-going co-option of local understandings and self-organising  
15 actions by the state (Ison, Alexandra, and Wallis 2018). Through the State government  
16 (DEWLP) funding we know that the systemic co-inquiries influenced the development  
17 of policy, but there is no guarantee of ongoing implementation of systemic co-inquiry as  
18 a policy paradigm. Our approach was sustained without specific funding or programs,  
19 the initial step backed by a small university grant, with other willing to contribute as the  
20 benefits of the process emerged.  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33

34  
35 The systemic co-inquiry was only possible by keeping diverse stakeholders  
36 engaged, trusting the process and capturing and articulating the emergent outcomes. Our  
37 starting point outside established authority in NRM facilitated this, however, the overall  
38 approach is likely to fail unless sustained support (from, for example, employers,  
39 agencies, philanthropic bodies) for a new type of organization, based on enacting a  
40 paradigm of co-inquiry/co-design, can be created. Organizations that facilitate design,  
41 reflection and transformation, ahead of planning and projects, are needed to break the  
42 pendulum and treadmill effects, to mediate between the arms of vertical and horizontal  
43 governance while maintaining ongoing relevance and avoiding state capture. Our co-  
44 inquiry was underway when co-design became flavour-of-the-month in  
45 policy/government circles, and our observation was that the state continues to see itself  
46 as ‘initiator’ for anything not part of its traditional role, and rather than being an  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



1  
2  
3 ongoing collaborator, handballing actual implementation of any new design to ‘the  
4 community.’ This does not bode well for state support for an approach that adds to the  
5 set of co-design possibilities, a commitment to rigorous inquiry, and to iterations of  
6 inquiry, design and action, rather than pursuit of single-shot solutions.  
7  
8  
9  
10  
11  
12

### 13 **Relevance for DPA**

14  
15  
16 There are clear links with DPA in the approach taken by the research  
17 consortium, in particular the will to build policy from practice outwards (see Cook and  
18 Wagenaar 2012), and to facilitate and foster insitutionalisation of social learning and  
19 systems thinking in practice (see Foster et al. 2019; Mackay 2018). DPA, which seeks  
20 to generate relevant and usable knowledge for policy actors, was originally described as  
21 having three related pillars - interpretation, deliberation and practice (Hajer and  
22 Wagenaar 2003). Practice in this context was considered to be pragmatic and  
23 purposeful, interpretive and holistic, interactive and moral and emotional, and with a  
24 systems understanding of community (Wagenaar and Cook 2003).  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35

36 West, van Kerhoff, and Wagenaar (2019) propose practice as a starting point for  
37 transdisciplinary interventions in situations of dynamic complexity. DPA argues that  
38 knowledge emerges from practice. Inquiry in the midst of practice, by people attuned to  
39 the contingencies of a complex situation, is more likely to generate transformative  
40 action than inquiry that assumes that knowledge precedes, and is applied to, action.  
41 Complex situations change, and knowledge is but one manifestation of practice that  
42 develops and is improvised in those situations. These understandings are consistent with  
43 claims about practice arising from applied systems thinking in practice (STiP) research  
44 at the UK Open University (OU). From the cybernetic systems and cognition lineages  
45 that inform their work, practice is (i) always situated and embodied; (ii) requires an  
46 observer for all observing; (iii) understands that everything said is said by someone (we  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 live in language); (iv) accepts that all knowing is doing and that all being, knowing and  
4 doing is relational and (v) appreciates that all observers, practitioners, actors have a  
5 history, a tradition of understanding, out of which they think and act.  
6  
7  
8  
9

10 While there is continued interest in, and scholarship on, DPA its three pillars  
11 appear to have uncoupled, and moved in different directions (see Li and Wagenaar  
12 2019b; Foster et al. 2019). The dissociation of the three pillars entrenches the tendency  
13 of DPA to maintain traditional forms of research practice within the linear model of  
14 ‘knowledge transfer’, with negative implications for the science of policy analysis and  
15 for all societies grappling with the new normal of the Anthropocene (Ison 2018). Li and  
16 Wagenaar (2019a, 580) conclude that there are many reasons for the failure of DPA to  
17 be taken up as a coherent program of theory and practice, noting that the “continuing  
18 hegemony of positivist, reductionist and control-oriented social science is an important  
19 one”. But they also apportion blame to DPA itself for the absence of a set of operable  
20 procedures that potential practitioners can take. They suggest that “Currently people  
21 who are in principle sympathetic towards DPA have a hard time figuring out how to  
22 actually do it.”  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39

40 In this paper we reflect on our experience of using a systemic co-inquiry as a  
41 means to transform NRM to a form of systemic governance or governing. Describing  
42 and critiquing our use of systemic co-inquiry provides new insights to address  
43 challenges for future DPA, expressed by Li (2019) as: (i) how to render the DPA  
44 approach more operable, (ii) the absence of “analysis,” and (iii) the lack of purposeful  
45 and designed practice. This particular case demonstrates how ‘new wave’ DPA can be  
46 made operable, include analysis as deliberation, and generate purposeful, designed  
47 pilots. What remains in doubt, however are the means to initiate and sustain a wave of  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 governance reform that opens up spaces for institutionalising new-wave DPA  
4  
5 understandings and practices (see also Foster et al. 2019).  
6  
7  
8

## 9 **Conclusion**

10  
11 The case presented in this paper is situated within the broader ‘problematique’ of how  
12  
13 to operationalise relational policy and practice development as part of a shift towards  
14  
15 systemic/adaptive co-governance. We have demonstrated systemic co-inquiry as a  
16  
17 practice; a pragmatic and purposeful way of approaching policy that is interpretive and  
18  
19 holistic, and that by being interactive enables moral and emotional elements to be  
20  
21 brought into planning. As such it can be considered to be part of the interventionist  
22  
23 conception of DPA, that re-emphasises the centrality of practice, and gives direction to  
24  
25 the interpretive and deliberative elements. It is, perhaps, an approach to nurture, but  
26  
27 questions remain. In particular: What additional, complementary work is needed to  
28  
29 create the new structures that will support on going social learning and systemic co-  
30  
31 inquiry? Did the constant need for funding influence the shape and direction of the  
32  
33 systemic co-inquiry to its detriment? And perhaps most importantly, did we really jump  
34  
35 off the treadmill, or simply spin it a bit faster?  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45

## 46 **References**

- 47  
48 Allan, C. 2012. "Rethinking the ‘Project’: Bridging the Polarized Discourses in  
49 IWRM." *Journal of Environmental Policy & Planning* 14 (3):231-41. doi:  
50 10.1080/1523908X.2012.702012.  
51  
52 Allan, C., and A. Curtis. 2005. "Nipped in the bud: Why regional scale adaptive  
53 management is not blooming." *Environmental Management* 36 (3):414-25. doi:  
54 10.1007/s00267-004-0244-1.  
55  
56 Ansell, C., and A. Gash. 2007. "Collaborative Governance in Theory and Practice."  
57 *Journal of Public Administration Research and Theory* 18 (4):543-71. doi:  
58 10.1093/jopart/mum032.  
59  
60 Armson, R. 2011. *Growing wings on the way: systems thinking for messy situations*.  
Triarchy Press Limited.

- 1  
2  
3 Bates, G. 2006. *Environmental Law in Australia*. 6th ed. Chatswood, Australia:  
4 LexisNexis Butterworth's.
- 5 Blackmore, C. 2009. "Learning Systems and Communities of Practice for  
6 Environmental Decision-Making." The Open University.
- 7 Blackmore, C., N. Foster, K. Collins, and R. L. Ison. 2017. "Understanding and  
8 developing communities of practice through diagramming." In *Mapping  
9 environmental sustainability: reflecting on systemic practices for participatory  
10 research*, edited by S. Oreszczyn and A Lane, 155-82. London: Policy Press.
- 11 Brunner, R. D., and T. A. Steelman. 2005. "Beyond scientific management." In  
12 *Adaptive Governance: Integrating Science, Policy and Decision-Making*, edited  
13 by Ronald D. Brunner, Toddi A. Steelman, Lindy Coe-Juell, C. M. Cromley,  
14 Edwards C.M. and Donna W. Tucker, 1-46. New York: Columbia University  
15 Press.
- 16 Checkland, P. 2002. "The Role of the Practitioner in a Soft Systems Study: Notes of a  
17 Talk given to OuSyS and UKSS, Saturday 8th December 2001." *Quarterly  
18 Newsletter of the Open University Systems Society*:S5-11.
- 19 Checkland, P., and J. Poulter. 2006. *Learning for Action: A Short Definitive Account of  
20 Soft Systems Methodology and its Use, for Practitioners, Teachers and Students*  
21 Chichester: John Wiley and Sons Ltd
- 22 Churchman, C. W. 1971. *The Design of Inquiring Systems*. New York: Basic Books.
- 23 Collins, K., and R. L. Ison. 2010. "Trusting Emergence: Some Experiences of Learning  
24 about Integrated Catchment Science with the Environment Agency of England  
25 and Wales." *Water resources management* 24:669-88. doi: DOI  
26 10.1007/s11269-009-9464-8.
- 27 Colliver, R. 2012. "Community-based governance in social-ecological systems: an  
28 inquiry into the marginalisation of Landcare in Victoria, Australia." Murdoch  
29 University.
- 30 Cook, S. D. N., and H. Wagenaar. 2012. "Navigating the Eternally Unfolding Present:  
31 Toward an Epistemology of Practice." *The American Review of Public  
32 Administration*:1-36. doi: 10.1177/0275074011407404.
- 33 Curtis, A. 1998. "Agency-Community Partnership in Landcare: Lessons for State-  
34 Sponsored Citizen Resource Management." *Environmental Management* 22  
35 (4):563-74.
- 36 Curtis, A., and M. Lockwood. 2000. "Landcare and Catchment Management in  
37 Australia: Lessons for State-Sponsored Community Participation." *Society &  
38 Natural Resources* 13 (1):61-73. doi: 10.1080/089419200279243.
- 39 Curtis, A., H. Ross, G. R. Marshall, C. Baldwin, J. Cavaye, C. Freeman, A. Carr, and G.  
40 J. Syme. 2014. "The great experiment with devolved NRM governance: lessons  
41 from community engagement in Australia and New Zealand since the 1980s."  
42 *Australasian Journal of Environmental Management* 21 (2):175-99. doi:  
43 10.1080/14486563.2014.935747.
- 44 Davidson, S. L., and R. C. de Loe. 2016. "The Changing Role of ENGOs in Water  
45 Governance: Institutional Entrepreneurs?" *Environ Manage* 57 (1):62-78. doi:  
46 10.1007/s00267-015-0588-8.
- 47 Dewey, J. 1933. *How we think : a restatement of the relation of reflective thinking to the  
48 educative process*. Boston, N.Y.: D.C.Heath and co.
- 49 Foster, N., R. L. Ison, C. Blackmore, and K. Collins. 2019. "Revisiting deliberative  
50 policy analysis through systemic co-inquiry: some experiences from the  
51 implementation of the Water Framework Directive in England." *Policy  
52 Studies*:1-24. doi: 10.1080/01442872.2019.1618816.
- 53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 Gardens for Wildlife Victoria. 2019. "Gardens for Wildlife Victoria." Accessed 30  
4 August. <https://gardensforwildlifevictoria.com/>.
- 5 Hajer, M., and H. Wagenaar. 2003. "Deliberative policy analysis : understanding  
6 governance in the network society." In. Cambridge, UK: Cambridge University  
7 Press.
- 8  
9 Head, B. W. 2009. "From government to governance: explaining and assessing new  
10 approaches to NRM." In *Contested Country: local and regional natural  
11 resource management in Australia*, edited by M Lane, C. J. Robinson and B.  
12 Taylor, 15-28. Canberra: CSIRO Publishing.
- 13 Heron, J., and P. Reason. 2001. "The Practice of Co-Operative Inquiry. Research with  
14 Rather than on People." In *Handbook of Action Research*, edited by Peter  
15 Reason and Hilary Bradshaw, 179–88. London: Sage Publications.
- 16 Huitema, D., and S. Meijerink. 2010. "Realizing water transitions: The role of policy  
17 entrepreneurs in water policy change." *Ecology and society* 15.
- 18 Innes, J. E., and D. E. Booher. 2016. "Collaborative rationality as a strategy for working  
19 with wicked problems." *Landscape and Urban Planning* 154:8-10. doi:  
20 10.1016/j.landurbplan.2016.03.016.
- 21  
22 Ison, R. L. 2002. "Some reflections on a knowledge transfer strategy: a systemic  
23 inquiry." In *Farming and Rural Systems Research and Extension, Proceedings  
24 Fifth IFSA European Symposium*. Florence.
- 25 ———. 2017. *Systems Practice: How to Act. In Situations of Uncertainty and  
26 Complexity in a Climate-Change World*. London: Springer.
- 27 ———. 2018. "Governing the human–environment relationship: systemic practice."  
28 *Current Opinion in Environmental Sustainability* 33:114-23. doi:  
29 10.1016/j.cosust.2018.05.009.
- 30  
31 Ison, R. L., J. Alexandra, and P. J. Wallis. 2018. "Governing in the Anthropocene: are  
32 there cyber-systemic antidotes to the malaise of modern governance?"  
33 *Sustainability Science*. doi: 10.1007/s11625-018-0570-5.
- 34 Ison, R. L., C. Allan, and K. Collins. 2015. "Reframing water governance praxis: Does  
35 reflection on metaphors have a role?" *Environment and Planning C:  
36 Government and Policy* 33 (6):1697-713. doi: 10.1177/0263774X15614466.
- 37 Ison, R. L., N. Röling, and D. Watson. 2007. "Challenges to science and society in the  
38 sustainable management and use of water: investigating the role of social  
39 learning." *Environmental Science & Policy* 10 (6):499-511. doi:  
40 10.1016/j.envsci.2007.02.008.
- 41 Ison, R. L., P. Steyaert, P. P. Roggero, B. Hubert, and J. Jiggins. 2004. *Social Learning  
42 for the Integrated Management and Sustainable Use of Water at Catchment  
43 Scale*. Milton Keynes: The Open University. <http://oro.open.ac.uk/2839/>.
- 44 Ison, R. L., and E. Straw. 2020. *Crafting Governance Fit for the Anthropocene. The  
45 Hidden Power of Systems Thinking in Practice*. Abingdon: Routledge.
- 46 Jennings, S., and S. Moore. 2000. "The rhetoric behind regionalization in Australian  
47 natural resource management: myth, reality and moving forward." *Journal of  
48 Environmental Policy & Planning* 2 (3):177-91. doi: 10.1080/714038553.
- 49 Li, Y. 2019. "Deliberative policy analysis: towards a methodological orientation."  
50 *Policy Studies* 40:437-55.
- 51 Li, Y., and H. Wagenaar. 2019a. "Conclusion: building new momentum for deliberative  
52 policy analysis." *Policy Studies* 40:580-4. doi:  
53 10.1080/01442872.2019.1618814.
- 54 ———. 2019b. "Revisiting deliberative policy analysis." *Policy Studies* 40:427-36.  
55 doi: 10.1080/01442872.2019.161881.
- 56  
57  
58  
59  
60

- 1  
2  
3 Lockie, S. 1998. "Landcare in Australia: Cultural Transformation in the management of  
4 rural environments." *Culture and Agriculture* 20 (1):21-9.
- 5 Lockwood, M., and J. Davidson. 2010. "Environmental governance and the hybrid  
6 regime of Australian natural resource management." *Geoforum* 41 (3):388-98.  
7 doi: <http://dx.doi.org/10.1016/j.geoforum.2009.12.001>.
- 8  
9 Lockwood, M., D. Julie, A. Curtis, E. Stratford, and R. Griffith. 2009. "Multi-level  
10 Environmental Governance: lessons from Australian natural resource  
11 management." *Australian Geographer* 40 (2):169-86.
- 12 Mackay, M. 2018. "Transforming governance together: A co-inquiry into practices for  
13 transitioning from top-down to adaptive co-governance." Charles Sturt  
14 University.
- 15 Mackay, M., C. Allan, R. Colliver, and J. Howard. 2014. "Systems Approaches Enable  
16 Improved Collaboration in Two Regional Australian Natural Resource  
17 Governance Situations." *International Journal of Systems and Society* 1 (2):1-  
18 21. doi: 10.4018/ijss.2014070101.
- 19 Marshall, G. R. 2008. "Nesting, Subsidiarity, and Community-based environmental  
20 Governance beyond the Local Scale." *International Journal of the Commons* 2  
21 (1):75-97. doi: <http://doi.org/10.18352/ijc.50>.
- 22  
23 ———. 2009. "Polycentricity, reciprocity, and farmer adoption of conservation  
24 practices under community-based governance." *Ecological Economics* 68:1057-  
25 520.
- 26 Moore, M.-L., and F. Westly. 2011. "Surmountable chasms: networks and social  
27 innovation for resilient systems." *Ecology and society* 16 (1).
- 28 Morrison, T., and M. Lane. 2006. "The convergence of regional governance discourses  
29 in rural Australia: enduring challenges and constructive suggestions." *Rural*  
30 *Society* 16 (3):341-57.
- 31 Mumaw, L., and S. Bekessy. 2017. "Wildlife gardening for collaborative public-private  
32 biodiversity conservation." *Australasian Journal of Environmental*  
33 *Management* 24 (3): 242-60.
- 34 Mumaw, L., N. Gaskell, and C. Leskovec. 2018. From planning to wildlife gardening:  
35 evolving approaches to fostering urban biodiversity. Paper presented at the  
36 Remaking Cities - Proceedings of the 14th Australasian Urban History Planning  
37 History Conference, Melbourne. Australasian Urban History Planning History  
38 Group and the RMIT Centre for Urban Research.
- 39 Norton, B. G. 2005. *Sustainability: A Philosophy of Adaptive Ecosystem Management*.  
40 Chicago: The University of Chicago Press.
- 41 Open University. 2019. "Systems diagramming. OpenLearn." Accessed 28 August  
42 2019. [https://www.open.edu/openlearn/science-maths-technology/computing-  
43 and-ict/systems-computer/systems-diagramming/content-section-4.1](https://www.open.edu/openlearn/science-maths-technology/computing-and-ict/systems-computer/systems-diagramming/content-section-4.1)
- 44 Prager, K. 2010. "Local and Regional Partnerships in Natural Resource Management:  
45 The Challenge of Bridging Institutional Levels." *Environmental Management*  
46 46 (5):711-24. doi: 10.1007/s00267-010-9560-9.
- 47 Robins, L., and S. Dovers. 2007. "NRM Regions in Australia: the "Haves" and the  
48 "Have Nots"." *Geographical Research* 45 (3):273-90.
- 49 Robins, L., and P. Kanowski. 2011. "'Crying for our Country': eight ways in which  
50 'Caring for our Country' has undermined Australia's regional model for natural  
51 resource management." *Australasian Journal of Environmental Management* 18  
52 (2):88-108. doi: 10.1080/14486563.2011.566158.
- 53 Rockström, J., W. Steffen, K. Noone, Å. Persson, S. F. Chapin, E. F. Lambin, T. M.  
54 Lenton, et al. 2009. "A safe operating space for humanity." *Nature* 46.
- 55  
56  
57  
58  
59  
60

- 1  
2  
3 Russell, D. B., and R. L. Ison. 2007. "The research-development relationship in rural  
4 communities: an opportunity for contextual science." *Agricultural extension*  
5 *and rural development: Breaking out of knowledge transfer traditions*:10-31.  
6 Schön, D. A. 1973. *Beyond the stable state : public and private learning in a changing*  
7 *society*. Harmondsworth: Penguin.  
8 Stephens, M. 2013. "Translation of national environmental management programs by  
9 the State of Western Australia, the Commonwealth government, and Perth  
10 Region NRM, a citizen group." Curtin University.  
11 Steyaert, P., and J. Jiggins. 2007. "Governance of complex environmental situations  
12 through social learning: a synthesis of SLIM's lessons for research, policy and  
13 practice." *Environmental Science & Policy* 10 (6):575-86. doi:  
14 10.1016/j.envsci.2007.01.011.  
15 Tennent, R., and S. Lockie. 2013. "Vale Landcare: the rise and decline of community-  
16 based natural resource management in rural Australia." *Journal of*  
17 *Environmental Planning and Management* 56 (4):572-87. doi:  
18 10.1080/09640568.2012.689617.  
19 Torbert, W., and S. Taylor. 2008. "Action Inquiry: interweaving multiple qualities of  
20 attention in timely action " In *In The Handbook of Action Research*, edited by P.  
21 Reason and Hilary Bradbury, 239-51. London: Sage.  
22 Wagenaar, H., and S. D. N. Cook. 2003. "Understanding policy practices: action,  
23 dialectic and deliberation in policy analysis." In *Deliberative Policy Analysis:*  
24 *Understanding governance in the network society*, edited by Hendrik Wagenaar  
25 and Maarten Hajer, 139-71. Cambridge: Cambridge University Press.  
26 Wallis, P. J., and R. L. Ison. 2011. "Appreciating institutional complexity in water  
27 governance dynamics: a case from the Murray-Darling Basin, Australia." *Water*  
28 *resources management*:1-17.  
29 West, S., L. van Kerhoff, and H. Wagenaar. 2019. "Beyond "Linking" Knowledge and  
30 Action: Towards a Practice-Based Approach to Transdisciplinary Sustainability  
31 Interventions " *Policy Studies* 40 (5):534–55. doi:  
32 doi:10.1080/01442872.2019.1618810.  
33 Youl, R., L. Polkinghorne, T. Naben, and S. Marriott. 2001. *Landcare in*  
34 *Australia:founded on local action*. Melbourne: Landcare Foundation Victoria.  
35  
36  
37  
38  
39  
40  
41  
42  
43

---

44  
45 <sup>i</sup> NRM Regions Australia, <https://nrmregionsaustralia.com.au/what-is-nrm/> Accessed 20<sup>th</sup>  
46 August 2019.  
47

48 <sup>ii</sup> It can be argued that a NRM framing conserves the human-nature dualism, as do recent shifts  
49 to natural capital and the framing of parts of the biosphere as assets for human  
50 exploitation, or interventions to conserve ecological functioning. The shift to NRG does  
51 not escape the dualism but does introduce a practitioner(s) who, in the shift from  
52 management to governing, creates possibilities for a shift towards praxis i.e., theory-  
53 informed practical action (see Ison Alexandra and Wallis 2018).  
54  
55  
56  
57  
58  
59  
60

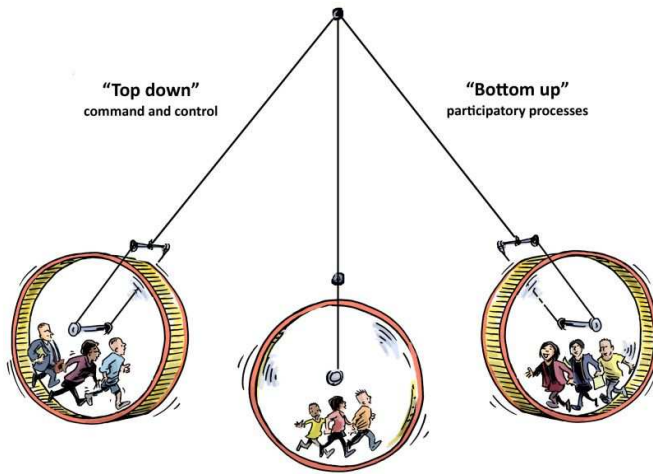


Figure 1. The pendulum swing of governance and the constant treadmill of activity that achieves little

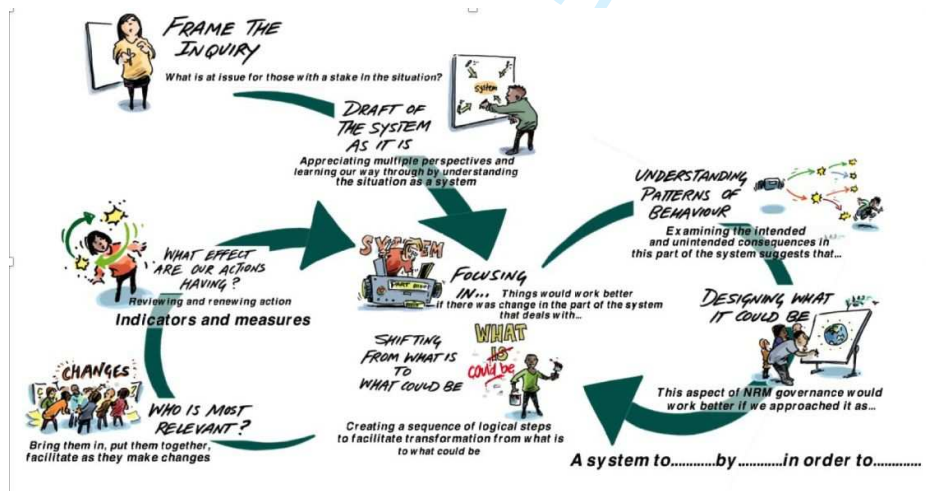
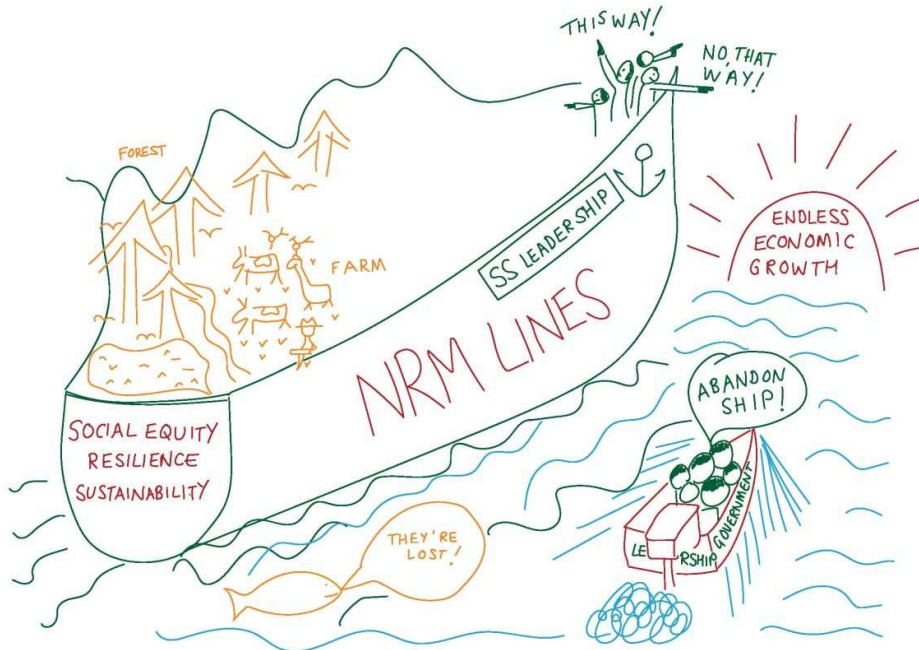


Figure 2. The design for the systemic co-inquiry, adapted from Mackay (2018)







Figures 4a & 4b. Rich pictures from Workshop 1.

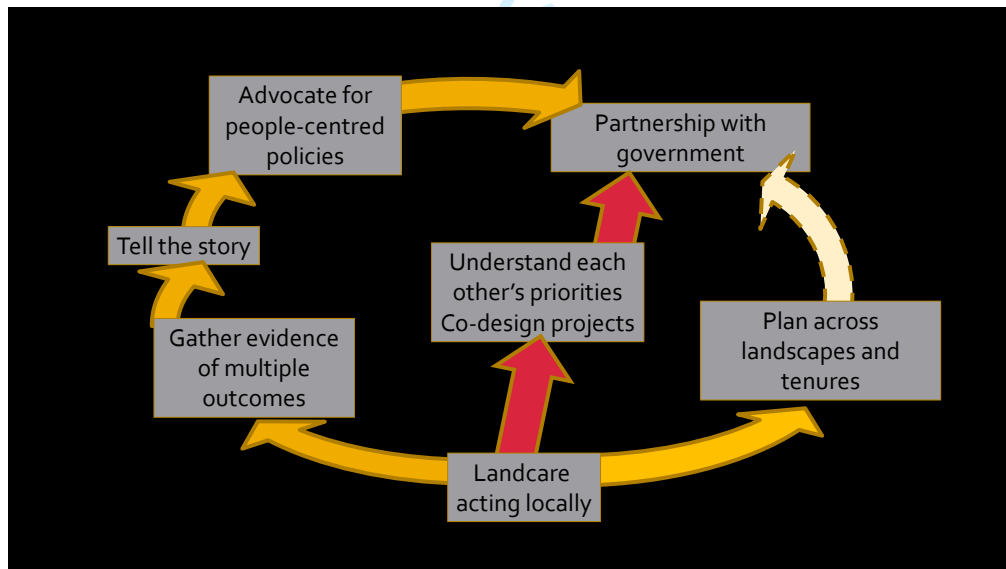


Figure 5. Alternative ways to strengthen the community-government partnership.

A system to invest in pilots to co-design collaborative approaches for government agencies and urban/peri-urban groups active in nurturing nature in order to involve Victorians in connecting with and taking care of nature.

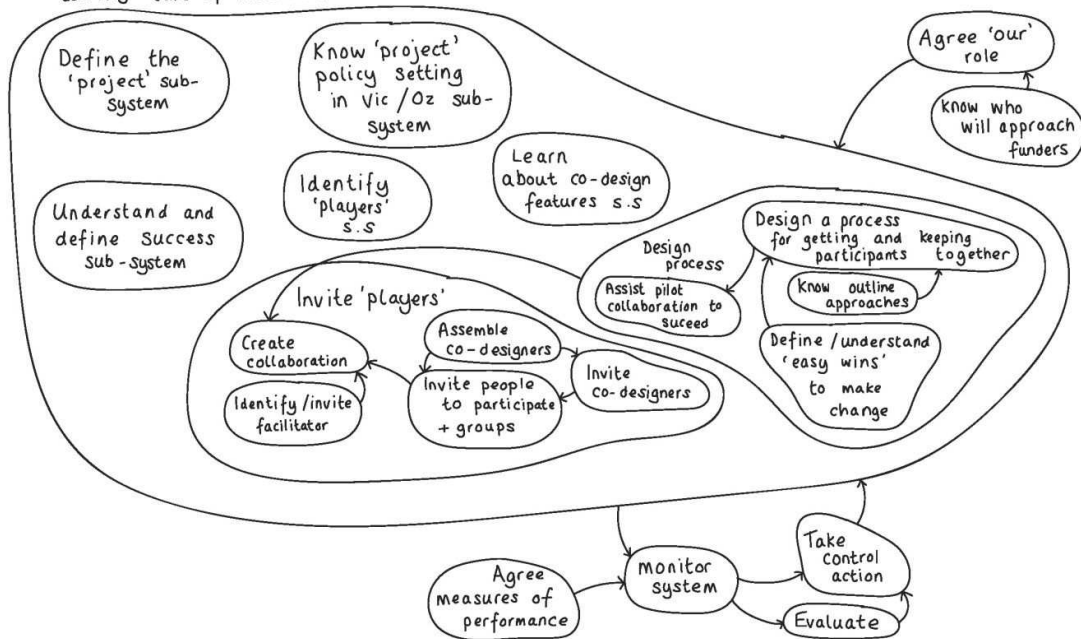


Figure 6. A system definition and human activity system for connecting Victorians with nature

1  
2  
3 **Jumping off the treadmill: transforming NRM to systemic governing with**  
4 **systemic co-inquiry**  
5

6  
7 **Author Names**  
8

9  
10 \*Catherine Allan  
11 Institute for Land, Water and Society,  
12 Charles Sturt University, PO Box 789, Albury, NSW, Australia  
13 callab@csu.edu.au  
14

15  
16 Ross Colliver,  
17 Director, The Training and Development Group, 288 Gap Road, Riddells Creek, Victoria,  
18 Australia  
19

20  
21 R.L Ison,  
22 ASTiP (Applied Systems Thinking in Practice) Group, School of Engineering & Innovation,  
23 The Open University, Walton Hall MK7 6AA, UK.  
24

25  
26 Laura Mumaw,  
27 Centre for Urban Research  
28 RMIT University, GPO Box 2476 Melbourne, Victoria, Australia  
29

30  
31 Moragh Mackay  
32 Latrobe Valley Authority,  
33 131 Princes Drive, Morwell, Victoria, Australia  
34

35  
36 Philip. J Wallis (dec'd)  
37 Formerly Victorian Catchment Management Council, Melbourne, Australia  
38

39  
40 Luisa Perez-Mujica, Institute for Land, Water and Society, Charles Sturt University,  
41 Australia  
42

43  
44 \*Corresponding author  
45

46  
47 **Notes**  
48 (See endnotes)  
49

50  
51  
52 **Disclosure Statement**  
53

54  
55 No potential conflict of interest was reported by the authors  
56  
57

58  
59  
60 **Funding**

1  
2  
3  
4  
5 We thank the Institute for Land, Water and Society, Charles Sturt University, for funding  
6  
7 workshop 1 and the Victorian Landcare Council for funding workshop 2, enabling the inquiry  
8  
9 to start, and the Helen Macpherson Smith Trust for taking a chance and funding workshops 3,  
10  
11 4 and 5, enabling the inquiry to thrive. The late Phil Wallis received support initially from  
12  
13 Monash Sustainability Institute, Monash University, Melbourne and then the Victorian  
14  
15 Catchment Management Council, Melbourne, Australia. There was substantial *pro bono*  
16  
17 contribution from the research consortium members, and from Natalie Foster from the Open  
18  
19 University, who redrew the figures.  
20  
21  
22  
23  
24  
25

### 26 **Notes on Contributors**

27  
28  
29  
30 *Moragh Mackay*, PhD is a practitioner-researcher in the field of collaborative governance.

31  
32  
33 Moragh's work continues to focus on the practice of collaborative governing through  
34  
35 application of systemic co-inquiring and mindfully employing practices that support  
36  
37 participants to develop systems capability beyond the direct engagement in workshops and  
38  
39 meetings. The NRM systemic co-inquiry discussed in this paper and the methodological  
40  
41 application of the systemic co-inquiry process emerged from Moragh's PhD research.  
42  
43

44  
45 Moragh currently works in a government authority specifically designed to facilitate the  
46  
47 transition of a region from dependence on the fossil fuel industry as coal fired power stations  
48  
49 have and continue to shut down; where systems thinking and collaborative governing are  
50  
51 everyday practice.  
52  
53

54  
55  
56 *Ross Colliver*, BSW, PhD, is a consultant, facilitator and social researcher in natural resource  
57  
58 management. He has investigated the marginalisation of community-based NRM, and how  
59  
60

1  
2  
3 movements such as Landcare can become more influential within NRM governance  
4  
5 arrangements. His recent work supports innovation in NRM governance between  
6  
7 organizations and across scales.  
8  
9

10  
11  
12 *Catherine Allan*, BAgSci, MNatRes, PhD, is Associate Professor of Environmental  
13  
14 Sociology at Charles Sturt University, Australia. Building on her experience as a State  
15  
16 agency based NRM extension agent, her academic research has centred on adaptive  
17  
18 management and participatory practice. She has authored over 50 peer reviewed publications,  
19  
20 20 commissioned research reports, and one book for NRM practitioners.  
21  
22  
23

24  
25  
26 *Ray Ison*, BScAgr, PhD, is Professor of Systems, The Open University (OU) UK. From 2008  
27  
28 to 2015 he also held a joint appointment as Professor, Systems for Sustainability at the  
29  
30 Monash Sustainability Institute, Monash University Australia where he, with Phil Wallis,  
31  
32 created the Systemic Governance Research Program. He is an internationally recognised  
33  
34 researcher in the field of water and NRM governance and a pioneer of research on social  
35  
36 learning and exploring cyber-systemic possibilities for moving to systemic governing in the  
37  
38 Anthropocene. At the OU is co-responsible for managing a post-graduate program in Systems  
39  
40 Thinking in Practice (STiP). He successfully coordinated (2000-4) a major interdisciplinary  
41  
42 5th Framework program (30 researchers, 6 countries) researching social learning for  
43  
44 sustainable river catchment management; co-managed the EPSRC-funded Systems Practice  
45  
46 for Managing Complexity Network and was a major contributor to the international  
47  
48 CADWAGO Project. He is the (co) author or (co) editor of 6 books, 40 book chapters, 150+  
49  
50 refereed papers, 70+ other publications, 7 journal special editions and has been an invited  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65  
66  
67  
68  
69  
70  
71  
72  
73  
74  
75  
76  
77  
78  
79  
80  
81  
82  
83  
84  
85  
86  
87  
88  
89  
90  
91  
92  
93  
94  
95  
96  
97  
98  
99  
100  
101  
102  
103  
104  
105  
106  
107  
108  
109  
110  
111  
112  
113  
114  
115  
116  
117  
118  
119  
120  
121  
122  
123  
124  
125  
126  
127  
128  
129  
130  
131  
132  
133  
134  
135  
136  
137  
138  
139  
140  
141  
142  
143  
144  
145  
146  
147  
148  
149  
150  
151  
152  
153  
154  
155  
156  
157  
158  
159  
160  
161  
162  
163  
164  
165  
166  
167  
168  
169  
170  
171  
172  
173  
174  
175  
176  
177  
178  
179  
180  
181  
182  
183  
184  
185  
186  
187  
188  
189  
190  
191  
192  
193  
194  
195  
196  
197  
198  
199  
200  
201  
202  
203  
204  
205  
206  
207  
208  
209  
210  
211  
212  
213  
214  
215  
216  
217  
218  
219  
220  
221  
222  
223  
224  
225  
226  
227  
228  
229  
230  
231  
232  
233  
234  
235  
236  
237  
238  
239  
240  
241  
242  
243  
244  
245  
246  
247  
248  
249  
250  
251  
252  
253  
254  
255  
256  
257  
258  
259  
260  
261  
262  
263  
264  
265  
266  
267  
268  
269  
270  
271  
272  
273  
274  
275  
276  
277  
278  
279  
280  
281  
282  
283  
284  
285  
286  
287  
288  
289  
290  
291  
292  
293  
294  
295  
296  
297  
298  
299  
300  
301  
302  
303  
304  
305  
306  
307  
308  
309  
310  
311  
312  
313  
314  
315  
316  
317  
318  
319  
320  
321  
322  
323  
324  
325  
326  
327  
328  
329  
330  
331  
332  
333  
334  
335  
336  
337  
338  
339  
340  
341  
342  
343  
344  
345  
346  
347  
348  
349  
350  
351  
352  
353  
354  
355  
356  
357  
358  
359  
360  
361  
362  
363  
364  
365  
366  
367  
368  
369  
370  
371  
372  
373  
374  
375  
376  
377  
378  
379  
380  
381  
382  
383  
384  
385  
386  
387  
388  
389  
390  
391  
392  
393  
394  
395  
396  
397  
398  
399  
400  
401  
402  
403  
404  
405  
406  
407  
408  
409  
410  
411  
412  
413  
414  
415  
416  
417  
418  
419  
420  
421  
422  
423  
424  
425  
426  
427  
428  
429  
430  
431  
432  
433  
434  
435  
436  
437  
438  
439  
440  
441  
442  
443  
444  
445  
446  
447  
448  
449  
450  
451  
452  
453  
454  
455  
456  
457  
458  
459  
460  
461  
462  
463  
464  
465  
466  
467  
468  
469  
470  
471  
472  
473  
474  
475  
476  
477  
478  
479  
480  
481  
482  
483  
484  
485  
486  
487  
488  
489  
490  
491  
492  
493  
494  
495  
496  
497  
498  
499  
500  
501  
502  
503  
504  
505  
506  
507  
508  
509  
510  
511  
512  
513  
514  
515  
516  
517  
518  
519  
520  
521  
522  
523  
524  
525  
526  
527  
528  
529  
530  
531  
532  
533  
534  
535  
536  
537  
538  
539  
540  
541  
542  
543  
544  
545  
546  
547  
548  
549  
550  
551  
552  
553  
554  
555  
556  
557  
558  
559  
560  
561  
562  
563  
564  
565  
566  
567  
568  
569  
570  
571  
572  
573  
574  
575  
576  
577  
578  
579  
580  
581  
582  
583  
584  
585  
586  
587  
588  
589  
590  
591  
592  
593  
594  
595  
596  
597  
598  
599  
600  
601  
602  
603  
604  
605  
606  
607  
608  
609  
610  
611  
612  
613  
614  
615  
616  
617  
618  
619  
620  
621  
622  
623  
624  
625  
626  
627  
628  
629  
630  
631  
632  
633  
634  
635  
636  
637  
638  
639  
640  
641  
642  
643  
644  
645  
646  
647  
648  
649  
650  
651  
652  
653  
654  
655  
656  
657  
658  
659  
660  
661  
662  
663  
664  
665  
666  
667  
668  
669  
670  
671  
672  
673  
674  
675  
676  
677  
678  
679  
680  
681  
682  
683  
684  
685  
686  
687  
688  
689  
690  
691  
692  
693  
694  
695  
696  
697  
698  
699  
700  
701  
702  
703  
704  
705  
706  
707  
708  
709  
710  
711  
712  
713  
714  
715  
716  
717  
718  
719  
720  
721  
722  
723  
724  
725  
726  
727  
728  
729  
730  
731  
732  
733  
734  
735  
736  
737  
738  
739  
740  
741  
742  
743  
744  
745  
746  
747  
748  
749  
750  
751  
752  
753  
754  
755  
756  
757  
758  
759  
760  
761  
762  
763  
764  
765  
766  
767  
768  
769  
770  
771  
772  
773  
774  
775  
776  
777  
778  
779  
780  
781  
782  
783  
784  
785  
786  
787  
788  
789  
790  
791  
792  
793  
794  
795  
796  
797  
798  
799  
800  
801  
802  
803  
804  
805  
806  
807  
808  
809  
810  
811  
812  
813  
814  
815  
816  
817  
818  
819  
820  
821  
822  
823  
824  
825  
826  
827  
828  
829  
830  
831  
832  
833  
834  
835  
836  
837  
838  
839  
840  
841  
842  
843  
844  
845  
846  
847  
848  
849  
850  
851  
852  
853  
854  
855  
856  
857  
858  
859  
860  
861  
862  
863  
864  
865  
866  
867  
868  
869  
870  
871  
872  
873  
874  
875  
876  
877  
878  
879  
880  
881  
882  
883  
884  
885  
886  
887  
888  
889  
890  
891  
892  
893  
894  
895  
896  
897  
898  
899  
900  
901  
902  
903  
904  
905  
906  
907  
908  
909  
910  
911  
912  
913  
914  
915  
916  
917  
918  
919  
920  
921  
922  
923  
924  
925  
926  
927  
928  
929  
930  
931  
932  
933  
934  
935  
936  
937  
938  
939  
940  
941  
942  
943  
944  
945  
946  
947  
948  
949  
950  
951  
952  
953  
954  
955  
956  
957  
958  
959  
960  
961  
962  
963  
964  
965  
966  
967  
968  
969  
970  
971  
972  
973  
974  
975  
976  
977  
978  
979  
980  
981  
982  
983  
984  
985  
986  
987  
988  
989  
990  
991  
992  
993  
994  
995  
996  
997  
998  
999  
1000

1  
2  
3 *Laura Mumaw*, MScFish, PhD is a Vice Chancellor's postdoctoral research fellow in RMIT's  
4  
5 Centre for Urban Research, researching governance of urban biodiversity. She has an  
6  
7 international career as a Board member and executive for nature conservation and natural  
8  
9 resource management organizations active in community engagement.  
10  
11  
12

13  
14 *Luisa Perez-Mujica*, PhD is a systemic scientist with an interest in complex social-ecological  
15  
16 systems, and has published four papers in this area. She has international experience in  
17  
18 approaching social-ecological problems, including Mexico and Australia. Currently, she  
19  
20 designs and implements state wide education and behaviour change campaigns for an  
21  
22 environmental regulator in Australia.  
23  
24  
25

26  
27  
28 *Phil Wallis* (deceased) Formerly Victorian Catchment Management Council, Melbourne,  
29  
30 Australia  
31  
32

33  
34  
35 Orcid  
36

37 *Moragh Mackay* <https://orcid.org/0000-0002-2566-0879>  
38  
39

40 *Ross Colliver* <https://orcid.org/0000-0003-1858-7893>  
41

42 *Catherine Allan* <https://orcid.org/0000-0003-2098-4759>  
43

44 *Ray Ison* <https://orcid.org/0000-0001-9191-119X>  
45

46 *Laura Mumaw* <https://orcid.org/0000-0001-6164-8482>  
47

48 *Luisa Perez-Mujica* <https://orcid.org/0000-0003-3280-9077>  
49

50 *Phil Wallis (deceased)* <https://scholar.google.com.au/citations?user=aKG7v9sAAAAJ&hl=en>  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60