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Water Governance and Agricultural Management: Collaboratively Dealing with Complex Policy Problems

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Introduction

It is not difficult to appreciate why ideas of 'integrated' and 'joined-up' planning have become key motifs of emerging approaches to the sustainable management of water and agricultural systems. Decision-makers with responsibility for this rapidly developing arena of cross-sectoral policy quite reasonably seek a future in which system interdependencies will be recognised, priorities for management assigned, and responsibilities for action borne fairly. In England, for instance, the

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government department with responsibility for sustainable rural development recently published its strategy for water (DEFRA 2008), setting out a vision that positions agricultural systems as central to the process of resolving competing issues of water supply and demand, and water quality and quantity by the year 2030. While priorities for action vary greatly according to political and material circumstances, parallel calls can be found elsewhere (Blanco 2008; Conca 2006; Faby et al. 2005; Lemos and Oliveira 2005; Swatuk 2005). Driven in part by the exigencies of an increasingly congested terrain of international agreements (such as the Convention on Biological Diversity) and laws (such as the pan-European Water Framework Directive), what holds this diversity together is the recognition that fragmented policymaking and implementation across the agricultural and water sectors continues to be a systematic and deeply institutionalised feature of natural resource management and, consequently, a major obstacle to the realisation of sustainable livelihoods and development.

Recent calls to address agriculture and water as linked policy and scientific agendas reflect, of course, the changing nature of priorities. For example, current interest in England for devising strategies that can mitigate the risks of diffuse pollution from agriculture to water is partly the consequence of a concerted effort during the 1970s and 1980s to intervene—primarily via regulation of privatised utilities—in problems of domestic, industrial, and urban water management. That is to say, as significant gains in one arena of environmental protection have been made, 'blind spots' of regulation have also been revealed. Thus, the scientific and regulatory focus of action has changed as insight and public concern have evolved. At the same time, new problems with new complexities for the water and the agriculture sectors are emerging. The aforementioned strategy for water in England published by the Department for Environment, Food and Rural Affairs (DEFRA) is governed, in large part, by wider climate change agendas, and the need to build long-term resilience among urban and rural communities through the effective management of land–water interactions. Indeed, agriculture's role in influencing the water cycle is central to discussions of how climate change risks are managed and mitigated (Thorne et al. 2007).

In recent years, bodies of work have duly emerged seeking to explain how the codependencies of land, water, and human well-being can be shaped according to the principles of sustainable development. From 'integrated water management' (e.g. Furey and Lutyens 2008) and 'integrated catchment management' (e.g. Prato and Herath 2007) to 'integrated water resources management' (e.g. Saravanan et al. 2009) and 'integrated environmental management' (e.g. Reagan 2006), this variegated literature is important not only in the way it amplifies the types of natural and social scientific research required to understand these codependencies, but also in signalling, quite clearly, the complex and changing institutional and political conditions of management. In particular, one common line of reasoning in this work is to understand processes of natural resource management as being shaped, to an increasing extent, by the principles and practices of 'governance'. This is a concept designed to point to the broadening and deepening of non-state activity in the policy process. It is closely related to wider normative debates about the need to foster more equitable, responsive, and politically engaged forms of decision-making. In this chapter, we critically inspect this idea and its implications for this special edition's specific concern with 'integrating water and agricultural management' (hitherto 'IWAM').

The text begins by considering the origins of the governance agenda, outlining its key tenets, and explaining how it is potentially taking science and policy into new conceptual and practical territory. We explain the discrepancies that surround this terrain, drawing attention to a body of work critiquing not only its empirical reality, but its underlying normative claims. Nonetheless, we argue that the regulatory thrust of the governance agenda—towards more collaborative and holistic approaches to working—is essentially well founded or at least is a step in the right direction. The chapter then considers how these concerns might best be approached as an adaptive form of environmental management, one based on a commitment to dialogue, deliberation, and negotiation among stakeholder groups with vested, often competing assessments of policy priorities. The corollary to this, we suggest, is a series of interesting questions surrounding the role and nature of research, not least the matter of how to foster effective models of cross-disciplinary working that can create the kind of evidence base required to inform adaptive policy

processes. We consequently argue that land and water governance and research have to be approached differently in the future if the process of integrating multi-sector and multi-scalar natural resource systems of management is to be realised in effective ways.

The Institutional Challenges of IWAM

The institutional basis for developing integrated approaches to water and agricultural management is complex and multifaceted. Interpreted broadly, institutional structures and processes that underpin the formation and implementation of public policy are political, legal, economic, social, and administrative, in character (Mitchell 1990; Saleth and Dinar 2005). We suggest these structures and processes present a dynamic, and often contested, context in which to gauge prospects for IWAM. The situation in England and Wales illustrates this point well. Here, many of the companies providing public water supply and sewerage services are owned and operated by multinational corporations, while the regulation of the industry involves a central government department (DEFRA), a non-departmental agency (Environment Agency), an economic regulator (Office of Water Services), and an independent monitoring body (Drinking Water Inspectorate) (Watson et al. 2009). There are also complex arrangements for environmental protection that place these institutions within wider policy networks encompassing (among others) bodies with statutory responsibility for nature conservation (such as Natural England), designated authorities for protected landscapes (such as the National Park Authority), as well as regional and local government. In all of this, important cross-sectoral linkages between the water and agricultural sectors can be identified at the level of policy design, and indeed a multitude of partnership arrangements for spatial entities such as river basins, catchments, and coastal zones are duly emerging as platforms for more integrated forms of land and water management. As elsewhere in the European Union (EU), an important case in point here would be the development of policy platforms that can respond to the emerging mandates of the Water Framework Directive. Even so, this potential for cross-sectorality belies

a deeper institutional complexity. Debates about integrated approaches to agriculture and water systems are not, of course, conducted in isolation. Priorities for both sectors are implicated in a multi-scalar and contested political economy and bear the wider institutional influence of non-governmental organisations (NGOs), professional associations, consumer groups, and, perhaps most notably in the context of agriculture, trade organisations. This means that the institutional basis of shared programmes of action *within*, as much as *between*, the water and agricultural sectors are by no means assured.

For some, overcoming this complexity is less a matter of how to foster more coordinated institutional responses to water and agricultural management, but more about fundamental changes in the way policy processes now take shape and assert influence. In particular, recent years have witnessed an emerging debate over whether we have entered an era of 'governance' (Higgins and Lawrence 2005; Hooper 2005; Bakker 2006; Warner 2007; Pahl-Wostl et al. 2008; Pahl-Wostl 2009). This is an idea used to point to a change in the relationship between the state and civil society and the way in which responsibilities for the provision of environmental quality and other public goods are thought by some to have shifted since the 1980s (Pierre 2000). Specifically, it is suggested that the historically central role of the state and its bureaucracies in activities of planning, regulation, policy implementation, monitoring, and evaluation has been recast under the ascent of more liberalised economic regimes. As a consequence, it is claimed that regulatory and institutional decision-making increasingly involves actors operating beyond the boundaries of formal government as well as traditional state-based agencies and bureaucracies. Thus, it is argued that new spaces for policymaking have emerged, which are occupied by a diverse range of self-organising actor networks, public–private partnerships, and other multiparty arrangements. In an era of governance, then, distinctions and boundaries that previously defined state–market–civil society relations are thought to have increasingly blurred (Bevir 2009).

For those interested in natural resources and the environment, the claim that we have entered an era of 'governance' brings with it a new set of challenges. As Tropp (2007) argues in the context of water management, governance-based management relies on developing more

'sociocratic' forms of knowledge and capacity development, putting the emphasis on the management of people and processes, organisational diversity, and knowledge sharing. Yet the extent to which such a transformation is possible and the degree to which governments are ready and willing to share power with non-state actors remains unclear; transformation and participation are always the object of political contestation. While in principle government departments and public authorities are now often required to interact on more equal terms with other social 'players' and alongside a host of other powerful non-state entities (Stoker 1998), the role and the influence of non-state actors in decision-making processes remains uneven and highly contested. In purely practical terms, the orchestration of multiple actors and interests and the marshalling of collective action are difficult tasks themselves. Working effectively in an era of governance means challenging entrenched attitudes and practices, overcoming organisational resistance to change, and mobilising individuals to engage with seemingly intractable, cross-sectoral environmental problems. Perhaps more critically, Petersen et al. (2009) argue that, while a governance approach favours the collective resolution of problems, it is often the state that continues to take ultimate responsibility, particularly where blame or liability cannot be established due to uncertainty, poor data, and/or lack of evidence. As a result, there is a risk that, when superficially adopted, a governance approach simply serves to renew and re-emphasise state power (and the influence of the stronger groups of interest) in environmental politics, rather than fundamentally changing the policy formulation or implementation process. Similar arguments have been made elsewhere. Writing in the context of water management and the provision of water services, Bakker (2003) explains that governance-based decision-making can amount to a process of re-regulation in which tacit state control of the allocation and management of resources remains. A related observation has been made by Ioris (2009), who demonstrates how the main policy instruments of water governance are often appropriated by the stronger stakeholder groups and, in circumstances of a weak institutional context, result in the maintenance of long-lasting management problems and associated asymmetrical power relations. As such, collective action to integrate water and agriculture within a governance framework cannot be taken

as a given or neutral procedure. Indeed, for some, governance remains a deeply problematic concept which fails to take adequate account of the politics and power relationships that exist within resource management regimes (Castro 2007; Mollinga 2008).

If there is a tendency to overlook the fact that interventions in water and land systems by different categories of stakeholders (characterised by unequal political opportunities and varied access to resources) tend to generate costs, benefits, and risks in uneven ways (Molle 2007), it is also the case that the challenges of dealing with multiple actors with competing interests and values are now exacerbated by problems of scale and spatial 'fit'. It is notable here that the catchment area or river basin is often represented as the most effective operational scale for managing land–water dynamics (cf. Oliver et al. 2009), but in institutional terms, such prescriptions are often problematic (Moss 2003). Experience in integrated catchment management has shown, for instance, that the effectiveness of catchment-scale policy interventions is frequently limited by factors such as multiple overlapping agency and organisational jurisdictions, fragmented and poorly coordinated administrative structures and processes, differences in power, unclear lines of responsibility and authority, and slow and unresponsive decision-making. It is in this vein that social scientists have argued that catchments are more than just a landscape carved by the flow of water from headwaters to the mouth, but an unstable, 'permeable', and evolving socio-ecological system (Molle 2007).

To the extent that catchment-scale planning continues to be positioned as the site where integrated governance and resource management will be realised, it remains clear that at least some of these systemic failings can only be addressed by reconciling catchment politics with the higher and lower scales of governance that produce them. That is to say, the process of joining up the governance of agriculture and water management depends as much on enhancing the vertical linkages among decision-making nodes at different spatial and institutional scales as it does on fostering closer horizontal links between the two sectors. In this sense, the drivers of change which shape these systems are effectively unbounded and operate outside and inside of the biophysical parameters of catchment systems. This seems certainly the

case when we think of water management in the context of agricultural change. The local practices of farmers are shaped by a wider political economy of agriculture which may not be necessarily in step with the goals of sustainable water management. In Europe, processes of trade liberalisation and Common Agricultural Policy (CAP) reform, for instance, are major drivers of land use change (Potter and Tilzey 2007), yet such factors are rarely, if ever, acknowledged or fully addressed within water policy. Furthermore, the water management community has a tendency to portray agriculture simply as a cause of both water quality and quantity problems while failing to acknowledge its vital role in food production and maintaining rural livelihoods.

To summarise, institutional arrangements for both water and agriculture are complex and multidimensional, encompassing networks of 'loosely coupled' state and non-state actors. For some, these arrangements characterise a transition towards more governance-based approaches to natural resource management, though empirical reality of this transition is by no means settled. As we have shown, the idea of governance is inevitably a highly contested and politicised process through which resources are allocated and benefits and costs are distributed. In such circumstances, IWAM cannot be treated as a purely technical or scientific matter. It requires the development of a process that is capable of making trade-offs among competing objectives and reconciling different values and beliefs regarding the use and management of land and water. This presents considerable challenges for many IWAM-related agendas today, not least in addressing the institutional ramifications of managing water and agricultural systems across spatial scales. From a scientific perspective, the catchment, watershed, or river basin may appear to be the most logical scale for the integration of water management and agriculture (Newson 2008). Nevertheless, many of the market and institutional processes that drive and regulate both water management and agriculture operate at entirely different scales. As such, IWAM requires an approach to governance that is capable of working both inside and outside the frame of catchment management and is able to deal with the dynamic relationships between water and agricultural systems. The question of how these challenges might be addressed within a governance framework for IWAM is examined in the following section.

Towards Alternative Models of Governance

One of the central social science challenges to emerge from these complexities is the identification of approaches to governance which can satisfactorily cope with unbounded system interconnections. This would be relatively easy if it were simply a matter of constraining uncertainty and complexity by cumulatively investing in more sophisticated scientific research. However, such an approach overlooks important philosophical arguments about the limits of knowledge in a complex and rapidly changing world. As the scale of the unit of analysis is expanded from a single farm up to an entire catchment area and beyond, an increasing number of systems, interactions, feedback, and non-linearities are brought in to play. This results in a step change in the nature of the uncertainty that has to be confronted, moving from 'risk' where prediction is possible through to 'ignorance' and even situations of 'indeterminacy', where understandings of system boundaries and interactions are defied because they are in constant flux (Wynne 1992). In the absence of certainty, it is inevitable that issues such as managing the effects of agriculture on nutrient pollution or flood risk or agricultural demand for water tend to be highly controversial. Indeed, recognising the boundaries of what it is possible to know in a limited period of time and reaching consensus when data and evidence are lacking are indicative of the fundamental challenges associated with IWAM. It is clear that governance models with the capacity to cope with these sorts of 'messy' or 'turbulent' conditions must be created (Trist 1980). Conventional models that emphasise rational-comprehensive and technocratic styles of policymaking dominated by government bureaucracies are unlikely to be a good match in these circumstances.

In recent years, more collaborative forms of governance have started to emerge in a variety of different spatial and environmental contexts in response to the perceived deficiencies of technical knowledge and, we contend, have great potential for dealing with the challenges of IWAM (Wondolleck and Yafee 2000; Armitage et al. 2008). Drawing on theoretical arguments concerning communicative rationality, discourse, and policy dialogue (Habermas 1981; Innes and Booher 1999), collaboration is posited as a highly interactive and adaptive process that is capable of

transforming social relations by creating new knowledge networks among interdependent actors and interests. This can include interests with little or no prior experience of each other because they operate in socially and organisationally separate domains at entirely different spatial scales, or those who have been historically engaged in competition or conflict over underlying institutional, commercial, or cultural priorities. In this vein, Dengler (2007) demonstrates how different organisations and groups, while invested with different degrees of power, can work together to achieve agreed policy outcomes, and advocates a regime of governance based on sharing expertise between complementary organisations, so called 'knowledge-based' governance.

Conventional styles of policymaking have certainly involved interactions across institutional and social boundaries, often in the form of cooperative agreements and efforts to coordinate policies and practices. However, these are relatively short-term arrangements designed to allow each party to pursue separate goals and objectives under stable policy conditions. In these circumstances, government agencies often remain in control of the decision-making process with limited accountability. Collaborative governance, in contrast, involves a more sophisticated, emergent, and enduring form of interaction in which two or more groups pool understanding and/or tangible resources to address a set of problems which neither could solve alone (after Gray 1985). It is a process in which organisations and groups are required to re-examine basic assumptions, beliefs, attitudes, and values through iterative cycles of knowledge exchange, dialogue, deliberation, and negotiation. It is suggested that through this process, joint understandings and commitments for action begin to emerge (Watson 2007).

In practical terms, collaboration involves a number of phases (Fig. 2.1), as well as opportunities and constraints which are shaped by prevailing economic, social, political, and environmental conditions (Watson 2004). Often, collaboration is initiated as a result of several factors, such as a perceived environmental threat or crisis, a new legal mandate, or the availability of financial incentives. When an initial commitment to collaboration has been made, a 'problem-setting' phase occurs in which groups with legitimate stakes are identified and the nature of the joint problem or issue they face is articulated (Gray 1989; McCann 1993). As

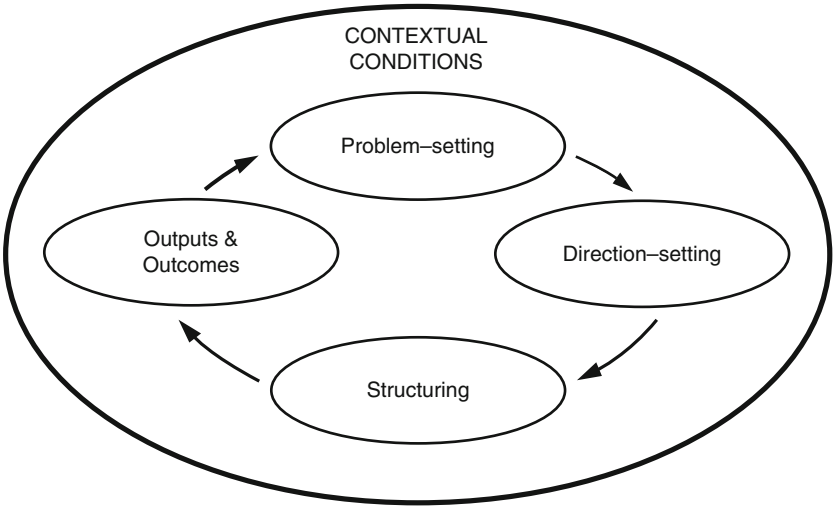

Fig. 2.1 Conceptual framework for collaborative governance

a result, stakeholders begin to appreciate their interdependence and the need to act together. In the subsequent 'direction-setting' phase, participating organisations focus on desirable future conditions as well as the underlying values, beliefs, and principles that will guide them towards their joint ambitions and aspirations. This tends to be followed by a 'structuring phase' in which specific goals and objectives are established, programmes of activity are designed, and roles and responsibilities are assigned to the various participating organisations and groups. Although some commentators regard this to be the end of the process, others have argued that collaboration should generate outputs, such as policies and programmes (Selin and Chavez 1995), which must be implemented in order for measurable outcomes to be realised.

While it is convenient to conceptualise collaboration as a well-defined process, in practice, some of the phases may occur simultaneously and several cycles may be required over time before satisfactory results are achieved. In other cases, changes in knowledge or circumstances may require the participants to return to one or more of the earlier phases of activity in order to redefine problems, objectives, or working arrangements.

According to Innes and Booher (2003), this sort of collaborative approach is not just a method for solving complex problems in the existing policy system, but crucially is a way of establishing new networks through which capabilities can be developed and sustained. Effective collaboration can be identified from four immediate or first-order results: reciprocity, relationships, learning, and creativity. Collaborative dialogue can lead to the establishment of reciprocal relationships among the participants as they begin to appreciate their interdependence. A reciprocal agreement might involve compromises among the participants but it can also lead to a situation where one group is able to take action at little or no extra cost which may have benefits for others. Such situations arise when there is a strong sense of purpose and a commitment to a common vision of a future that is more desirable than present-day conditions. It is important to realise that reciprocity is not a predetermined or straightforward attribute of the interplay among stakeholders, but is a constructed quality that helps groups to do joint work and to build trust. That is why successful collaboration also builds relationships and social capital based on mutual understanding and respect. It is precisely these kinds of enduring human and interorganisational resources that enable collaborative governance to cope with uncertainty, changing conditions, contested knowledge, and conflict, conditions which are closely associated with the objectives of the IWAM agenda. A further result of collaboration is collective learning. Participants not only learn about the problem at hand and how scientists and lay groups understand it, but also typically learn about the values and norms of the other interests and actors involved. More fundamentally, engagement in collaboration can eventually lead to deep 'double-loop learning', whereby the values, beliefs, and norms of a participating group are transformed (Argyris and Schön 1978; Pahl-Wostl 2002, 2009). Problem-framings, aims, objectives, and strategies may be adjusted on the basis of the shared understanding that emerges from collaboration. Finally, one of the greatest virtues of collaboration is that it encourages out-of-the-box thinking and creativity. Potential strategies and solutions which might otherwise be dismissed as irrelevant or poorly informed are likely to receive more considered and careful attention in an environment where alternative

views and perspectives are valued and respected. Ultimately, effective collaboration can lead to system adaptations because of the shared identities, meanings, heuristic principles, and innovations that it creates. It is precisely these kinds of system adaptations that are needed in order to bring about the integration of water and agriculture.

It should be noted that this analysis is not designed to imply that collaboration is unproblematic. Indeed, one of the main challenges of this approach to governance and problem-solving is to maintain trust and commitment to shared long-term goals when obstacles are encountered and when evidence of progress is only weak. Potential benefits as well as challenges and risks associated with collaborative approaches to the governance of land and water are summarised in Table 2.1.

Table 2.1 Potential benefits, challenges, and risks of collaboration

Benefits	Challenges and risks
Improved personal, social, and interorganisational relations	Increased transaction costs due to the number of actors involved and the added complexity of decision-making
Access to alternative sources and forms of scientific and lay knowledge	'Capture' or diversion of the process due to asymmetrical power relations among the participants
Deep learning, leading to the exploration of underlying values, assumptions, attitudes, and expectations	Potential 'implementation gaps' arising from difficulties in translating agreed plans into polices, projects, and actions
Reframing of complex issues and questions, leading to enhanced problem-solving capacity	Failure to broker agreement in the face of uncertainty, limited data, or contested knowledge
Legitimisation of decisions through consensual decision-making	Maintaining trust among organisations with different cultures, norms, and practices
Commitment to long-term goals and future visions	Ensuring the benefits and costs of collaboration are fairly distributed among the participants
Leverage of additional financial, technical, administrative, and political resources	Maintaining commitment to long-term goals when evidence of progress may be limited
Reallocation of roles and responsibilities according to organisational capacities and skills	

Perhaps most significantly, the obstacles of making a full transition from old systems of governing and policymaking to a new ethic and regime of collaborative governance should not be underestimated. Other models of policymaking, which rely more on political influence, technocratic tools, and bureaucratic structures, are deeply embedded in the institutional systems of agriculture and water and will not easily be removed or reformed. At the individual level, personnel involved in either sector may inadvertently preserve values and practices that reflect centralised, unresponsive modes of governance when trying to achieve collaboration. What this implies is that the future development of IWAM governance is likely to be hesitant and contested because the process of implementation brings together different perspectives, values, norms, and customs. Much will rest on the level of political and scientific support given to the process of integrating water and agriculture and the ability of government ministers and civil servants as well as non-governmental stakeholders to push through institutional reforms aimed at improving genuine collaboration.

Ultimately, a viable approach to governance for agriculture and water systems must be capable of integrating multiple voices and reconciling competing interests. Dealing with complexity and uncertainty requires innovative strategies to the relations among social groups and between society and the state apparatus which can foster constructive and enduring collaboration. This means that governance is not just about changing the format of policymaking or management activities, but also about a profound shift in terms of commitment to working together to understand, and constructively resolve, shared problems. Collaboration creates some of the conditions upon which legitimate actions depend even in the face of uncertainty and political and socio-economic differences among groups or spatial areas. It is the most appropriate model for achieving this change because of its commitment to dialogue, deliberation, and negotiation. By enabling reciprocal agreements, establishing enduring institutional and social relationships, promoting learning, and encouraging creativity, collaborative governance has the potential to produce the kinds of transformations which IWAM is seeking to achieve.

Integrating the 'Social' and 'Natural' in Land–Water Research

In the same way that integration challenges current thinking about governance and policymaking, it raises equally fundamental questions about how academic research should be organised and conducted. As clients of this new policy agenda, single-discipline researchers with historically little reason (or perhaps inclination) to share the same intellectual space must now navigate a stable pathway through a fundamental and seemingly intractable set of issues regarding how scientists—as a diverse community of social and natural science researchers—describe and construct the realities of water and land management, acquire and marshal knowledge for the purposes of closer integration, and judge the efficacy of our interventions. These are just some of the questions that characterise the problem of creating and operating within integrated research 'platforms' (Warner 2007). For some, this might imply a compromise and dilution of standard disciplinary pathways to knowledge and understanding, the idea that integrated thinking lies at the 'shallow end' of water research. For others, progress towards the application of these policy goals is not only producing novel theoretical constructs in the arena of land–water research but also driving the formation of new study areas that do not respect neat disciplinary boundaries (see Lane et al. 2006). At the same time, the outputs of joined-up research on agri-water systems from research must reflect the needs of policy and practice if there is to be any real prospect of making new knowledge relevant and 'useful'.

Given the simultaneously human and non-human complexion of land–water systems, it is perhaps not surprising that collaboration across the social and natural sciences is regarded as a necessary, and underpinning, facet of integrated land–water policy. One of the common presumptions behind this view is that we can create holistic understandings of land–water systems rather like fitting together a jigsaw puzzle, with cognate specialisms and expertise adding up to a complete picture. In essence, the logic is that the natural and social sciences, by their very nature, are concerned with different parts of a connected reality: the natural sciences accounting for the environmental manifestations of human

and non-human processes, the social sciences for the economic, social, political, and cultural relations that condition and give rise to them. In other words, the rationale behind this 'additive' world view rests on the notion that the social and natural sciences are compatible with each other because they prioritise different thematic areas in the study of land–water interactions. By working collectively, it is argued, social and natural science researchers are therefore able to make up for disciplinary deficiencies and forge innovative approaches to complex questions.

Holistic scientific working involving the meshing together of different types of preoccupations and expertise is a fundamentally attractive idea, yet two key challenges emerge with it. The first of these challenges concerns the need to reconcile the prevalent divergence between natural and social science research. That is to say, an important precondition of joined-up approaches *between* the natural and social sciences is to foster coherent conceptual and methodological narratives *within* them. In the natural sciences, this problem has been addressed by Haygarth et al. (2005), who, specifically in the case of phosphorus research, draw attention to the different cognate specialisms underpinning this field of inquiry and highlight the kind of challenges (and possibilities) arising for the research community when seeking to create collaborative and mutually reinforcing agendas in the context of contrasting methodological logics. An equivalent analysis of the social sciences shows that economics, political science, geography, psychology, anthropology, sociology, and planning, to name but a few, all have something of value to offer to the IWAM debate. While cross-fertilisation of ideas (and careers) among these fields makes it difficult to appreciate how exactly each has added to the understanding of water management and agriculture, it is certainty the case that this community has produced a rich mix of research priorities and fostered varied pathways to an understanding of the relations between society and nature (Haberl et al. 2006; Waterton et al. 2006; Dixon and Sharp 2007; Giller et al. 2008; Jansen 2009).

Given this, some of the principal cross-disciplinary preoccupations of social science approaches are depicted in Fig. 2.2, which highlights three arenas of inquiry around which it seeks to understand the politics of land–water management: structural trends, capacities to act, and institutional complexity. Each of these cognate areas of inquiry provides the

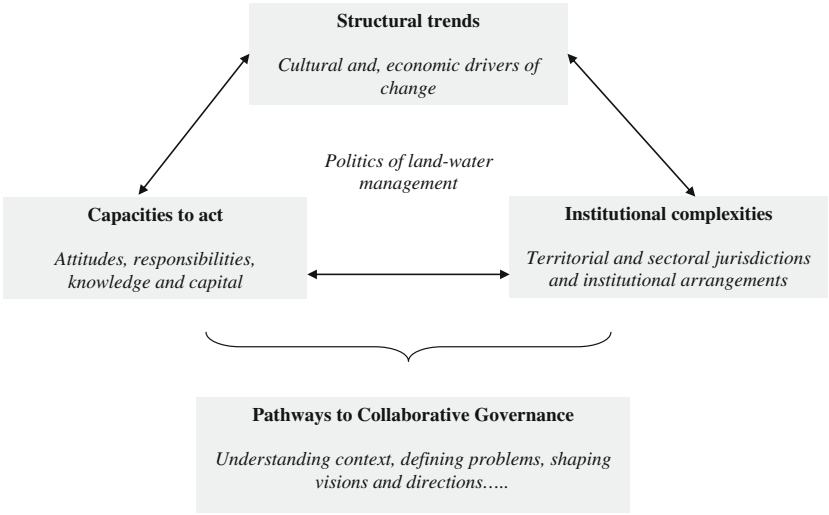

Fig. 2.2 The thematic scope of social science research in IWAM

analytical insights necessary to promote effective pathways to collaborative governance. Thus, sites of inquiry shift from studies of 'capacity' in which the concern is to unpack how attitudes, responsibilities, knowledge, and capital come to shape the behaviour of individuals and groups, through to an account of the territorial and sectoral jurisdictions that influence frameworks of interventions across multiple scales, and finally into the analysis of 'structural trends'—cultural and economic—that dictate wider terms in which inclinations and capacities to act take shape. What this implies is that IWAM-related research must seek to understand how these domains interact to produce barriers and opportunities for effective action, the first and necessary step in the collaborative process.

The second key challenge concerns the development of approaches to joint working that have the potential to *transform*, rather than simply *reaffirm*, segmented ways of researching land–water problems. In its most reductive form, holistic thinking is conflated with the idea of *multidisciplinarity*: in essence, the provision of a sequence of distinct, neatly bounded disciplinary perspectives around a given research problem (Tress and Tress 2001). According to this logic, communities of research find common cause in a particular aspect of land–water systems

(diffuse pollution, flood risk, or drought, for example), but since priorities are shaped by different kinds of issue, standard disciplinary pathways to knowledge remain largely intact. In effect, the research problem is itself divided up according to the particular theoretical, methodological, and empirical perspectives favoured by the participating disciplines. It is almost inevitable that such an approach will lead to answers that are specific to the different elements under study and that understanding the research problem as a whole can remain elusive. As such, the idea of a holistic, transdisciplinary or even post-disciplinary approach to land–water systems remains at best a distant aspiration of the research process, and at worse, a cover for a 'business as usual' discipline-bound approach to problem-framing and investigation. Despite a stronger emphasis on the need for interdisciplinary research agendas, and the incorporation of non-academic expertise, it is still the case that universities and research councils in general continue to assess the quality of academic work in terms of relevance to single disciplines. This is a major disincentive for the kind of innovation and collaborative working that is required to develop and deliver integrated strategies for water and agriculture.

One unfortunate consequence for IWAM of simplistic *interdisciplinary* thinking is that it tends to reinforce certain caricatures of what the social and natural sciences are perceived to do, and leads to deeply problematic and unreflexive views of the power we should (or should not) then invest in social and natural science judgement. In a disciplinary world, it is not unusual, for instance, for social scientists to be derogatively consigned to a rather nebulous world of conjecture and interpretation, the implication being that, not only do they have little meaningful effect on material processes and outcomes, but they also engage in a kind of obfuscatory relativism that serves to stall expedient forms of action. Accordingly, abstracted from the messy social relations and politics of the human world, the natural sciences can duly carry on with the business of 'evidence gathering', revealing the deeper 'objective' truths behind appropriate policy action.

In contrast, ideas of *interdisciplinarity* and *transdisciplinarity* offer more expansive and proactive interpretations of holistic working. In the former case, models of working proceed and carry with them an underlying aspiration for synthesis (Fish et al. 2008). Problems are defined collaboratively

from the outset of research, while methodological frameworks are designed to synthesise findings at strategic points in the research process. Transdisciplinarity working, in turn, implies progression to a vision of holistic research involving, as Harvey (2006: 332) has put it in the context of rural economy and land use, 'unification of the involved disciplines at the paradigmatic (metaphysical) level'. In these circumstances, common vocabularies of problem-framing may begin to emerge among ostensibly different kinds of land–water researchers, methodological pathways to knowledge associated with one disciplinary area begin to find expression and application in others—often transforming them in the process—while underlying assumptions concerning the basis of disciplinary authority begin to dissipate. Importantly, a common characteristic of transdisciplinarity is its tendency to collapse neat distinctions between scholarly and non-scholarly communities of expertise, a characteristic which resonates well with the ambitions, logic, and ethic of IWAM.

In the same way that IWAM governance cannot be treated as an additive processes in which two policy arenas are simply joined together, IWAM research demands a more sophisticated, collaborative, and beyond-disciplinary approach. At the present time, most IWAM research appears to be characterised by either single discipline or multidisciplinary work within the natural or social sciences. Research which seeks to transcend the conventional natural/social divide in land and water research is a very recent development which requires a significant 'upfront' investment of time and trust in order to develop common definitions, conceptual models, methods, and working languages (Bracken and Oughton 2006). However, scale dependencies, system interactions and adaptations, risk, and uncertainty are all concepts which are recognised and have currency in the natural and social sciences and therefore have great potential as the basis of a common language for transdisciplinary IWAM research.

Conclusions: Moving IWAM Forward

IWAM has emerged as a new policy agenda from a variety of different debates about rural resource management, including diffuse and point-source pollution, flood risk, water conservation, drought management, and

sustainable farming and food systems. While a broad range of policy fields and research disciplines related to land and water have switched on to the idea of joined-up ways of working, the underpinning concept of *integration* is used in a variety of ways and has not received sufficient careful consideration. Indeed, much of the debate about IWAM to date has been concerned with the scientific, technical, and economic dimensions of land and water. While such debates are necessary for the development of effective policy tools and instruments, other fundamental and equally important questions related to the integration of policymaking for agriculture and water, and the role of science in that process, demand much closer research attention.

IWAM is not just about the connection of two very different policy areas (agriculture and water) at a single (catchment) scale. Both agriculture and water management are complex multilayered socio-biophysical systems, and neither are neatly delineated nor organised to fit hydrologic boundaries defined solely by river catchment areas or river basins. As a consequence, a superficial 'additive' approach to integration is not viable for IWAM because it fails to take adequate account of the complex, multidimensional, and uncertain nature of the systems which policymakers and researchers are attempting to merge. To use a simply analogy, the integration of agriculture and water management is not like a jigsaw puzzle with a relatively small number of large pieces which simply have to be put together in the right order to create a complete picture. Rather, it is more like a puzzle in which the sizes and shapes of a large number of pieces are constantly changing, producing different patterns and configurations over time. Clearly, this sort of task requires a much more sophisticated and creative approach to both policy and research.

In a policy environment characterised by complex, evolving systems and interactions, pervasive uncertainty, and contested knowledge claims, the difficult task of jointly managing water and agriculture cannot be achieved by government departments or public agencies acting in isolation, no matter how large or powerful they might be. Clearly, such organisations have legal responsibilities for land and water and are likely to play key roles, but the IWAM policy process itself must be based on a new system of multiparty and multilevel governance that not only operates within catchments but is also linked to higher and lower levels of

governance and private decision-making. Collaborative governance, we contend, provides the kind of response repertoire that is required to begin coping more effectively with complexity and uncertainty, to realign agriculture and water in the context of rural space, and to achieve the ambitious policy goals of IWAM. One of the implications is that those who are involved in the development and application of IWAM policy need a clear understanding of the different phases in a collaborative process; the kinds of organisational, management, and research skills that it demands; the potential pitfalls and recovery strategies; and the kinds of outputs which can be expected to lead to positive outcomes in the long term.

The IWAM agenda also has major implications for the ways in which research on agriculture and water is practised. Future IWAM research needs to be transdisciplinary and synthetic, rather than simply multidisciplinary and additive, if it is to yield worthwhile knowledge regarding systemic interactions across multiple scales. As such, a common language is required to enable researchers from very different disciplinary backgrounds in the natural and social sciences to understand each other in order to develop shared problem definitions and make use of combined methodologies. Concepts such as 'complexity', 'interdependence', and 'uncertainty' could provide very useful starting points. Such terms might have different meanings to different research communities, but nevertheless provide some common ground for the development of a dialogue about how IWAM can be understood and further developed.

One of the potential dangers in advocating both collaborative governance and transdisciplinary research for IWAM is that the two activities become distanced from one another when in fact what is needed is an arrangement whereby policy and research are mutually reinforcing. Once again, notions such as 'complexity' and 'uncertainty' are readily recognised by both the policy and research communities and could provide the necessary bridges between them. In particular, approaches such as Adaptive Environmental Management (AEM) have been specifically designed to combine policymaking and research in highly complex, dynamic, and uncertain environments (Holling 1978; McLain and Lee 1996). The underlying principle of AEM is that policies inevitably have to be designed on the basis of incomplete scientific understanding, and therefore should be treated as trial-and-error experiments which are adapted

over time on the basis of feedback from scientific monitoring and evaluation. In effect, AEM brings together policymakers and researchers in a collaborative governance environment where complexity and uncertainty are openly acknowledged and addressed. Given the nature of the scientific and policy challenges associated with the integration of agriculture and water management, it is precisely this sort of proactive, experimental, and collaborative approach that needs to be developed for the future.

At the present time, IWAM represents a long-term goal or aspiration that has yet to be fully translated into an operational strategy for dealing with water and agriculture in a holistic or interconnected fashion. Any future strategy must be capable of maintaining food production systems without compromising the long-term viability of water and ecological systems. In addressing agriculture and water in a combined way, IWAM must include a range of stakeholders who are unlikely to have interacted closely with each other in the past. As such, IWAM requires particular effort in developing mutual understanding, negotiation, and cooperation so that political, organisational, and disciplinary differences and conflicting interests can be overcome. Ultimately, success will depend on the development of transparent and legitimate channels of dialogue and collaboration that connect the local, catchment, national, and international scales of governance and research on agriculture and water.

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