Resource governance and the politics of the social: Ordering in and by socio-ecological systems

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In studies of natural resource governance, agency is commonly treated as a property that evolves in conditions of socio-ecological systems (SESs). While the SES framework has established its position within a multidisciplinary scholarship, it remains controversial. Critical scholars note that the social component has been left under theorised. Yet, it is argued that once developed, the framework can provide a useful foundation for studying human–environment relations. This article critically examines such a position. Drawing from actor-network theory, it analyses the assumptions the SES framework makes about the social forms constitutive for natural resource governance. The focus is on the entities in terms of which governance and management are envisioned to evolve. The analysis shows that the descriptions of SES dynamics often treat social forms as unambiguous and a priori existing. The paper argues that the material ordering that is enacted downplays potentials of politics. Management and governance of natural resources rest on demarcations that are not supposed to be challenged. At the same time radical un-restrictedness is claimed to co-exist and to open up potentials for social learning. The promise of management enacted by the SES framework seems thus to be based on a very particular kind of fluctuation between opening up and closing down of system spaces.

KEYWORDS
actor-network theory, agency, natural resource governance, resilience thinking, social, socio-ecological system

INTRODUCTION

Sustainable governance of natural resources calls for sensitisation to ecological and human interdependencies and a fair distribution of responsibilities. However, in complexly networked modern societies, it is difficult to say what the units of collective action are or should be, and how the capacities to act evolve or should evolve. Here, the academic literature on natural resource governance and management offers help. This literature argues, ever more frequently, that managerial action develops in contexts that can be conceptualised as socio-ecological systems (SESs). As such, this emphasises the co-evolution of social and ecological processes as a coupled, multi-scalar system. The system dynamic is non-linear, intermediated by feedback loops and interactions across scales.

The SES concept has its roots in ecology and conservation studies (Berkes & Folke, 1998), but has been under active development by social scientists (e.g., Adger, 2006; Ostrom, 2009; Toonen, 2010; Young et al., 2006) who have, in their different ways, “intended to contribute to the integrated study of the interplay of ecological, technological, social, economic,
and political factors as strategic components of modern, globally perceived ecosystems” (Toonen, 2010, p. 199). SES scholarship is strongly orientated towards the generation of policy- and management-relevant knowledge. According to Fischer et al. (2015), the framework has indeed gained recognition among policy-makers.

Despite its popularity and success, the SES framework has remained controversial. Strong criticism has been aired by social scientists who, while often recognising the merits of a systems approach to the understanding of human–environment relations, also note that the “socio” or “social” in socio-ecological systems has been left under-theorised (Fabinyi et al., 2014; Fischer et al., 2015). The sterner and most frequent criticism has been focused on the concept of resilience (Brown, 2014). A SES can be more or less resilient; capable of facing disturbance and to change and renew, and to do so without losing its function and dynamic (e.g., Folke, 2006; Walker et al., 2004). The understanding of resilience-critical system components and dynamics can be used to inform the design of governance and management (Brown, 2014; Carpenter et al., 2001; Folke, 2006; Folke et al., 2010). However, as Cote and Nightingale (2012, p. 479) note, the tendency of the SES scholarship to operate in terms of “abstract structural properties,” such as institutional arrangements, “masks the necessity to ask normative questions regarding power and dominance” (see also Bush & Marschke, 2014; Fabinyi et al., 2014). Remaining unaddressed are questions related to the distribution of rights and responsibilities. So, as highlighted by a number of authors (Adger, 2006; Bush & Marschke, 2014; Cote & Nightingale, 2012; Davidson, 2010; Davoudi, 2012; Fabinyi et al., 2006; MacKinnon & Derickson, 2012; Turner, 2014), resilience by and for whom, and at whose expense? The tendency of the SES model to neglect these concerns reflects its privileging of “consensus and homogeneity over contestation and difference” (Fabinyi et al., 2014; unnumbered; Hatt, 2013). At the same time, the critics point out, human agency tends to diminish into a mechanism that enables responsiveness (Cote & Nightingale, 2012; Davidson, 2010; Olsson et al., 2015).

The critics of the SES framework also propose remedies for the identified shortcomings. It is suggested that, within the SES framework, social and ecological dynamics should be treated more symmetrically (Hatt, 2013). The call is to develop the framework so that it takes fully into account the lessons achieved in sociology, human geography and political ecology (Bush & Marschke, 2014; Cote & Nightingale, 2012; Davoudi, 2012; Fabinyi et al., 2014). Moreover, new alliances between political ecology and resilience thinking are envisioned to have the capacity to become mutually advantageous (Turner, 2014).

This paper contributes to the discussion on the potentials of the SES framework by providing an actor-network theory (ANT) (e.g., Latour, 2005; Michael, 2017) inspired analysis of the framework. ANT proposes a particular view to sociality and social forms. It thus opens up a new perspective for studying what the SES framework assumes about the social in socio-ecological systems.

The ANT view of the category of “social” is special in three important ways. First, ANT treats social forms as networks that act; as actor-networks. Agency is a collective, social achievement. ANT pays attention to the relations and forms of connectedness that make, for example, natural resource management and governance possible. This means that “social” does not refer to a random crowd occupying a time-place, but to connectedness that makes management happen and evolves along with it.

Second, the social forms do not gather together humans only. The capacity to act – to manage and to govern – requests connectedness between specific resources, such as rivers or lakes; and of monitoring systems, norms and pollution control practices, for example. Calculative tools bring the watersheds to matter for management, while legal standards, process management and wastewater treatment technologies, among others, associate industrial or other productive activities with water governance efforts (Valve et al., 2017; Van Herzele et al., 2011).

Finally, ANT emphasises that connectedness is an achievement that cannot be presumed to exist automatically or naturally. Nor can a social unit be viewed as a neutral constellation. The networks of natural resource management and governance allocate powers and responsibilities in specific ways. They also embody assumptions regarding the elements and processes that are relevant for successful practice. However, these assumptions may be challenged by changing circumstances and emerging new knowledge, among others. As a result, it is reasonable to treat social units as vulnerable and contestable – and therefore also shifting – constellations.

When conducting the analysis of the SES framework, ANT guided me to ask what brings and keeps together the social forms described in the SES literature. I thus traced the descriptions of managerial agency and its becoming. More specifically, what does the SES literature expect about the entities in which collective action and shared responsibility evolve or should evolve? Moreover, what do the texts reveal about the capacities of the emerging social forms and the governance dynamics they make possible? Finally, what do the in-built assumptions do: what – perhaps unintentional – messages about governance-relevant demarcations do they send to policy-makers?

The merit of ANT is that it focuses attention on the ordering and organising work the SES framework performs. The assumptions on which ANT sets focus explain many of the problems identified by SES critics, but their revelation also brings forth additional qualities of the framework. From an ANT perspective, it is not just the assumptions related to the
human dimensions that make a difference. Attention must be paid also to the non-human entities that are used to allocate managerial powers and responsibilities.

Instead of a full review of the vast SES literature, I seek in this paper to create conditions for a dialogue between SES and ANT. Bringing together the two counterparts necessarily dispels differences in both streams of literature and research. Nonetheless, the encountering allows introduction of new dimensions to the “SES and the social” debate.

To identify key SES literature, I undertook a Scopus search using the key words “socio-ecological system” and “social-ecological system.” In the next stage of the iterative process, I reviewed abstracts of the most-cited, peer-reviewed literature to identify articles that focus on natural resource management or governance or that provide accounts of SES configuration and dynamics. From the 20 most cited articles, five referred to SES as the broad context in relation to which their specific focus evolved. These articles I left beyond the scope of the analysis. The remaining ones are listed in Box 1. I supplemented the literature with books expected to open up the SES heuristics in a comprehensive fashion. The reading of the texts pointed to two specific themes in need of extra attention. The first theme deals with scale and scalar fit; the second with adaptive management and social learning. Therefore, the analysis makes reference to frequently cited articles addressing these topics. The examination is guided by ANT’s conceptualisation of the social, but I also make use, and reflect back to, the social science literature more broadly to complement the analysis.

The following sections first present the dimensions of ANT that are relevant for the development of my argument and specification of the analytical strategy. In the third section I trace the social forms co-constitutive for SESs. In order to understand what holds and keeps together the system entities, I start by reviewing general characterisations of the systems. These characterisations lead me to specific locations of human subsistence. Natural resources located in specific places tie together social units. However, the texts remind us that there is variation within systems. Yet the heterogeneity is seldom expected to open up contestation about the ways managerial rights and responsibilities should be divided or the units of governance defined. The management-relevant demarcations appear absolute and scientifically definable. However, the well ordered circumstances are assumed to provide fruitful grounds for self-organising agency and social learning.

BOX 1  The articles identified through SCOPUS to form the basis for the analysis

Adger, N. W. (2006). Vulnerability. Global Environmental Change, 16, 268–281. https://doi.org/10.1016/j.gloenvcha.2006.02.006

Berkes, F. (2004). Rethinking community-based conservation. Conservation Biology, 18, 621–630. https://doi.org/10.1111/j.1523-1739.2004.0077.x

Folke, C. (2006). Resilience: The emergence of a perspective for social–ecological systems analyses. Global Environmental Change, 16, 253–267. https://doi.org/10.1016/j.gloenvcha.2006.04.002

Folke, C., Carpenter, S., Elmqvist, T., Gunderson, L., Holling, C. S., & Walker, B. (2002). Resilience and sustainable development: Building adaptive capacity in a world of transformations. Ambio, 31, 437–440. https://doi.org/10.1579/0044-7447-31.5.437

Folke, C., Carpenter, S. R., Walker, B., Scheffer, M., Chapin, T., & Rockström, J. (2010). Resilience thinking: Integrating resilience, adaptability and transformability. Ecology and Society, 15, 20. http://www.ecologyandsociety.org/vol15/iss4/art20/

Folke, C., Hahn, T., Olsson, P & Norberg, J. (2005). Adaptive governance of social-ecological systems. Annual Review of Environment and Resources, 30, 441–473. https://doi.org/10.1146/annurev.energy.30.050504.144511

Holling C. S. (2001). Understanding the complexity of economic, ecological, and social systems. Ecosystems, 4, 419–422. https://doi.org/10.1007/s10021-001-0101-5

Nelson, D. R., Adger, N. & Brown, K. (2007). Adaptation to environmental change: Contributions of a resilience framework. Annual Review of Environment and Resources, 32, 395–419. https://doi.org/10.1146/annurev.energy.32.051807.090348

Olsson, P., Folke, C. & Berkes, F. (2004). Adaptive comanagement for building resilience in social–ecological systems. Environmental Management, 34, 75–90. https://doi.org/10.1007/s00267-003-0101-7

Olsson, P., Gunderson, L. H., Carpenter, S. R., Ryan, R., Lebel, L., Folke, C. & Holling, C. S. (2006). Shooting the rapids: Navigating transitions to adaptive governance of social-ecological systems. Ecology and Society, 11, 18. http://www.ecologyandsociety.org/vol11/iss1/art18/

Ostrom, E. (2007). A diagnostic approach for going beyond panaceas. Proceedings of the National Academy of Sciences, 104, 15181–15187. https://doi.org/10.1073/pnas.0702288104

Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. Science, 325, 419–422. https://doi.org/10.1126/science.1172133

Walker, B., Carpenter, S., Anderies, J., Abel, N., Cumming, G. S., Janssen, M., Lebel, L., Norberg, J., Peterson, G. D. & Pritchard, R. (2002). Resilience management in social-ecological systems: A working hypothesis for a participatory approach. Conservation Ecology, 6, 14. http://www.consecol.org/vol6/iss1/art14/

Walker, B., C. Holling, C. S., Carpenter, S. R. & Kinzig, A. (2004). Resilience, adaptability and transformability in social–ecological systems. Ecology and Society, 9, 5. http://www.ecologyandsociety.org/vol9/iss2/art5/

Walker, B., Gunderson, L., Kinzig, A., Folke, C., Carpenter, S. R. & Schultz, L. (2006). A handful of heuristics and some propositions for understanding resilience in social-ecological systems. Ecology and Society, 11, 13. http://www.ecologyandsociety.org/vol9/iss2/art5
2 | THE SOCIAL ACCORDING TO ANT

Actor-network theory provides fruitful analytical means for the studying of human–environment relations and natural resource governance (e.g., Callon, 1986; Hinchliffe, 2007; Lockie, 2007; Valve et al., 2017; Van Herzele et al., 2011). However, while enabling new insights, the approach rules out methodological options that are well established in environmental social science research. No longer, the argument goes, can research build upon units such as regions, scales, communities or interests as pre-given categories of social life and social analysis. Instead, scholars are to “focus analytical attention on how particular social arrangements come to be” (Lockie, 2007, p. 793). Making such claims and demands is radical. What justifies such a strict stance? What is so wrong with the studying of the social in terms of a pre-defined group or unit?

To a large extent, the demands result from the ANT practice that equals social with distributed forms of agency. Capacities to act call for sociality, and for sociality that goes beyond human–human relations. The social forms – theorised as networks, collectives, assemblages or rhizomes (Michael, 2017) – gather together people, but also non-humans, including physical features and ecological processes; and time, money and equipment, among others.

Management of a eutrophic lake, for example, demands human collaboration, but also specific tools and technologies. If the problems are caused by farming, it may be necessary to reduce phosphorus levels in soils to avoid any additional nutrient leakage into the lake. This requires changes in land-use practices (Walker et al., 2004). According to ANT, the aspiration could be backed by an analysis that traces connections or associations critical for the unfolding of farming practices. The analysis would make visible the human skills and non-human resources, as well as the diverse types of material flows and exchanges, on which practices rest. It might also show that some associations have become rather stable, for instance, thanks to contract cultivation arrangements. The farmers have committed to a specific kind of production and the buyers to the purchase of the produced outcomes. However, the agreements and the co-constitutive associations must be actively maintained and done so in relation to changes in yields, input costs, consumer demands and other market changes. The social forms are more or less fragile, being susceptible to human and non-human resistances and to more overarching re-organisation attempts.

In the ANT literature, concepts such as intressement, enrolment and translation have been used to analyse the drawing and alignment of associations and the shaping of social forms (e.g., Callon, 1986; Latour, 2005; Michael, 2017). The key message is that the mobilisation capacities indicate ability to exercise power. Like associations, association attempts may also be contested. In the case of the eutrophic lake, it may turn out that not only the lake and its spokespersons want to “make their presence felt” (Allen, 2011, p. 284) at farms and for the development of farming practices. For one thing, the manure accumulating at a farm may be difficult material to be relocated. Nonetheless, new managerial capacities would necessitate disassociation of manure from the fields of the farm.

Since social forms through which farming, for example, unfolds are dynamic and contested, they cannot be treated as pre-existing and fixed units. Instead:

[I]t's now possible to bring into the foreground the practical means to keep ties in place, the ingenuity constantly invested in enrolling other sources of ties, and the cost to be paid for the extension of any interaction.

(Latour, 2005, p. 66)

Thus it becomes evident that operation in terms of pre-existing social units has consequences. Consider, for example, that the study of conditions of land-use change did not ask what associations and disassociations assemble the social and condition its change, but presupposed that the relevant social formation can be grasped by focusing on the attitudes and values of the farmers living around the lake. Soon, some (ANT or “non-ANT”) scholars would note that the methodological choice suggests an individualist take on the social. The critics might also add that material conditions are unfoundedly deemed irrelevant for the shaping of agency. Nonetheless, from an ANT-inspired perspective, even additional problems entail. First, instead of analysing “how particular social arrangements come to be,” the study creates such arrangements. Farmers within the drainage basin are made to form a social entity. The analysis brings humans and non-humans together and does so in ways that may not be empirically or theoretically justified. Connectedness and disconnection are merely assumed but, thanks to the chosen methodology, made to exist as if real (Law, 2009). Moreover, while “cutting” the social in a particular way, the researcher sets terms for what is in and out, and what can make its presence felt for the analysis of the social. The problem is that the modes of cutting tend to stabilise, implicating that research practices create systemic absences or blind spots.
Across scientific and social scientific traditions, geometric conventions provide common coordinates for a priori arrangement of interactions (Allen, 2011). For example, conceptualisations about geographical scales and administrative levels are used to ground analytic strategies. As can be expected, ANT rejects such predetermination, arguing that “we have to try to keep the social domain completely flat” (Latour, 2005, p. 171, emphasis in the original). This is not to say that interactions would not create patterns and scalar formations, but that the orders cannot be treated as pre-established or uncontradicted.

While ANT provokes criticism of the methods used in social scientific research (Callon & Latour, 1981; Latour, 2005; Law & Urry, 2004), it is important to acknowledge that all research—including ANT-inspired analyses themselves—intervene by sorting out complex realities in order to make sense of them. Analysability always rests on material arrangements through which “entities are detached from other contexts, reworked, displayed, related, manipulated, transformed, and summed in a single space” (Callon & Law, 2005, p. 730). Natural resources and living processes unfold in relation to particular devices and practices of knowledge creation (e.g., Law, 2004; Valve, 2011). Scientific mappings or evaluations cannot be treated as a view “from nowhere” (Law, 2004). Therefore science cannot provide neutral underpinnings for the organisation of management and governance. This ANT position is important to keep in mind when we now turn to the analysis of the SES framework and to the assumptions the SES texts make about the shaping of social forms and their powers.

3 | THE SOCIAL IN SOCIO-ECOLOGICAL SYSTEMS

3.1 | SESs in place

The specificity of the SES approach lies in the integrated perspective on humans in nature (Berkes & Folke, 1998, p. 4). The starting point is that the management of natural resources takes place in conditions of interconnectedness and dependence. However, somewhat different accounts are provided about the origin of co-evolutionary dynamics; of the organisation of the system forms in which conditions of managerial agency evolve or should evolve. Sometimes it is emphasised that the existence of a systemic mode of co-evolution cannot be taken as given. Instead, fruitful reciprocity must be actively made to happen. The critical issue here has to do with the synchronisation of human practices and ecological processes. For example, Janssen et al. (2007, p. 309) analyse SESs that:

Are systems composed of biophysical and social components where (1) individuals have self-consciously invested time and effort in institutional infrastructure (and, in some cases, physical infrastructure) that affects the pattern of outcomes (e.g., patterns of resource use and their distribution within the population) achieved over time in coping with diverse external disturbances and internal problems, and (2) these components are embedded in a network of relationships among smaller and larger components. In other words, humans have designed some parts of the overall SES. The design effort may have occurred at one time period in the past. Or, more likely, the design may have developed over time as feedbacks generated information about how the SES was operating.

Janssen et al. (2007) thus emphasise SESs as historic entities. Connectedness and its maintenance have called for work; it has been essential to learn to cope with the dynamic environment. In a SES, the instant need and even struggle for survival guides sensitisation and adaptation. Dependency on the resource base is direct and obvious. However, not just any utilisation or harvesting practice will do. Productivity demands care, reciprocity and investment. Solicitude moves across time and place; reaching from existing populations to coming generations of both humans and non-humans. The common material basis, such as a fish stock or a common pasture, and the work invested in institutional infrastructure, tie together the social units.

In the SES literature, it is suggested that the complex interactions within a system can be analysed through a scheme that differentiates specific subsystems and their key variables (Ostrom, 2007, 2009). The scheme proposes a heuristic that can support consistent data gathering and analysis and synthetisation of findings. According to the heuristic:

SES are composed of multiple subsystems and internal variables within these subsystems at multiple levels analogous to organisms composed of organs, organs of tissues, tissues of cells, cells of proteins, etc. (Ostrom, 2009, p. 419)

In the scheme, the governance subsystem refers to the institutions, such as property right schemes and constitutional rules, conditioning the use of a specific resource and the development of user interactions.
Although the synchronisation of relevant system components is sometimes presented as an achievement (Janssen et al., 2007), in analytical practice the SES concept is typically used to refer to a territorially bounded unit, such as a river basin, natural park or species habitat (Olsson et al., 2015; for examples see Carpenter et al., 2001; Lebel et al., 2006; Olsson et al., 2004, 2006; Stringer et al., 2006; Walker et al., 2002). Although Walker et al. (2006, np) point out that social-ecological systems are not equal with “humans embedded in an ecological system,” the descriptions of the systems treat spatially bounded stocks of natural resources as entities that bring humans together as resource users and managers. The capacities of the resources to associate seem straightforward: There is little that would make connectedness uncertain or susceptible to change. Furthermore, connectedness follows boundaries that can be drawn on a map, indicating that spatial proximity to the resource base guides shaping of a SES and the managerial responsibilities that can be located within the system.

From an ANT-inspired perspective – and from the perspective of many critical geographers – this kind of place centrality is ungrounded. Spatial distances significantly contribute to the ordering of interactions so that elements physically close become associated easier than those far off. However, entanglement and the capacity to affect do not evolve in any deterministic or clear-cut fashion (Allen, 2011). Blok (2010, p. 898) phrases the distinction by noting that “social space is contained within, but different from, universal geometrical space.”

So spatial closeness does not guarantee association, but this, of course, also works the other way round: spatial distance does not guarantee disassociation. As Haila and Dyke (2006, p. 27) note, “some human activities have an immediate and localised presence.” In such cases, it may be possible to trace the interdependencies into a bounded area or territory. Haila and Dyke (2006) name gardening and farming as such activities. But, at the same time, they raise a cause for caution, stating that “a more conspicuous feature of human culture is to cross local boundaries through trade and other sorts of transactions such as tribute, plundering, and welfare” (2006, p. 27). Moreover, as ANT helps to point out, the ability to enrol “distant others” in management processes, and the ability of these “others” to make their presence felt – with or without any explicit accountability – point to abilities to exercise power (Allen, 2011, p. 284).

Socio-ecological systems scholars acknowledge that natural resources and their management may associate with far-reaching entities and processes (Berkes, 2006; Nelson et al., 2007), emphasising that it is important to analyse how the interactions across scale affect adaptability and resilience of a SES (Folke et al., 2007; Young et al., 2006). The systems gain qualities as potentially destabilising objects of globalisation. Increased connectivity, speed and “spatial stretching” (Young et al., 2006, p. 310) guide attention to the expanding scales of socio-ecological coevolution. For example, agricultural systems increasingly link to international markets, therefore being more vulnerable to global epidemics and price fluctuations. In such circumstances the call is for the development of multi-level governance arrangements that can better respond to perturbations that evolve through cross-scalar interactions (Armitage, 2008; Berkes, 2006; Folke et al., 2005; Lebel et al., 2006; Young et al., 2006). What becomes critical is “the sharing of management power and responsibility” (Folke et al., 2005, p. 463). New connections must be created across and within governance levels so that the outcome consists of “multiple and often polycentric institutional and organisational linkages among user groups or communities, government agencies, and nongovernmental organisations” (Folke et al., 2005, p. 463). Such a constellation:

Needs to develop capacity for dealing with changes in climate, disease outbreaks, hurricanes, global market demands, subsidies, and governmental policies. The challenge for the social-ecological system is to accept uncertainty, be prepared for change and surprise, and enhance the adaptive capacity to deal with disturbance. (Folke et al., 2005, p. 464)

The model of governance proposed here bounds accountability in a particular fashion. For one thing, operation in terms of predefined levels proposes that the practicing of power follows a hierarchical dynamic that can be reorganised for managerial purposes. Second, the conceptualisation suggests that (re)division of responsibilities is to happen through official and civic extensions while corporates and commercial actors, for example, seem disassociated from the network that performs governance. Developments beyond a SES can be contested only up to a limit. In relation to what remains outside, the task is to adjust and to adapt (Reid, 2012; see also MacKinnon & Derickson, 2012).

### 3.2 The search for a scalar fit

Asking questions about the origin and development of SESs points to assumptions that, from the ANT point of view, are already highly normative. By largely bypassing the origins of scalar formations, and of connectedness and disconnectedness more generally, the SES concept seems to take for granted arrangements that for ANT are achievements and even indications of power.
However, SES scholars also criticise the ways management and governance units are being defined. Administrative demarcations are the target of this criticism. It is argued that too often bureaucratic divisions, instead of the real-life interactions on the ground, guide the organisation of governance and management. The outcome is a misfit between ecosystems and institutions (Folke et al., 2007), or “scalar mismatch” so that “the scale of management and the scale of the ecological processes or natural resources being managed” (Cumming et al., 2006, np; see also Cash et al., 2006; Cumming & Norberg, 2008; Cumming et al., 2013) fail to correspond.

However, examples pointing to positive progress are also identified. Paavola et al. (2009) note that the European Union’s Water Framework Directive specifically seeks to avoid scalar mismatch by announcing that the management of water resources should proceed in terms of river basins instead of arbitrarily cut regional units. River basins qualify as correct spatial scales since they bring and keep together water flows. Operations that fail to acknowledge this connectedness are apt to undo each other or even to cause problems downstream.

It is indeed justified to argue that river basins “‘demand’ to be included” (Bell, 2012, p. 114) in the social forms constitutive for management. However, the connectedness of water flows and ecosystem functions do not make river basins neutral units of management (Huitema et al., 2009). The fixing of ecosystems as bounded policy objects disregards their evolving and living nature (Olsson et al., 2015; Welsh, 2014). Even river basins are specific kinds of cuts, unfolding mostly in relation to the tools and practices of hydrological research. To argue that the watersheds provide a natural, apolitical basis for water management reflects a position according to which the scientific mode of cutting is either incomparable or not a cut at all. But, whatever the option, the outcome is that only the life-worlds, worries and the entanglements that operate in terms of, or can be aggregated to fit into, the basin “container” qualify as management relevant (Valve et al., 2013, 2017).

The fixing of nature objects comes with significant material and, as understood in ANT terms, political implications. The act suggests that the conditions of managerial agency are, and should be, scientifically cemented. So, while the aim is to extend managerial sensibilities so that they acknowledge the complexity of system dynamics, the framework actually ends up narrowing down the space of sensitisation. The official and/or scientific demarcations take over. The problem is not in the demarcations per se; acknowledgement of the unitedness performed by river basins is, as noted, highly important. Yet it is a different thing to treat such “ecological scales” as guides than to allow them to determine the terms of relevance. If the ability to challenge demarcations is eliminated, and if it is impossible to rethink what processes and dimensions are relevant to management, the practice is in danger of losing its responsiveness. Little space is left for the political; for the “dynamic, critical and questioning politics” constitutive for reflexive and democratic governance (Walker & Shove, 2007, p. 223). Instead, new options and innovations can emerge, and come to count for management, only in the limits of the pre-set material terms.

In part, the problems related to technocratic determination have been recognised within the SES scholarship. Cash et al. (2006; see also Berkes, 2004) note that it may be difficult to “recognize heterogeneity in the way that scales are perceived and valued by different actors, even at the same level.” Likewise, Hukkinen proposes an embodied perspective to the analysis of system formation: “cognitive operation that performs the distinguishing of a SES as a system needs itself to be in the domain of that system” (2014, p. 101). However, it seems that here systems and scales are not regarded as cuttings and relational outcomes in the ANT sense, but as absolute entities that can just be perceived in different ways.

### 3.3 The social dynamics of management

According to the commonly expressed postulate of SES heuristics, sustainable, co-evolutionary associations are emergent phenomena that may actualise in favourable circumstances. Likewise, norms that condition collective action can evolve in a bottom-up fashion; through encounters between resource users and other relevant participants. The task of governance is to support this potential: “solutions must be enabled and not provided” (Norberg & Cumming, 2008, p. 285).

Surprisingly enough, there is little in the SES accounts that would indicate that in the encounters in which solutions are innovated and explored, deliberation would be harmfully constrained. No potential conflict appears to exist, for example, between the proper scale of management and the arrangements as part of which people wish to make their presence felt. For the most part, the ability of the ecological in socio-ecological systems to set terms for the shaping of the social is not seen as a problem. The unambiguous material basis brings critical humans and non-humans together. In this sense, terms of agency are determined indeed. Yet it needs to be borne in mind that there is more than one option available for the organisation of co-evolution. Moreover, since a SES may be shaped through several simultaneous adaptive cycles (Davoudi, 2012; Gunderson & Holling, 2002; Walker et al., 2004), its destruction may not be as fatal as it sounds. Instead,
in conditions of ecological and institutional diversity, destruction may be creative, resulting in new openings and forms of coevolution.

However, rather than being at risk of bifurcating or eroding, in the accounts of SES dynamics the cohesion of the social units has the tendency to increase in time. The collective search for, and testing of, common rules of resource use and management constitutes a potential process of social learning (e.g., Cumming et al., 2013; Gunderson et al., 2008; Pahl-Wostl, 2007; for an analysis of different conceptualisations and uses, see Ison et al., 2013). Social learning is presented as an associating phenomenon that generates social glue and increases cohesion. Again, it is the common and absolute system that gathers and provides the starting point for deliberation:

Time needs to be spent developing shared understandings of the system to be managed. This should involve the groups and individuals who know the system best, who are embedded within it and who hold a stake in what happens to it. (Stringer et al., 2006)

Social learning may be a result of self-organisation “from below,” but it can also be a significant component of intentional and carefully orchestrated moves of adaptive (co)management (Carpenter et al., 2001; Gunderson & Holling, 2002; Folke et al., 2002, 2005; Nelson et al., 2007; Walker et al., 2006; for a review see Fabricius & Cundill, 2014). Typically, adaptive management is “an iterative process that develops an ongoing dialogue about the functioning of the system and the goals of management” (Gunderson et al., 2008, p. 225). Iteration takes place within, and through, temporally subsequent phases. Management and policy-making should qualify as experimentation so that each cycle provides lessons for the retailoring of policy. The model is one of increased sensitivity and reflexivity, suited to living with complexity and uncertainty. Management ideally proceeds in recurring and self-strengthening loops, although in practice adaptation may fail or face resistance (Olsson et al., 2006; Walker et al., 2004). However, even in the case of a failure, the system does not divide but transforms as a single unit.

In a SES, adaptive management resting on social learning can increase the cognitive abilities of humans, but it may also initiate change in values, attitudes or mental models. At issue may not just be the ability of humans to know how to manage the systems, but to become more deeply involved in their operation and care:

Collective action and the resolution of conflicts require that people recognise their interdependence and their differences and learn to deal with them constructively. The different groups need to learn and increase their awareness about their biophysical environment and about the complexity of social interactions. (Pahl-Wostl, 2007, p. 56)

At its best, social learning may gain capacities of an immaterial and apolitical reframing process through which the needs of the “common good” – of the well-being of the “commons” – can surpass potentially narrow, short-sighted views. The Grand Canyon management program is presented as one of the good examples (Folke et al., 2002; Gunderson et al., 2008). It has succeeded in bringing together stakeholders to discuss the key lessons gained from already implemented measures and to contemplate how these lessons should be taken into account in further planning.

4 | DISCUSSION: POLITICS OF ARRANGEMENT

The findings of an ANT-inspired analysis echo in many ways what critical social scientists have identified as key pitfalls in the SES framework. ANT also has much to add to the debate. It helps to show how SES treatises enact social forms and, while so doing, produce outcomes identified by SES critics. Moreover, the ANT-inspired analysis brings forth new insights about the conceptions the SES framework creates about the terms of managerial agency.

The analysis carried out shows that the descriptions of SES dynamics build on conceptualisations that take some interdependencies and their stability for granted. In particular, the model affords ample capacity for natural resources to act as connective ties. The associations are expected to evolve in spatially determined limits or at least be strongly guided by spatial proximity. Although global or cross-local forces also affect and set pressures on resource use and management, the place as a site of natural resources and human dwelling appears effectively to glue together social units (see also Welsh, 2014). Moreover, there is little that would detach or separate humans and non-humans that are located spatially close. Developments within and outside the system are not expected to cause asymmetries that would result in
differentiation that splits the system into several new systems. Instead it appears that a SES adapts, or fails to adapt, as a single unit.

Management and governance rest on demarcations that are not supposed to be challenged. This material ordering downplays the potentials of politics. However, the pre-defined premises of deliberation – the boarders of the social containers – are not envisioned to hinder social learning. While the SES framework expects a lot from material entities to associate and hold together, the actual management and governance of natural resources are presented as taking place through rather immaterial learning processes. Learning generates fresh perceptions of the material conditions, but does not challenge the system-constitutive demarcations.

The promise of management enacted by the SES framework seems to be based on a very particular kind of fluctuation between opening up and closing down of system spaces. On the one hand, the material pillars of the system are quite fixed. At the same time, however, radical un-restrictedness is claimed to co-exist and to open up potentials for social learning. Moreover, the learning processes are not supposed to shake the unity of the SES.

These enactments come with potentially unintended policy messages and consequences. First, the descriptions can be read to propose that allocation of rights and accountabilities follows spatial cuttings. As a result, some human and non-human elements and forces may thus appear too easily as external or marginal for organisation of governance. Second, if the policy practitioners expect such orderliness as the SES treatises suggest, they may be ill-equipped to operate with the contestation and overflows (Callon, 1998) that nonetheless emerge. Finally, the proposed variation between openness and closure of system spaces can be read to indicate that there is fairly little need for state intervention. Policy instruments based on the creation of deliberative spaces and consensus may appear to be promising and sufficient.

An ANT-inspired analysis may support the development of the SES framework. However, can SES modes of ordering change – and the framework still maintain its fundamental standpoints? While answering this question goes beyond the scope of this article, it is clear that development of the SES framework is likely to remain mainly cosmetic if its ordering functions are not taken into account. Re-politicisation of management and governance is difficult if allocation of capacities and responsibilities is a priori an unambiguous issue, determined by ecosystem boundaries.

5 | CONCLUSIONS

The distinctive feature of ANT, its theorisation of the social, provides a viewpoint on the arrangements performed by the SES framework. The SES treatises appear to make significant assumptions about the existence and solidity of social ties; apolitical determination of managerial capacities and responsibilities; and about the potentials of social learning in conditions in which key (dis)associations must be taken as given. Although the SES framework only arranges spaces of governance on paper, the ordering that is performed sends potentially powerful messages to policy practitioners.

The associations and disassociations enacted by the SES framework take part in, and create conditions for, the privileging of consensus and homogeneity. So the privileging does not result only from the ways humans and their relative positions are treated, but is significantly an outcome of the assumptions made about the shaping of social forms and the roles material and non-human elements play in that process. Therefore the theorisation the “social” or “socio” must proceed hand-in-hand with the overall development of the SES framework.

To a significant extent, the criticism aired in this paper is relevant for environmental social science research more generally. Social science research tends to mobilise and enact social containers (Law & Urry, 2004). It is the social scientists who have been accused of acting as if the social would be “always already there at their disposal” (Latour, 2005, p. 8). Nonetheless, this tendency may only grow if we take it as our task to revise the social in socio-ecological systems without giving additional attention to the shaping of social forms.

The opening of the deadlock calls for case studies that focus on tracing the networks through which natural resource management unfolds. Accounts describing the evolution of responsibilities and capacities can then be placed in relation to SES comprehension about the same phenomenon. The outcome can help to reveal in more detail how the approaches differ and what “ordering on paper” implies in a real-life setting. An ANT-inspired analysis is also likely to point to tensions related to the organisation of managerial action. It is realistic to assume that such politicisation of natural resource governance is not very appealing from management officials’ point of view – or is not appealing at least compared with the de-politicisation promoted by the SES framework. However, while politicisation no doubt complicates coordination of resource management and governance, it can also help to make explicit forces and arrangements that hinder positive environmental change.
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ENDNOTES

1 Social-ecological is used together with socio-ecological, see for example, (Fabinyi et al., 2014; Hatt, 2013; Hukkinen, 2014).

2 When referring to the SES framework, I follow Cote and Nightingale (2012).

3 In order to gain a grasp of the diversity within the ANT literature, see (Michael 2017). Michael (2017, pp. 2–3) also notes that “ANT cannot be easily packaged” and picked up as an analytical recipe. Yet its sensibility “opens up a space for asking certain sorts of methodological, empirical, analytic and political questions about the processes of the (more-than-) social world.” It is for this purpose that I aim to use ANT in this paper.

4 The small role allocated to the state is seen as a sign of the neoliberalism embedded in, and enacted by, resilience thinking (Davoudi, 2012; MacKinnon & Derickson, 2012; Walker & Cooper, 2011). Explicit calls for state intervention are nonetheless put forward in the SES literature. For example, according to Armitage et al. (2009, p. 100), “Conventional institutional responses, including strictly enforced regulations, the development of protected areas and set-asides, and other social and market incentives, are still needed.”

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