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# Supporting Water Governance and Climate Change Adaptation Through Systemic Praxis

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Understanding and working with multiple perspectives on issues of change is an essential part of managing “common pool” water resources. In uncertain and complex situations arising from changes in human settlements and climate, both lives and livelihoods can be at stake. One individual’s or group’s choices can adversely affect others and traditional processes of participation and legislation are often inadequate. Discourse on environmental law recognises that non-compliance with legislation is associated with weak national governance structures. A systemic approach to managing change is required to appreciate interconnections among issues at various levels and to mediate different stakeholdings. Yet there are no blueprints for effecting systemic transformations of complex situations. This paper explores how the implementation of climate change adaptation can be supported when grounded in situations, such as water governance. It draws on the authors’ experiences of systemic praxis in the water sector.

Keywords: water governance, systemic praxis, participation, legislation, social learning

## Introduction

A story heard by many familiar with the trans-disciplinary intellectual fields of systems and cybernetics, what Ison (2010) calls cyber-systemics, is the systemic failure in public policy that unfolded in the USA following the first successful moon landing. President Kennedy, on the back of this seemingly great and successful achievement, urged policy makers to turn their attention to the problems of inner city decay and the desire for urban renewal as a ‘fix’ for the problem. We know now that they failed – the thinking that achieved a successful moon landing was not the type of thinking (and practice) needed to address the complex and uncertain issues of inner city decay. It could be said that in the inner cities the problem was to know what the problem was but at a more profound level the framing of situations characterised by inner city decay as problems was itself unhelpful. As Thompson and Warburton (1985) found in their work on people-land interaction in the Himalayas, “The problem was that there was not a problem but a multiplicity of contending and contradictory problem definitions, each of which takes its shape from the particular social and cultural context that it helps to sustain” (p. 203). Within these situations all too frequently one person’s problem is another’s opportunity. This recognition of multiple perspectives on issues of change has led to many who have previously focused on problems in the context of sustainability

to take a step back to instead speak of 'issues' and how, by whom, and what is at issue comes to be constructed, agreed upon (through learning and negotiation) and acted upon (Open University, 2006).

The systemic failures of early attempts to address inner city decay did lead to another type of flourishing – the formulation of neologisms, new terms, to describe what policy makers and researchers experienced (Ison, 2010). Thus Rittel and Webber (1973) formulated the terms wicked and tame problems, Ackoff (1974) coined the terms mess and difficulty, Schön (1995) referred to the swamp of real life issues and the high ground of technical rationality. Around the same time those working for the global think tank, the Club of Rome, chose the term *problematique* to refer to the complex of interacting issues perceived to be confronting the world (The Club of Rome, 1970). Today the term *anthropocene* refers to a similar complex of issues but has at its core the recognition that humans themselves are, through their actions, effecting the world's future trajectory. Unfortunately in the 40 or so years since some of these concepts were invented practice to address the implications these framings carry has not greatly improved; there is still far too much public policy failure (APSC, 2007). Academic practice itself has contributed to this failure by the pervasive tendency to reduce, through processes of reification (making concepts into things), potentially useful framings of situations. This powerful and unhelpful epistemological shift from *concept as concept* to *concept as thing* (something real) can be understood by the following two linguistic framings: (i) we need to define rigorously what a wicked problem is and know one when we see it (concept as reification) and (ii) what can we gain in terms of improvement in this situation if we choose to frame it as a 'wicked problem'? (concept as epistemological device). As such linguistic framings are also at the core of how we do or do not communicate and learn, we argue that it is important to both notice and understand the implications of how concepts operate in language.

The emergence of the Anthropocene as an organising concept and metaphor has been particularly influenced by the evidence of human-induced climate change and a complex of other issues of which water or river governance is one of the most important (Crutzen & Stoermer, 2000; Rockström & Karlberg, 2010; Schmidt, 2013; Syvitski, 2012). In recent history, rivers have traditionally been framed as hydrological or biophysical systems and the concern primarily of hydrologists, engineers, physical geographers and the like. With the emergence of the discipline of ecology they became framed as, or contributing to, important ecosystems. Thus a form of ecological rationality began to displace or merge with an earlier technical rationality (Steyaert & Ollivier, 2007). These contesting rationalities are prominent in important water policies of today such as the European Water Framework Directive, the Murray Darling Plan, the South African Water Act, etc. This shift has constrained water governance effectiveness as evidenced by the critique of stationarity (Milly et al., 2008) and of contemporary water governance generally (Ingram, 2008).

In this paper we draw on lessons from research conducted for over a decade, which concerns how particular forms of systems thinking and practice (systemic praxis) have been used to transform understandings of water governance. This includes the EU-funded SLIM project on social learning for the management and sustainable use of water at catchment scale (see Blackmore, Ison and Jiggins, 2007) which began by making a radical framing choice – to see sustainability of water catchments as a product of social process and not a feature of a biophysical entity. We draw on design features of a newly funded project (CADWAGO) to outline shifts in our own understandings and practices that take us beyond a naive concern with participation, and lead us to ask how concepts, such as 'the commons,' are deployed. We will argue that addressing these concerns can open up new possibilities for systemic governing in commons-like situations.

## Outgrowing and Re-Framing Traditional Processes of Participation and Legislation

A focus on social process in contexts of climate change and water governance draws attention to the ways in which human activity and interaction can and cannot make a difference. Two aspects of social process that have been much associated with activity and interaction for sustainability are *participation* and *legislation*.

Participation has in the past couple of decades become something of a panacea in the contexts of water managing and climate change adaptation. Woodhill (2002) argues that “the idea of local level community action with an emphasis on stakeholder participation and empowerment ...has become a corner stone of natural resource management and development programmes the world over” (p.318 ). Collins and Ison (2009) note that participation has become a recurring theme in climate change debates on adaptation. They are critical of framing participation in terms of power, as perpetuated by the use of the metaphor of Arnstein’s (1969) ladder of citizen engagement arguing that “...Arnstein’s enduring framing of participation, as a manifestation of power, can constrain policies and practices of adaptation...the foundational epistemology for Arnstein’s typology is insufficient to enable progress toward concerted action for adaptation among multiple stakeholders” (Collins & Ison, 2009 p. 369). Woodhill (2002) and Collins and Ison (2009 ) argue instead for particular kinds of participation that lead to social learning about the nature of the issue itself and how it might be progressed. Within this framing participation, as long as meaningful and well managed, is necessary but not sufficient to transform complex, multi-stakeholder situations.

There are many examples to be found of multi-stakeholder, multi-level, dialogue processes that have led to concerted action for more integrated management and sustainable use of water (e.g., EUWI, 2011; Mostert, Craps & Pahl-Wostl 2008; Jiggins van Slobbe & Röling, 2007). This interaction does not happen automatically as a result of participation, but needs active and purposeful facilitation for social learning to take place. As detailed by Steyaert and Jiggins (2007) there are other factors which might enhance or constrain social learning in any given context – these include the history of the situation (which includes historical framing choices; initial starting conditions and potential pathway dependencies), institutions – including policies, the extent and nature of stakeholding in an issue, and whose knowledge or ways of knowing hold sway. Social learning from the SLIM perspective typically involves individuals and multi-stakeholder groups becoming more aware of the way in which they use water and for what purposes, and then changing their practices (Ison, Röling & Watson, 2007).

Articulating multiple perspectives or participating in a dialogue process may be a part of, but does not necessarily lead to, systemic praxis. There has been increasing recognition that in complex and messy situations such as management of scarce natural resources, stakeholders need to engage in joint-processes of learning of the sort that generates new and emergent understandings and harmonise their actions, drawing on their different ways of knowing. This kind of social learning requires interaction both across and within levels of a hierarchy (Blackmore, 2007).

Participation has also to some extent become reified, with legislation to support it such as the 1998 Aarhus convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters coming into force in Europe through, for instance, the Water Framework Directive (CEC, 2000) and the public participation directive (CEC, 2003). Many have also focused their attention on developing tools and techniques for participating in decision making (Open University, 2006; IEMA, 2002). Questions of purpose of participation do arise in these discourses and participatory techniques have been used purposefully by many communities (Woodhill, 2002; Planning for Real). But there are many examples where stakeholders’ expectations of participating in decision making have been raised and not materialised because of the way participation has been framed regarding who has been

involved in which aspects of decision making (e.g. concerning the general public in the UK's currently ongoing contentious infrastructural planning processes for high speed rail and concerning the public and NGOs in building dams such as those on the Nu river in China [New Economics Foundation, 2011; Jiangto, 2012]).

Reification of participation extends beyond conceptual issues. Wenger (2010) sees them as a duality, a dual process of meaning making related to engagement in social contexts:

On the one hand, we engage directly in activities, conversations, reflections, and other forms of personal participation in social life. On the other hand we produce physical and conceptual artefacts – words, tools, concepts, methods, stories, documents, links to resources, and other forms of reification that reflect our shared experience and around which we organise our participation. (p. 180)

In order to understand how the legal reification of participation has proven challenging for those involved in meaning making in relation to issues of water governance and climate change adaptation, it is necessary to step back and consider some processes and products of legislation more broadly.

McEldowney and McEldowney (2010) argue that the twenty first century is a new historical period in environmental law dominated by the market economy and globalization. They claim that in the early twenty first century “increases in oil prices and gradual acceptance of climate change has forced the environment further up the legal, economic, social and political agenda” (p. 353) and that science’s role in understanding global change and humankind’s environmental impacts has meant collaboration between scientific and non-scientific disciplines to shape the environmental agenda. But others tell different stories, perhaps because they are focusing on different events, regions, and times. Lee (2005) argues that environmental law faces some serious challenges associated with the complex, evolving, highly political nature of environmental problems together with significant legitimacy questions being asked of the EU, following its expansion. She links legal responses to these challenges to decision making, as the European Commission is extending its range of contributors to decision making (i.e., the ‘market’, the ‘people’, the experts, industry itself, environmental interest groups). Lee (2005) points out a need for responsible and accountable public decision makers if final decisions are to be in the public interest.

Kahn and Kotchen (2010) are among those who have found that effective environmental policy in general and climate-change policy in particular is more likely during economic booms than recession. A case in point is that large-scale transition to renewable and non-carbon sources of energy will require huge new investments, unlikely to take place during times of economic downturn. Beyerlin and Maruhn (2011), in their book on international environmental law, consider the success and failure of different states’ endeavours to enhance international environmental and development co-operation. They highlight how when faced with economic challenges, national self-interest dominates actions more often than common concerns at an international level. They call for a holistic rather than a sectoral approach towards the further development of international environmental law to overcome fragmentation in the face of many different treaties.

There are some very large time lags between international agreements being made, coming into force and reaching domestic law and issues of poor compliance and non-compliance that are partly associated with lack of finance and inadequate administration and human resources. It is generally recognized that ensuring compliance is not just about trying to control what happens but also that it requires assistance as there are often multiple causes for non-compliance associated with weak administrative, economic or technical national governance structures (Beyerlin & Maruhn, 2011).

Beyerlin and Maruhn (2011) also comment:

The number of multilateral environmental agreements (MEAs) concluded since the 1970s is impressive. The question must be raised, however, whether all these MEAs have had any effect. International relations scholars answer this question in terms of the behavioural or environmental changes which can be attributed to specific MEAs. In contrast international lawyers and legal scholars will examine the effectiveness of MEAs in terms of the extent to which parties comply with their commitments. (p.317)

It is therefore perhaps not very surprising that promises of, and even legislation for, participation in the contexts of water and climate change have not delivered what has been hoped for by some of the stakeholders in these situations. Traditional processes of participation and legislation have undoubtedly been found lacking in terms of addressing issues of sustainability and climate change. But whether or not they are found useful depends very much on how they are used. In the next section we use examples from our research to show how some of the discourses around participation that we are familiar with have moved on and how we expect them to keep moving on.

## **Learning From a Decade of Inquiry: An Evolving Discourse on Social Learning for Water Governance and Climate Change**

The SLIM project began as the Water Framework Directive (WFD) passed through the European Parliament (Kaïka, 2003; CEC, 2003). It arose partly because the EU, in its research commissioning role, wanted to know how the WFD could be implemented not only through traditional legal and economic means but also through communicative and participatory approaches (e.g., Ison et al., 2007; Ollivier, 2004). SLIM was not directly involved with the WFD but the project took place at a time when we were conscious that the legislation would fundamentally change the historical basis of managing water in Europe (Kaïka & Page, 2003). The project acknowledged that a systemic approach to managing change is required to appreciate interconnections among issues at various levels and to mediate different stakeholdings. In recognition that there are no blueprints for effecting systemic transformations of complex situations, it focused on social learning. Different kinds of stakeholder participation were considered, but as sub-questions to consideration of new forms of governance (e.g., Ison et al., 2007; Steyaert & Jiggins, 2007). The starting conditions and details of the SLIM project are documented elsewhere (Ison et al., 2007; Blackmore et al., 2007). Here we are more concerned with what has happened since.

Research within the SLIM lineage has been pursued in the Netherlands – under the rubric of ‘innovation systems’ or ‘systemic innovation’ – (Jiggins et al., 2013), from Sweden (Powell, Osbeck, Sinh & Vu, 2011), and in Australia – under the rubric of the Systemic Governance Research Program – (Monash University Sustainability Institute). Within the UK post-SLIM research has continued to be concerned with water catchment governance (e.g., Collins & Ison, 2010), which has run in parallel with new educational developments in systems thinking in practice (STiP - see Blackmore & Ison, 2012). Cross-case comparisons have also been made (e.g., Collins, Colvin & Ison, 2009). Enacting social learning is for us a form of systemic praxis (theory informed practical action).

Colvin et al. (under review) consider three long term case studies that originated in the SLIM project, in England and Wales, in South Africa, and in Italy. They identify more than three pathways of praxis development that have emerged from the original SLIM experience. Whilst SLIM originally concerned water resources managing in the context of the European WFD, only one of the pathways of praxis development maintains this focus. All increasingly focus on governance; another pathway extends the original focus of inquiry to new cultural and political contexts beyond WFD and a third broadens the focus beyond water

resources to explore social learning in the context of climate change adaptation. The full detail of these pathways cannot be given here without compromising Colvin et al.'s paper which is awaiting publication, but we can consider here how and why these foci continued and have evolved.

## ***Climate Change Adaptation***

Since the SLIM project the discourse concerning climate change adaptation has progressed, both through the work of the Intergovernmental Panel on Climate Change (IPCC, 2007, 2008), but also through reactions of many individuals and groups of people in many different parts of the world in response to extreme weather events that have been linked to climate change, in particular to changing temperatures, droughts, and flooding. Collins and Ison (2009) suggest that “perhaps in recognition of the difficulties experienced by many researchers in relation to participation across various domains of environmental management ... there has been a discernible shift in academic and practitioner literatures towards recognizing the social embeddedness of climate change adaptation” (p.360). They cite Adger et al. (2009) in suggesting a view of adaptation that increasingly includes thinking about the organisation and values of societies, the knowledge they construct and the relationships among individuals, institutions and the state. The new CADWAGO project mentioned at the start of this paper brings together focuses of climate change adaptation and water governance. The authors of this paper are contributing a work package (WP) to CADWAGO that is linked to the SLIM lineage. This WP will critically assess how history, facilitation, stakeholding and reflexive praxis contribute to water governance performances under conditions of climate change. In this way it will aim to appreciate key elements of praxis involved in transforming a water managing situation through social learning.

## ***Social Learning, Systemic Praxis, and Governance***

As noted by Ison, Blackmore, Iaquinto (2013) there has been a burgeoning of interest in social learning and a certain level of contestation as to how it might be understood and enacted. Few authors however make the distinction between social learning as social process (as in say the dynamics between the players in a string quartet) and a governance mechanism which can be invested in and understood as an entity (as in a particular named and sponsored quartet). Clearly both are needed; to this end we have come to understand that when the social processes exemplify systemic praxis which is embedded in a conducive governance framework then the possibility for systemic governance arises.

To further explain this idea, we draw on a cybernetic metaphor of a person at the helm of a boat charting a course in response to feedback from wind and currents (Ison, 2012). Examples from our work, for example in South Africa (Collins et al., 2009; Colvin et al., (under review)) show how the course of adaptive managing has been charted in relation to a purpose that is negotiated and renegotiated within an unfolding context i.e., in response to uncertainty (see Freitag, Biggs & Breen, in press; Cook & Yanow, 1993; Ison, 2010). The South African case is one where there has been leadership, seventeen years of adaptive learning, attention to process and relationships, changes in boundaries of systems of interest and a changed role for science. In this case, the ‘response to feedback from winds and currents’ is feedback to the daily activities of managing within higher level practices associated with planning, regulating, and governing. Systemic governance, or governing, is therefore the context in which adaptive planning, designing, regulating, and then managing sits. Governance that is ‘adaptive’ incorporates learning and change in response to uncertainty, but despite the growing need is, in the main, poorly done (e.g., Allan & Curtis, 2005). This is partly because, drawing on the South African example, it may not be possible to chart a similar course in another context where the governance framework is less conducive, i.e., there are no ‘blue-prints’ that can be ‘rolled-out’.

The discipline of cybernetics, which has had a major influence on ideas about systems and about learning, involves the study of communication and control in both living organisms and machines. Understanding how communication occurs among humans and how it does or does not lead to action is central to developing an understanding of social learning. The cyber-systemic lineage of framing governance adopted in the Systemic Governance Research Program is not new (see Blunden & Dando, 1994) but is neglected in recent governance discourse. Cyber-systemic framing of governing encompasses the totality of mechanisms and instruments available for influencing social change in certain directions including a practitioners own history (i.e., traditions of understanding and identity). Whether purposeful or not, the collective of activities of governance produces effects comprising varying degrees of coordination/ lack of coordination, control/ loss of control and certainty/ uncertainty. The point is to arrive where a loss of control does not lead to fear but to social learning and innovation (Ison, Grant & Bawden, 2013).

## ***Communities of Practice and Landscapes of Social Learning Systems Praxis***

Although this paper makes many conceptual distinctions, an enduring feature of the SLIM lineage in terms of supporting water governance under conditions of climate change is not just a focus on theory but also on practice. In systemic praxis, systemic theories and practices inform each other, as discussed above. However, our praxis can also be described in other ways which are relevant when considering the post-SLIM evolution of discourse on social learning for water governance and climate change. Wenger's ideas on communities of practice (1998, 2010) and Bawden's ideas on critical social learning systems (2000, 2010) continue to be highly relevant to us and continue to evolve in use in the wider contexts that Colvin et al. (under review) refer to in the three post-SLIM pathways of praxis. Wenger's (1998, 2010) use of the concept of a 'landscape of practices' as an epistemological device in relation to the identity of individuals has also been found relevant as in our experience it can also help to understand more collective identities, of projects and groups. Blackmore (2010) mapped a 'landscape of social learning systems praxis' with fourteen themes, drawing on Wenger's (1998,2010) idea of a landscape of practices and his and several other authors' acknowledgement of the importance of praxis-based approaches. These themes were: institutions, organisations and institutionalising; ethics, values and morality; communication; facilitation; managing interpersonal relationships and building trust; communities and networks; levels and scale; boundaries and barriers; conceptual frameworks and tools; knowledge and knowing; transformations; time lag and dynamics of praxis; design for learning and stability, sustainability and overall purpose. Many of these themes will feature in CADWAGO, and while this project has not been framed exclusively as social learning systems, returning to our point at the start of this paper about using concepts as epistemological devices, we recognise the challenge of using a multiplicity of concepts in this way. It could appear that in our research we have moved on from focusing on participation and legislation to social learning to governance in relation to water managing and climate change adaptation but instead we argue that we need all of these focuses at different times for different purposes.

## ***Emerging Research and Praxis Concerns for Water Governance – CADWAGO***

The systems-theoretical stance adopted by our group within CADWAGO is based on an appreciation that systems are a social construct which involve boundary judgments by concerned stakeholders – i.e. what is in or outside a system of interest? and how are the internal dynamics between elements understood? When understood in this way a system is a way of framing an inquiry into complex or 'wicked' situations that leads to new, systemic ways of knowing about and changing a situation. When done with others, this process triggers changes in understanding and practice of those involved and can lead to concerted



action or social learning (Blackmore et al., 2007). Drawing on this form of systems theory contributes to epistemic resilience (Powell et al., 2011).

Our WP responsibilities employ the cyber-systemic lineage framing of governance outlined above. In the practical context of water governance a helmsperson might usually be a group existing in some institutionalized or self-organizing form. Equally it could be a government department. We hold no normative view of who the helmsperson might be – what is critical is the relationship between those who fulfil this role, how purpose is generated and understood, and how governance is enacted in relation to a changing and dynamic context. Thus, governance that is ‘systemic’ and ‘adaptive’ incorporates learning and change in response to unfolding circumstances which requires understanding and managing feedback processes. Built into CADWAGO is a distinction between generating different types of data that contribute to epistemic resilience based on incorporating different ways of knowing into praxis.

## Conclusions

Effective support for water governance and climate change adaptation will take many forms depending on what and who are to find support and for what purpose. In this paper we have drawn on our experience of over a decade of research to illustrate the need for systemic praxis in this context, which uses a cyber-systemic tradition of understanding. Participation has been one of many concepts that has been found meaningful in this tradition but has to some extent become reified in unhelpful ways, partly through some processes of legislation. Nonetheless, it is still very much an essential part of our landscape of praxis. However, we have come to recognise that naïve concerns with participation are insufficient unless situated within a conducive, systemic governance context that has the capacity to conserve, through institutionalisation, any gains made from participation. Systemic praxis, which is not a capability that is widely encouraged, is for us another essential ingredient. Any gains from participation in terms of addressing complex and uncertain issues will necessarily be emergent and thus the design and conduct of participation is not amenable to command and control practices of managing and governing.

## References

- Ackoff, R.L. (1974). *Redesigning the future*. New York, NY: Wiley.
- Adger, W.N., Dessai, S., Goulden, M., Hulme, M., Lorenzoni, I., Nelson, D.R., & Wreford, A. (2009). Are there social limits to adaptation to climate change? *Climatic Change*, 93, 335–354.
- Allan, C., & Curtis, A. (2005). Nipped in the bud: Why regional scale adaptive & management is not blooming. *Environmental Management*, 36, 414-425.
- APSC (Australian Public Service Commission). (2007). *Tackling wicked problems: A public policy perspective*. Canberra: APSC.
- Arnstein, S. (1969). A ladder of citizen participation. *Journal of the American Institute & of Planners*, 35, 216–224.
- Bawden, R.J. (2000) Valuing the Epistemic in the Search for Betterment: The Nature & and Role of Critical Learning Systems. *Cybernetics and Human Knowing* 7(4): 5–25).
- Bawden, R. (2010) Messy Issues, Worldviews and Systemic Competencies, in & Blackmore, C. (Ed.) *Social learning systems and Communities of Practice*. Springer: London pp.89-101.
- Beyerlin, U., & Marauhn, T. (2011). *International environmental law*. London: Hart Publishing.
- Blackmore, C. (2007). What kinds of knowledge, knowing and learning are required for addressing resource dilemmas? — A theoretical overview. *Environmental Science and Policy*, 10(6), 512–525.
- Blackmore, C. (2010). *Social learning systems and communities of practice*. London: Springer.

- Blackmore, C.P., Ison, R.L., & Jiggins, J. (2007). Social learning: An alternative & policy instrument for managing in the context of Europe's water [Editorial], & *Environmental Science & Policy*, 10 (6), 493-498.
- Blackmore, C.P., & Ison, R.L. (2012). Designing and developing learning systems for & managing systemic change in a climate change world. In Wals, A. & Corcoran, P.B. (Eds.)(2012) *Learning for sustainability in times of accelerating & change*. pp. 347- 364. . Wageningen, The Netherlands: Wageningen & Academic Publishers, Education and Sustainable Development Series.
- Blunden, M., & Dando, M. (Eds.). (1994). Rethinking public policy making. Questioning assumptions, challenging beliefs. Essays in honor of Sir & Geoffrey Vickers on his centenary. *American Behavioral Scientist*, 38 (1).
- CADWAGO, Climate change adaptation and water governance: reconciling food security, renewable energy and the provision of multiple ecosystem services. <http://www.cadwago.net/> ( Accessed 04/07/2013)
- CEC (Commission of the European Communities). (2000). European Water & Framework Directive 2000/60/EC. Brussels: CEC.
- CEC. (2003). Public Participation Directive 2003/35/EC. Brussels:CEC.
- Collins, K.B., Colvin, J., & Ison, R.L. (2009). Building 'learning catchments' for & integrated catchment managing: Designing learning systems and networks & based on experiences in the UK, South Africa and Australia. *Water Science & Technology*, 59(4), 687-693.
- Collins, K.B., & Ison, R.L. (2009). Jumping off Arnstein's ladder: Social learning as a new policy paradigm for climate change adaptation. *Environmental Policy & Governance*, 19(6), 358-373.
- Collins, K.B., Ison, R.L. (2010). Trusting emergence: Some experiences of & learning about integrated catchment science with the Environment Agency of England and Wales. *Water Resources Management*, 24(4), 669-688.
- Colvin, J., Blackmore, C., Chimbuya, S., Collins, K.B., Dent, M., Goss, J., Seddaiu, & G. (under review). In search of systemic innovation for sustainable development: Learning from a decade of inquiry with the SLIM social learning praxis.
- Cook, S.D., & Yanow, D.J. (1993). Culture and organizational learning. *Journal of Management Inquiry*, 2(4), 373-390.
- Crutzen, P.J., & Stoermer, E.F. (2000). The 'Anthropocene'. *Global Change & Newsletter*, 41: 17–18.
- EUWI (European Water Initiative). (2011). Annual report. Retrieved from <http://www.euwi.net/>
- Freitag, S., Biggs, H., & Breen, C. (in press).The spread and maturation of & strategic adaptive management within and beyond South African National & Parks over two decades. *Ecology & Society*.
- Ingram, H. (2008). Beyond universal remedies for good water governance: A political and contextual approach. Paper presented at the Rosenberg Forum for Water Policy, Zaragoza, Spain, June 25-26; Retrieved from <http://rosenberg.ucanr.org/documents/V%20Ingram.pdf>
- IEMA (Institute of Environmental Management and Assessment) .(2002). 2002 & perspectives: Guidelines on participation in environmental decision making. London: IEMA.
- IPCC (2007). Summary for policymakers. In Solomon, S., Qin, D., Manning, M., & Chen, Z., Marquis, M., Averyt, K.B., Miller, H.L. (Eds.). (2007). *Climate & Change (2007): The Physical Science Basis, Contribution of Working Group I & to the Fourth Assessment Report of the Intergovernmental Panel on Climate & Change* pp. 1-18. Cambridge: Cambridge University Press.
- IPCC (2008). Summary for policymakers. In Pachauri, R.K., & Reisinger, A. (Eds.). (2008). *Climate Change 2007: Synthesis Report, Contribution of Working & Groups I, II and III to the Fourth Assessment Report of the Intergovernmental & Panel on Climate Change*, pp. 1-22. Geneva: IPCC.
- Ison, R.L. (2010). *Systems practice: How to act in a climate change world*. London: Springer.
- Ison, R.L. (2012). A cybersystemic framework for practical action. In Murray, J., & Cawthorne, G., Dey, C., & Andrew, C. (Eds.). *Enough for all forever. A & handbook for learning about sustainability*, pp. 269-284. Champaign, IL: Common Ground Publishing.
- Ison, R.L., Röling, N., & Watson, D. (2007). Challenges to science and society in the sustainable management and use of water: Investigating the role of social & learning. *Environmental Science & Policy*, 10(6), 499 – 511.

- Ison, R.L, Blackmore, C.P., & laquinto, B. (2013a). Towards systemic and adaptive governance: Exploring the revealing and concealing aspects of contemporary social-learning metaphors. *Ecological Economics*, 87, 34–42.
- Ison, R.L., Grant, A., & Bawden, R.B. (2013b). Scenario praxis for systemic and & adaptive governance: A critical framework. *Environment & Planning C: Government & Policy*.
- Jiangto, S. (2102). Decision on contentious dam project for Nu River on hold. *South China Morning Post*. Retrieved from <http://www.scmp.com/>
- Jiggins, J., van Slobbe, E., & Roling, N. (2007). The organisation of social learning in response to perceptions of crisis in the water sector of The Netherlands. *Environmental Science & Policy*, 10(6), 526–536.
- Jiggins, J., Essegby, G., Klerkx, L., van Paassen, A., Pyburn, R. and Tossou & R.(2013). ‘Why, what and how’ Presentation for CTA/CoS-SIS:Expert & consultation on innovation systems: Towards more effective theories of & change. Theme 4: Analysing & Systems & Measuring Performance. Wageningen, The Netherlands: CTA. Retrieved from: <http://knowledge.cta.int/Media/Multimedia/The-COS-SiS-Programme-Why-What-How-CTA-COS-SiS-Expert-Consultation-Feb-2013>
- Kahn, M.E., & Kotchen, M.J. (2010). Environmental concern and the business & cycle: The chilling effect of recession. NBER Working Papers 16241, & National Bureau of Economic Research, Inc.
- Kaïka, M. (2003). The water framework directive: A new directive for a changing & social, political and economic European framework. *European. Planning. Studies*, 11(3), 299–316.
- Kaïka, M., & Page, B. (2003). The EU water framework directive. Part 1. European policy-making and the changing topography of lobbying. *European Environment*, 13(6), 314–327.
- Lee, M. (2005). *EU environmental law: Challenges, change, and decision making*. Oxford and Portland, OR: Hart Publishing.
- McEldowney, J., & McEldowney, S. (2010). *Environmental law*. Harlow: Pearson & Education Limited.
- Milly, P.C., Betancourt, J., Falkenmark, M., Hirsch, R.M., Kundzewicz, Z.W., & Lettenmaier, D.P., & Stouffer, R.J. (2008). Stationarity is dead: Whither water management? *Science*, 319 (5863), 573-574.
- Monash University Sustainability Institute Systemic Governance Research Program (Accessed 04/07/13).
- Mostert, E., Craps, M., & Pahl-Wostl, C. (2008). Social learning: The key to & integrated water resources management? *Water International*, 33:3, 293-304.
- New Economics Foundation (2011). Response to the HS2 consultation: High speed rail, investing in Britain’s future. Retrieved from <http://www.neweconomics.org/>
- Ollivier, G. (2004). An analytical understanding of the water framework directive & questioning its potential to enable sustainable management of water, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) case study monograph 9. Retrieved from & <http://slim.open.ac.uk/>
- Open University (2006). T863 Environmental decision making: A systems approach. Milton Keynes: The Open University.
- Planning for Real - <http://www.planningforreal.org.uk/> (Accessed 04/07/2013)
- Powell, N., Osbeck, M., Sinh, B.T., & Vu, C. (2011). Mangrove restoration and & rehabilitation for climate change adaptation in Vietnam. Washington, DC: World Resources Report.
- Rittel, H.W., & Webber, M.M. (1973). Dilemmas in a general theory of planning. *Policy Science*, 4, 155-169.
- Rockström, J., & Karlberg, L. (2010). The quadruple squeeze: Defining the safe & operating space for freshwater use to achieve a triply green revolution in the Anthropocene. *AMBIO - A Journal of the Human Environment*, 39(3), 257- & 265.
- Schmidt, J.J. (2013). Integrating water management in the anthropocene. *Society & Natural Resources*, 26(1), 105-112.
- Schön, D.A. (1995). The new scholarship requires a new epistemology. *Change*, November/December, 27–34.
- Steyaert, P., & Jiggins, J. (2007). Governance of complex environmental situations & through social learning: A synthesis of SLIM’s lessons for research, policy and practice. *Environmental Science and Policy*, 10, 575-586.

- Steyaert, P., & Ollivier, G. (2007). The European water framework directive: How ecological assumptions frame technical and social change. *Ecology and Society*, 12(1), 25. Retrieved from <http://www.ecologyandsociety.org/>
- Syvitski, J.P. (2012). Anthropocene: An epoch of our making. *International Geosphere-Biosphere Programme Newsletter 'Global Change'*, 78.
- The Club of Rome. (1970). The predicament of mankind - Quest for structured & responses of growing world-wide - Complexities and uncertainties – A & PROPOSAL. Retrieved from <http://sunsite.utk.edu/>
- Thompson, M., & Warburton, M. (1985). Knowing where to hit it: A conceptual & framework for the sustainable development of the Himalaya. *Mountain & Research and Development*, 5(3), 203-220.
- UNECE (United Nations Economic Commission for Europe). (1998). Convention on access to information, public participation in decision-making and access to justice in environmental matters (the Aarhus Convention). Retrieved from & <http://ec.europa.eu/>
- Wenger, E. (1998) *Communities of Practice: Learning, Meaning and Identity*, Cambridge, Cambridge University Press.
- Wenger, E. (2010). Communities of practice and social learning systems: The career & of a concept. In Blackmore, C. (Ed.). (2010). *Social Learning Systems and Communities of Practice*, pp179-198. . London: Springer.
- Woodhill, J. (2002). Sustainability, social learning and the democratic imperative: lessons from the Australian landcare movement. In Leeuwis, C., & Pyburn, R. (Eds.). (2002). *Wheelbarrows full of frogs – Social learning in rural & resource management*, pp. 317–331. Assen: Koninklijke Van Gorcum BV.