

Social-Ecological Systems Governance: From Paradigm to Management Approach

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ABSTRACT

This article presents the reframing of flood management practices in the light of social-ecological systems governance. It presents an exploratory theoretical analysis of social-ecological systems (SES) governance complemented by insights from case study analysis. It identifies a mismatch between the goals of the underlying ecosystem paradigms and their manifestation in management practice. The Polder Altenheim case study is an illustration of the consequences of flood management practices that do not match their underlying paradigm. The article recommends two institutional arrangements that will allow institutions to increase their capacity to co-evolve with SES dynamics: (a) institutional arrangements to ensure and enable openness in actor participation, and (b) institutional arrangements to enable updating of the management practices in response to SES dynamics.

KEYWORDS

dynamics, floods, Polder Altenheim, governance, institutions, mismatch, water management policy



From Governance Paradigm to Management Approach

Social-ecological systems are coupled, non-linear dynamic systems manifesting complex behavior patterns on multiple temporal and spatial scales (Scheffer et al. 2001). For a social-ecological system (SES) to be sustainable, both the social and ecological dynamics and their interactions need to be safeguarded. Different governance paradigms hold different views on how to sustain and manage the interdependency of SES, giving rise to different management approaches. These management approaches are manifested in the field in suites of practices. When practices are ineffective in dealing with SES dynamics, practitioners perceive problems in the field and often attempt to address these problems by changing their practices. These modifications in practices often occur without considering the principles of the underlying governance paradigm and this can lead to mismatches be-





tween the goals of the governance paradigm and its manifestation as management approach in practice. Institutions are the means of translating the governance paradigms into management approaches. Accordingly, institutions provide the ground in which we examine the mismatches between governance paradigms and management approaches, and address the inability of management practices to effectively accommodate social-ecological dynamics.

Floods are an intrinsic dynamic in a social-ecological system. Hence, SES paradigms also determine management approaches to floods and hence flood management practices. To reframe flood management approaches, we need to re-examine the translation between the underlying governance paradigms and associated management approaches focusing on institutions. This article contributes to the reframing of floods in two ways: (a) by pinpointing the mismatches between current governance paradigms and management approaches as expressed by institutions, and (b) by providing two suggestions of institutional arrangements oriented to accommodating the dynamics of social-ecological systems such as floods (see box 1).

Box 1. Definitions

Governance paradigm—the overarching set of ideas constituting the conceptual basis of a specific domain. A paradigm reflects the deep structure of the governance system (Douglas 1986) in that it consists of ideas, perceptions, views, and the underlying assumptions. It can be referred to as part of the culture of the system (North 1990; Scott 1998).

Institutions—as systems of rules (Young et al. 2008) are the means to translate paradigms into management approaches. Each paradigm can direct the way institutions are structured and how they function while remaining receptive to influences from these very institutions. This capacity of institutions to remain receptive either results in institutional adaptation (Carlsson and Berkes 2005; Imperial 1999) or in paradigm shifts (Kuhn 1962). Institutions are therefore different from organizations.

Governance is conceived as the process of steering by whatever means (Kooiman 1993; Mayntz 1993, 11–13; Stoker 2000). Following Mayntz (1993), we specify the object of governance to be the social-ecological system (its dynamics and interdependencies) and the subject or “governor” to be policy practitioners and policymakers. Policy practitioners are understood as the street-level administrators who are assigned to implement the policies (put policies into practice).

Structure of the Article

The article explores the evolution of two relevant governance paradigms and their translation into management approaches. Institutions are the means translating the governance paradigms into management approaches. This gives us the possibilities to address the inability of management practices to effectively accommodate social-ecological dynamics. The article then analyzes the two-faced nature of institutions. On the one hand, institutions provide the frame to translate the governance paradigm into management approaches while regulating and legitimizing interests and practices. On the other hand, the institutionalization of social-ecological system dynamics and interdependencies can turn into an over-reliance on rules that results in a reduced efficacy of institutions and an emerging mismatch between management practices and their underlying paradigm. Next, the article illustrates the mismatch between management practices and their underlying paradigm using a case of flood retention along the Rhine River. To address the problems associated with mismatches between management practices and their underlying paradigms, institutions (as the means translating paradigms to management approaches) need to have the capacity to co-evolve along with social and ecological dynamics. The article therefore suggests two institutional arrangements aimed at addressing the mismatches. It concludes with pointers on how to operationalize the recommended institutional arrangements.

The Translation of SES Governance Paradigms to Management Approaches

We adopt a meta-level view of the evolution of social-ecological systems governance paradigms. Different governance paradigms contain different views on how to sustain and manage the interdependency of SESs, giving rise to different management approaches. The theoretical exploration of the translation of two SES governance paradigms into management approaches provides the background against which the mismatches (between governance paradigms and management approaches) can be understood. Figure 1 depicts the relationships between governance paradigms and their associated management approaches and their manifestations as views, rules, and practices. Figure 2 depicted the translation of the ecosystem management paradigm and the adaptive management paradigm to their associated management approaches.

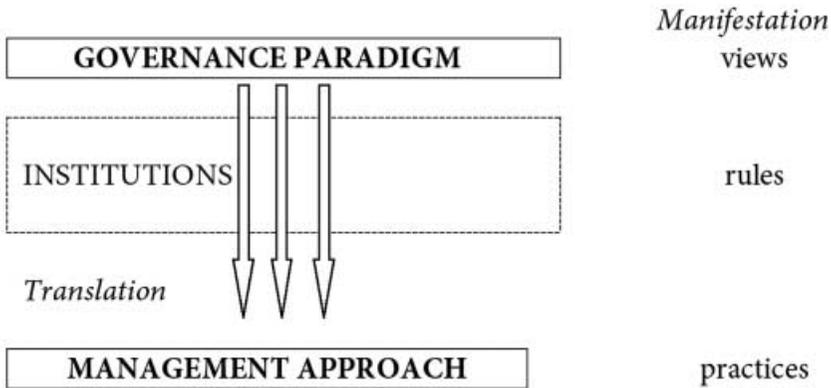


Figure 1 ■ Conceptual framework of the relations between governance paradigms and management approaches for the governance of social-ecological systems.

In the discussion which follows, we refer to two classes of SES governance paradigms, which have the term “management” in their names. Both the ecosystem management paradigm and the adaptive management paradigm could more accurately be termed the ecosystem governance paradigm and the adaptive governance paradigm, respectively, because they represent the overarching set of ideas constituting the conceptual basis for managing a social-ecological system. In this paper, we choose to continue to refer to them by the names they have been given in the literature although this may be a little confusing.

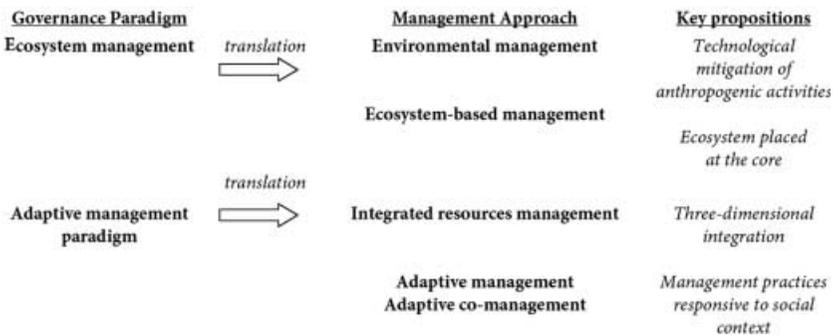


Figure 2 ■ The evolution of social-ecological systems’ governance paradigms and their translation to management approaches.

Ecosystem Management Paradigm

The need for protection of the ecosystem from the negative effects of human practices provided the driving force for the development of the ecosystem management paradigm (Imperial 1999; Pretty and Ward 2001). In its early stages, ecosystem thinkers made a distinction between the management and engineering of the ecosystem.

According to ecosystem thinkers (Costanza et al. 1997; Pretty and Ward 2001), the ecosystem could not be engineered or controlled; rather information from ecologists on the capricious dynamics of the system was necessary for effective non-interventionist management. Some hold this view today, while others maintain that society may intervene to correct societal impacts on the ecosystem by using technology. These two views led to the manifestation of the ecosystem management paradigm in two related management approaches: the environmental management approach and the ecosystem-based management approach (Costanza 1998, 2000; Costanza et al. 1997). The environmental management approach encompasses practices to protect and rehabilitate the environment. It explicitly includes technology-based solutions to deal with the by-products of social use (e.g., effluents). The ecosystem-based management approach reflects a common-pool resources thinking (Dietz et al. 2003; Imperial 1999; Ostrom 1990), requiring “sound ecological models and understanding” while recognizing that the active involvement of humans is essential (Imperial 1999: 451). Within an ecosystem-based management approach the functioning of the ecosystem itself is central.

Though both the environmental management approach and the ecosystem-based management approach stem from the same paradigm, their fundamental difference lies in the reliance of the environmental management approach on technology as the means of tackling anthropogenic impacts.

Adaptive Management Paradigm

Practitioners and scholars from the integrated resources management field provided the arguments for an integrative view where ecological systems were not considered separately but in interaction with the social system as social-ecological systems. In this view, later termed the adaptive management paradigm (Dryzek 2005), society and the ecosystem are interrelated and society has to accommodate ecosystem dynamics. This contrasts with the view of society held in the ecosys-



tem management paradigm, where society has to protect, or be protected from the ecosystem dynamics. Essentially, the two paradigms differ in the way in which society's response to ecosystem dynamics is conceptualized. The ecosystem management paradigm is characterized by defensive societal responses (e.g., proclamation of conservation areas or flood prevention), while the adaptive management paradigm is characterized by inclusive societal responses to ecosystem dynamics (e.g., flood inundation areas).

The adaptive management paradigm is manifested in three related management approaches: the integrated resources management approach (Kidd and Shaw 2007; Mitchell 1990), the adaptive management approach (Lee 1993), and the adaptive co-management approach (Carlsson and Berkes 2005; Kofinas 2009). The integrated resources management approach focuses on the integration of three dimensions as a way of accommodating ecosystem dynamics: the integration of physical components of the water system itself (systemic integration), the integration of water and spatial planning (sectoral or vertical integration), and the integration of societal needs and ecosystems via rules and organizational practices (horizontal integration) (Kidd and Shaw 2007; Mitchell 1990; see figure 2).

The adaptive management approach focuses on incorporating knowledge on ecosystem functioning (e.g., from monitoring) and learning by doing (Lee 1993; Berkes and Folke 1998). The knowledge on ecosystem functioning and practical experience form the basis for changing the existing management practices and/or introducing new practices (Hamouda et al. 2004). The adaptive management approach facilitates the incorporation of research findings at an early stage of the cycle and integrates both societal actors' interests and policy practitioners' ideas (Pahl-Wostl 2007; Pahl-Wostl et al. 2008). It is the inclusion of the policy practitioners' ideas (and knowledge) that distinguishes the adaptive management approach from the ecosystem-based management approach.

The adaptive co-management approach (Carlsson and Berkes 2005; Dehnhardt and Petschow, 2008; Dietz et al. 2003; Folke et al. 2005; Olsson et al. 2004) is a community-based participatory version of the adaptive management approach. It maintains openness to scientific discoveries, the inclusion of the policy practitioners, and opts for deliberative and collaborative community-based management of the ecological system. This involvement of both community and policy practitioners, facilitates the learning process (Folke et al. 2009; Kofinas 2009).

The Two-Faced Nature of Institutions in SES Governance

Institutions, as systems of rules (Young et al. 2008; also termed formal institutions, North, 1990), are the means translating paradigms to management approaches. Institutions are social constructs that regulate, legitimize (Vatn 2005), and sustain the management approaches in the form of rules (Young et al. 2008). The importance of institutions and institutionalization processes are recognized and reported by scholars in the water management field (e.g., Imperial 2005; Lawrence et al. 2002). Imperial argues that “one way to make productive collaborative relationships endure is by institutionalizing them in a higher order set of rules or by creating new organizational structures. This minimizes potential governance problems and has the added benefit of diffusing policies, rules, norms, practices, procedures, and processes beyond the boundaries of the specific collaborative context where they developed” (2005: 303).

However, we contend that the hidden danger of institutionalization in governing social-ecological systems is an over-reliance on rules. This over-reliance has three potential implications. First, rules or practices that are successful in a specific context are transplanted to a different context without modification (Scott 1998) under the assumption that successful rules will always be successful. Second, it can cause policy practitioners to follow the rules blindly and act in a manner that deviates from the underlying paradigm while still claiming adherence to this paradigm. For example, local communities and innovators can unintentionally be excluded from the SES governance process (Vreugdenhil and Ker Rault 2009), even when an adaptive co-management approach is practiced. Third, it can lead policy practitioners to believe that the continued implementation of the paradigm can only be ensured by making new rules or modifying existing rules rather than adapting to the response provided by the social-ecological system. Such an over-reliance on rules is found when the term ecological surprises is used to express that the ecosystem dynamics do not match expected behavior. Examples include floods that exceed the expected water levels, or the increased local sediment deposition in the Elbe estuary owing to altered dynamics (Gerrits 2008), both of which can be perceived as surprises. In short, an over-reliance on rules as a mechanism for coping with ecosystem dynamics results in a reduced efficacy of institutions in dealing with the vagaries of nature (Healey 2006; Scott 1998) and an emerging mismatch between management approaches and their underlying paradigm. In the Elbe estuary, policy practition-



ers adhered to the environmental management approach. They had a strong technological focus and translated their understanding of the dynamics of the estuary into operational plans and schemes. A diverse and multi-disciplinary team was involved in the realization of the operational plans and schemes. However, the over-reliance on rules laid out in the operational plans and schemes resulted in the neglect of the ecosystem dynamics. Increased sediment deposition occurred in the Elbe estuary surprised the policy practitioners and forced them to invest in gaining an understanding of the ecosystem dynamics. The ecosystem dynamics of the Elbe estuary provided the signal that the governance of the coupled SES was proving ineffective owing to a mismatch between the existing environmental management approach and the underlying ecosystems management paradigm.

Whereas the Elbe Estuary example illustrates the neglect of ecosystem dynamics even when an ecosystem management paradigm is followed, the Polder Altenheim case study provides an example of flood retention where the societal dynamics are unintentionally neglected even when an adaptive management paradigm is followed. In both cases our argument is that both social and ecological dynamics need to be taken into account for effective SES governance.

Do You Hear the Voice of Society? The Case of Flood Retention in Polder Altenheim, Germany

The Integriertes Rhein Programm (Integrated Rhine Program; IRP) was developed for the Rhine section in Baden-Wuerttemberg, Germany (Gewässerdirektion Südlicher Oberrhein/Hochrhein 1997). In this section of the Rhine the construction of weirs has permitted control of the flow to provide conditions favorable for hydropower generation and shipping. As a result, floodplain wetlands were cut off from the river and flood protection levels were reduced in this stretch of the Rhine. In an attempt to increase the flood protection levels again, the IRP was developed. Measures in the IRP include dike relocation, the use of weirs, and the installation of thirteen retention areas in former floodplains.

Polder Altenheim was the first former floodplain installed as a retention area. This was even before the existence of the IRP and the flood defense plans back then consisted of the installation of five retention areas, each with a larger volume than the thirteen of the IRP. However, the first deliberate inundation of Polder Altenheim during a

flood in 1987 had major negative ecological impacts on the existing flora and fauna. Strong societal reaction to these impacts forced policy practitioners to adapt their management approach of direct implementation by increasing the number of floodplain retention areas to thirteen, reduce the inundation volume, and to integrate ecological enhancement in their planning using an ecological floods concept. The ecological floods concept encompasses regularly (56 times per year) allowing small inflows to the retention area so that the flora and fauna can adapt to near-natural conditions (Gewässerdirektion Südlicher Oberrhein/Hochrhein 1999).

Polder Altenheim was the first area in which the ecological floods concept was tested. The re-establishment of species and improved water and soil quality in Polder Altenheim was considered a positive development from an ecological point of view. Local society reacted positively to the increased naturalness of Polder Altenheim as it increased the quality of recreation. After these ecological and social successes, it was decided in the IRP that the ecological floods concept should be applied to other retention areas. The IRP was ratified in 1996, but so far only three of the thirteen former floodplain areas have been implemented as retention areas owing to opposition to changes in their environment from citizens.

Initially the IRP can be characterized as coherently planned by the policy practitioners (Vreugdenhil et al. 2008) based on an adaptive management paradigm, as the IRP complied with an integrated resource management approach. This is evidenced in the multi-disciplinary design and implementation teams of policy practitioners (engineers, ecologists, legist, and sociologists among others). However, the seeming strength of the multi-disciplinarity of the teams led to an unintended weakness: it resulted in a strong internal focus rather than engagement with society as the appointed teams considered themselves sufficiently diverse to tackle to problem, and did not realize that they unintentionally excluded other social actors.

The policy practitioners thus placed an increasing value on the ecosystem to the exclusion of the social system, thereby increasing tensions between practitioners and the citizens. Citizens were concerned about the (perceived) threats to their quality of life associated with the planned retention areas. Their opposition meant long delays in the implementation of the IRP and that the practitioners could no longer ignore the citizens.

This case study shows how the policy practitioners thought they were adhering to an integrated resource management approach by fo-



ocusing on multi-disciplinary integration within the teams. The policy practitioners focused on systemic and sectoral integration at the expense of horizontal integration (Kidd and Shaw 2007; Mitchell 1990). In terms of the implications of the over-reliance on rules, policy practitioners unknowingly followed the (integration) rules selectively as they excluded the social system. This means they acted in a manner that deviated from the underlying adaptive management paradigm while still claiming adherence to this paradigm. In addition, the ecological floods concept was transplanted from Polder Altenheim to other former floodplains with only marginal modification under the assumption that what was successful in Polder Altenheim would be successful elsewhere. The Polder Altenheim case study provides an illustration of the consequences of flood management practices that do not match their underlying paradigm owing to an over-reliance on rules. The increasing tensions between policy practitioners and citizens may be viewed as a signal that the governance of the coupled SES is proving ineffective.

Institutional Arrangements to Incorporate SES Dynamics

To avoid the problems associated with mismatches between management practices and their underlying paradigm, institutions (as the means translating paradigms to management approaches) need to have the capacity to co-evolve along with social and ecological dynamics. Taking into account the two-faced nature of institutions—namely, the beneficial function of institutions as the means translating paradigm to management approach and the danger of the over-reliance on rules—we recommend two ways in which institutions can increase their capacity to co-evolve. Our recommendations are distilled from our analysis of the SES governance paradigms and the Polder Altenheim case study.

First, we recommend institutional arrangements to *ensure and enable openness in actor participation*. Actors from local communities and relevant interest groups need to be included so as to support the transfer of knowledge to the SES governance processes (Scott 1998) and to ensure its transparency (De Bruijn et al. 2002: 49, 95).

Second, we recommend institutional arrangements to *enable updating of the management practices in response to SES dynamics*. This recommendation addresses the over-reliance on rule making yet maintains the function of institutions as the frame translating paradigm to

management approach. Practices (e.g., protocols) should not be encapsulated in laws. Instead the guiding principles of the management approach need to be reflected in policies. The practices need to be updatable in response to the SES dynamics, allowing sufficient flexibility at the level of local practitioners.

Governance of Social-Ecological Systems in Perspective

This article elaborates the evolution of social-ecological governance paradigms and their translation into management approaches via institutions. Institutions provide the ground in which we examine the mismatches between governance paradigms and management approaches. Examining the mismatches and their implications, we addressed the inability of management practices to effectively accommodate social-ecological dynamics. Floods are an example of an intrinsic inherent dynamic in a social-ecological system. Hence, paradigms on how to govern the dynamics of a SES are translated to management approaches to floods and flooding management practices via institutions. This article contributes to the reframing of floods by explicating the role of institutions in consistently translating governance paradigms to management approaches and identifying that problems arise when inconsistencies, in the form of mismatches, are present. The Polder Altenheim case study illustrates the consequences of flood management practices that do not match their underlying paradigm owing to an over-reliance on rules. More specific, the Polder Altenheim case study provides an example of flood retention where the societal dynamics are unintentionally neglected even when an adaptive management paradigm is followed.

To avoid the problems associated with mismatches between governance paradigms and management approaches, institutions as the means translating paradigms to management approaches need to have the capacity to co-evolve along with social and ecological dynamics. Our recommendations mean that the rules have to be updated responsively at the appropriate level of practice. In this way, the nature of institutions can evolve toward adaptive arrangements.

The possibilities for operationalization of these recommendations depend on the context (Scott 1998; Vreugdenhil et al. 2008) and remain a quest. However, we can present some pointers here.



(a) *To ensure and enable openness in actor participation*

— Pilot projects or transition experiments can be used to test different practices for ensuring openness in participation (Kemp et al. 2007; Vreugdenhil and Ker Rault 2009).

— At least three types of actors need to be involved—the local community, the practitioners, and the policy innovators. Scott (1998) demonstrates that local community actors are the carriers of system's memory, and Healey (2006) argues that actor participation in planning processes is the precondition for social learning. Policy practitioners hold the multi-disciplinary body of knowledge and can incorporate new scientific insights into management practice (Vreugdenhil et al. 2008). Policy innovators can be viewed as carriers of emerging dynamics and sensors of system's change (Huitema and Meijerink 2009). In summary, the local community, the practitioners, and the policy innovators are the carriers of the social and ecosystem dynamics.

(b) *To enable updating of the management practices in response to SES dynamics*

Transition management offers some insights and practical suggestions on how to respond to SES dynamics by testing innovative ideas and innovative practices in transition experiments. In particular, transition experiments demonstrate which practices are successful in enabling and accommodating innovation and how the existing suite of practices can be altered (Frantzeskaki et al. 2008; Loorbach 2007; Van der Brugge and Rotmans 2007; Van der Brugge and van Raak 2007; Van Buuren and Loorbach 2009).

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