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05. HOW
KNOWLEDGE
ENABLES
GOVERNANCE:
THE
CO-PRODUCTION
OF
ENVIRONMENTAL
GOVERNANCE
CAPACITY

Franke van der Molen [submitted]

Abstract

The creation and mobilization of knowledge are key issues in environmental governance. Consequently, understanding the roles that knowledge may play in governance is crucial for enabling well-informed governance arrangements. An aspect of knowledge-governance interactions that has received relatively little focused attention is that knowledge can be understood to be an intrinsic element of environmental governance. This paper aims to further the theoretical and empirical insight into this aspect. In order to do so, it elaborates a framework that conceptualizes various governance capacities in terms of the coproduction of knowledge, values, and social order. This framework is applied in the analysis of three cases of governance arrangements that notably concern the management of the Dutch Wadden Sea area. My findings suggest that settling disputes about natural resources and working towards a sustainable equilibrium between conserving and utilizing nature may be enabled by means of interactive and flexible governance arrangements that complement centralized governance. Moreover, knowledge may constitute the governance capacities that are needed for reaching such an equilibrium in various ways: as a steering mechanism, as a key to learning, and as a connective element of governance. The findings indicate that enabling well-informed environmental governance is not just a matter of managing the interfaces between knowledge and governance, but also a matter of capacity-building in order to bring about reflexive governance arrangements.

5.1 INTRODUCTION

A key question in many domains of environmental management is how the conservation of the natural environment and the utilization of natural resources can be balanced in a sustainable way. A growing body of literature suggests that governance-oriented forms of environmental management may contribute to realizing such a balance. Environmental governance encompasses forms of collective decision-making and action that are aimed at protecting the environment and resolving conflicts over natural resources; it usually entails the active involvement of both governmental and non-governmental actors (Paavola, 2007; Wallington et al., 2008; Tacconi, 2011; Driessen et al., 2012; Bixler, 2014). The literature has widely acknowledged that the creation and mobilization of knowledge are crucial issues with respect to environmental governance. For instance, environmental governance may involve informing decision-making on environmental change, bringing together a variety of scientific and other knowledges, and dealing with knowledge disputes that may exist between various groups of stakeholders (Burns & Stöhr, 2011; Evans et al., 2011; Armitage et al., 2015; Runhaar et al., 2016). One aspect of knowledge-

governance relations that has notably received attention in the literature is that realizing well-informed environmental governance requires managing the boundaries or interfaces that exist between knowledge and governance (Bremer & Glavovic, 2013a; Clarke et al., 2013; Wesselink et al., 2013). Such boundary management may involve processes of boundary work, such as coordination work and knowledge exchange between experts and policy-makers (Robinson & Wallington, 2012; Jordan, 2014; Wyborn, 2015b). Moreover, it may involve boundary organizations that “play an intermediary role between knowledge production and decision-making (in different domains and levels), with a view to achieving cooperation in relation to a shared objective” (Clarke et al., 2013: 94; see also van Enst et al., 2016). The recent literature usually conceptualizes such boundaries and interfaces as dynamic, interactive, and socially constructed phenomena (Bäckstrand, 2004; Bremer & Glavovic, 2013a; Wesselink et al., 2013; Janssen et al., 2015). In doing so, it implicitly or explicitly dismisses the “linear model” that depicts the relation between knowledge-creation and policy-making as a one-way flow across a static boundary or gap. (Atkinson and Klausen, 2011; Hegger et al., 2012; O’Toole & Coffey, 2013; Wesselink et al., 2013; Wyborn, 2015b).

What has received less attention is that knowledge, besides something that needs to be connected with or brought into governance, can also be seen as an intrinsic element of governance. This paper aims to further the theoretical and empirical insight into this aspect. Here, the term “intrinsic” signifies that performing environmental governance always involves knowledge in one way or another. In this paper I will operationalize this idea by means of a conceptual framework that combines the notion of governance as something that is constituted by a set of capacities (e.g., Termeer et al., 2013; Wyborn, 2015a) with the notion of the coproduction of knowledge and social order (Jasanoff, 2004).

The rationale behind this framework is twofold. Firstly, the framework distinguishes three key aspects of collaborative environmental governance. The first aspect is that environmental governance is a form of regulation that aims at reaching particular outcomes regarding the management or conservation of the environment (Lemos & Agrawal, 2006). The second aspect is that environmental governance often needs to deal with complex and dynamic processes in natural systems and with uncertainty on the effects of human interventions. Consequently, it has been argued that environmental governance arrangements need to be adaptive in order to be effective (Folke et al., 2005). The third aspect is that environmental governance usually includes a variety of governmental and non-governmental actors with diverging interests and perspectives. In order

to enable collaborative action such interests and perspectives need to be bridged or integrated (Raymond et al., 2010; Bohensky & Maru, 2011). From these three aspects may be inferred that performing environmental governance requires the capacities to regulate, adapt, and integrate. The next section provides a further operationalization of these three capacities on the basis of the environmental governance literature. Secondly, each of these capacities has an epistemic, a normative, and a social component. Thus, building and putting into action these capacities can be understood to be processes in which knowledge, values, and social order are coproduced (Jasanoff, 2004). I will use this framework to analyze how governance capacities were built and put into operation in three cases of coastal governance in the Netherlands. This analysis is notably focused toward identifying the roles of knowledge in relation to these capacities. This in turn may provide insight into the ways in which knowledge can be mobilized for building environmental governance capacity.

Section 5.2 provides an elaboration of the conceptual framework of coproduction and governance capacities. Subsequently, section 5.3 describes the materials and methods and briefly introduces the three cases. Section 5.4 provides the empirical results; it focuses on how governance capacities were built and put into action in the cases and it identifies cross-case patterns. Finally, section 5.5 provides a discussion and conclusion.

5.2 CONCEPTUAL FRAMEWORK

5.2.1 Coproduction

The term coproduction, as applied in the environmental governance literature, has two distinct meanings. Firstly, it is oftentimes used to denote a type of interactive process in which experts, policy-makers, and stakeholders are involved in the production, exchange, and application of knowledge (Berkes, 2009; Armitage et al., 2011; Edelenbos et al., 2011; Taylor & De Loë, 2012; Clarke et al., 2013). A second denotation of the concept concerns the ways in which knowledge and social order are created together. In this second sense “co-production is shorthand for the proposition that the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it” (Jasanoff, 2004: 2). From this perspective “knowledge and its material embodiments are at once products of social work and constitutive of social life; society cannot function without knowledge any more than knowledge can exist without appropriate social supports” (Jasanoff, 2004: 2-3). Thus, in this sense knowledge and social order are constructed together in social

practices and have a mutually constitutive relation. In recent environmental governance scholarship this second form of coproduction has been applied as an analytical framework, for instance in examining the interplay between knowledge and power dynamics in governance arrangements (Muñoz-Erickson, 2014). Moreover, it has been applied to conceptualize adaptive governance in terms of the “coproductive capacities” that “enable groups of actors to connect knowledge with action” in a governance context (Wyborn, 2015a). The latter application entails conceptualizing governance as a process of coproduction that involves the simultaneous employment of material, cognitive, social, and normative capacities (Wyborn, 2015a). The merit of this way of theorizing is that it conceptualizes knowledge as inherent to governance, thus lending insight into the roles of knowledge as a constitutive element of governance. However, it draws strong analytical divisions between knowledge, values, and social aspects by defining them in terms of distinct capacities (e.g., cognitive capacity, normative capacity, social capacity). The analytical framework I elaborate and apply in this paper provides a stronger analytical sensitivity to the intertwinements of knowledge, values, and social order, as it conceptualizes particular governance capacities as being constituted by the interplay of epistemic, normative, and social elements. The next section will provide a further operationalization of this conceptual framework based on the environmental governance literature. Table 5.1 summarizes the next section by providing a structured overview of the epistemic, normative, and social elements of the three governance capacities. These elements are not so neatly separated as this table may suggest; they are interrelated, imply each other, and may overlap.

5.2.2 Governance capacities

5.2.2.1 REGULATORY CAPACITY

Environmental governance involves organizing and steering collective action⁸⁵ in order to deal with environmental problems and conflicts (Paavola, 2007; Tacconi, 2011; Driessen et al., 2012). Thus, performing environmental governance requires regulatory capacity, which I define as the capacity to steer collective action with respect to the environment in desired directions.⁸⁶ This involves the formulation and pursuance of normative goals or visions, such as objectives laid down in environmental regulations or policies, or normative visions that have been formulated in the context of collaborative practices (Wyborn, 2015a). Moreover, it may

85 The term collective action in this paper refers to forms of human action with respect to the environment, such as the utilization and conservation of resources, in which multiple actors or collectives are involved.

86 This paper uses the term “regulatory” in a relatively broad social-scientific sense. It not only denotes legal forms of regulation but also other ways in which human action may be steered, organized, or directed.

		ELEMENTS OF GOVERNANCE CAPACITIES		
		EPISTEMIC	NORMATIVE	SOCIAL
GOVERNANCE CAPACITIES	REGULATORY	<ul style="list-style-type: none"> · Knowledge creation and mobilization as enablers or constituents of regulation 	<ul style="list-style-type: none"> · Goals · Visions · Limits 	<ul style="list-style-type: none"> · Rules · Power · Modes of governance
	ADAPTIVE	<ul style="list-style-type: none"> · Monitoring and understanding environmental change · Learning 	<ul style="list-style-type: none"> · Willingness and opportunity to adapt or revise decisions 	<ul style="list-style-type: none"> · Adaptive decision-making · Flexible arrangements · Iterative processes
	INTEGRATIVE	<ul style="list-style-type: none"> · Incorporation of a variety of knowledge forms · Incorporation of diverging knowledge systems 	<ul style="list-style-type: none"> · Incorporation of diverging values and normative frames 	<ul style="list-style-type: none"> · Joint knowledge creation processes · Organized reflection on normative frames and epistemological beliefs

Table 5.1: Conceptual framework

involve the enactment of normative limits, such as “natural limits” that determine to what extent natural resource use is possible without critically compromising ecosystem integrity (Swart and Van der Windt, 2012).

In this paper, I focus on governance arrangements as the locus in which governance capacities are built and put into action. Governance arrangements are temporary assemblages that combine the employment of coalition-building, power, discourses and rules in order to govern collective action (Arts et al., 2006). Of these four aspects, power and rules are the most closely and observably related to regulatory capacity. Power is both “the ability of actors to mobilise resources in order to achieve certain outcomes in social relations” and a “dispositional and a structural phenomenon of social and political systems” (Arts & Van Tatenhove, 2004: 343). Rules

may for instance include national and international legislations and rules that are laid down in collaborative agreements such as covenants.

Governance arrangements may encompass various ways in which knowledge and governance are interconnected. For instance, the ability to govern presupposes a “knowledge base” that informs decision-making; such a knowledge base for instance includes data, models, and practical experiences (Janssen et al., 2015: 313). However, governance arrangements may also encompass more intricate ways in which knowing and governing are interconnected. Power and knowledge for instance have been argued to constitute and imply each other; the exercise of power in a governance context necessarily involves knowing, just as much as producing knowledge for governance cannot be seen as independent of power relations (Van Assche et al., 2011; Winkel, 2012). Furthermore, rules laid down in environmental regulations and policies can structure the ways in which environmental issues are made knowable and measurable (Turnhout et al., 2014; Floor et al., 2016).

The social organization of governance arrangements may come in various forms; I highlight this variation in terms of different “modes of governance” (Driessen et al., 2012). Modes of governance are particular ways in which governance arrangements are structured; they include *centralized governance* in which national governments “take the lead”, *decentralized governance* in which regional or local governments are in the lead, *interactive governance* in which governments and societal actors “collaborate on equal terms”, and *self-governance* in which societal actors “enjoy far-reaching autonomy” (Driessen et al., 2012: 145, 148). Because these different modes of governance involve different divisions of competences and power among actors, they represent different ways in which collective action is organized and regulated. In this sense, they can be interpreted as different ways of organizing and tapping into regulatory capacity.

5.2.2.2 ADAPTIVE CAPACITY

The governance of complex social-ecological systems entails dealing with issues of environmental change, uncertainty, and unforeseen consequences of human interventions in nature (Folke et al., 2005). This requires environmental governance arrangements to be adaptive. Adaptive governance involves the capacity to “understand environmental change”, “use this understanding to inform decision making”, and “act on decisions in a manner that sustains resilience of desirable system states” (Evans et al., 2011: 21). Moreover, it involves the capacity to “review and adapt decisions as new information becomes available” (Cvitanovic et al., 2015:

26). Consequently, gathering knowledge through monitoring and learning from both ecosystem change and the effects of management interventions in natural systems are conceived to be key epistemic aspects of adaptive governing (Termeer et al., 2010; Weiss et al., 2012). On a normative level, adaptive governance requires the willingness to adapt or revise decisions in the light of changing circumstances.

In the adaptive governance literature, two key forms of learning are discerned. Firstly, due to its collaborative and participatory character, adaptive governance entails learning as a multi-actor process; this type of learning is also referred to as “social learning” (Pahl-Wostl et al., 2007; Rijke et al., 2012). The term social learning is used to denote changes in understanding that occur through social interactions and that become situated in social settings or practices (Reed et al., 2010). Secondly, in order to enable the adaptive capacity of governance arrangements, learning is to take place by means of feed-back loops between natural systems and adaptive governance arrangements (Berkes, 2010; Evans et al., 2011; Giebels et al., 2013; Wilson et al., 2013). These forms of learning may be enhanced by means of flexible governance arrangements and iterative governance processes (Clarvis & Engle, 2015). Consequently, knowledge creation, learning, openness to change, and flexible and adaptive social processes together constitute adaptive governance capacity.

5.2.2.3 INTEGRATIVE CAPACITY

In this paper, the term integrative capacity signifies the capacity to gain insight in diverging knowledges and normative perspectives and to bridge or integrate these for the sake of collaborative action with respect to the environment. Such capacity is required as environmental governance is usually a process in which different knowledgeable actors with different backgrounds, interests, and ideas are (expected to be) involved. Such knowledgeable actors may include citizens, scientists, NGOs, companies, and policy-makers (Birkenholtz, 2008; Edelenbos et al., 2011; Mauelshagen et al., 2014). Consequently, in environmental governance different knowledges and values meet and are confronted with each other.

A variety of concepts to distinguish between such differing knowledges can be found in the literature. Firstly, various conceptual distinctions have been applied in order to highlight the different forms or types of knowledge that may be relevant for environmental governance. For example, distinctions between scientific or expert knowledge and other forms of knowledge have often been highlighted (Birkenholtz, 2008; Berkes, 2009; Crona & Parker, 2012; Taylor & De Loë, 2012). Such “other” forms of

knowledge include local and indigenous knowledge; these terms usually signify forms of knowledge that resource-users have accumulated through close and long-standing interactions with the local environment (Ellis, 2005; Crona & Bodin, 2010; Taylor & De Loë, 2012; Bowie, 2013; Linke & Bruckmeier, 2015). Secondly, various concepts have been used to give expression to the idea that different or conflicting knowledges are embedded in different social and normative configurations. One of these concepts is the “knowledge system”, which signifies a social system encompassing knowledge claims, groups of actors, and ways of creating and exchanging knowledge; these elements together constitute a particular worldview or perspective on reality (Evans, 2010; O’Toole & Coffey, 2013). From this conceptual point of view, one of the key challenges of governance is to find fruitful linkages between conflicting knowledge systems, such as those of resource users and conservationists (King, 2004; Robinson & Wallington, 2012). A related line of environmental governance research focuses on the different “ways of knowing” of different coalitions of actors who are involved in governance (Janssen et al., 2015). Different ways of knowing “give rise to different understandings of precisely which factual knowledge is valid and relevant; they feed different world views, problem perceptions, and values” (Van Buuren, 2009: 209).

The literature that highlights different knowledges in the context of environmental governance suggests a number of ways in which the integrative capacity of governance arrangements may be built and put into action. Firstly, this may involve the integration or inclusion of various knowledges in governance, for instance by organizing joint knowledge creation processes in which various actors such as researchers, policy-makers, and stakeholders “cooperate in the exchange, production and application of knowledge” (Hegger et al., 2012: 53). Secondly, this may involve explicating and reflecting on often implicit “normative frames of reference” that actors with various backgrounds have (Van Buuren, 2009: 215). Thirdly, it may involve the identification and awareness of “the different epistemological beliefs which underpin knowledge claims”, such as beliefs concerning “the validity and reliability of different knowledge claims” (Raymond et al., 2010: 1775).

5.3 METHODS AND MATERIALS

5.3.1 Methodology

This paper is empirically informed by three case studies of coastal governance in the Netherlands. All three cases are related to the governance

of the Dutch Wadden Sea area. This area is part of a UNESCO world heritage site that covers parts of the coasts of the Netherlands, Germany, and Denmark. It includes intertidal zones, salt marshes, and barrier islands. Moreover, it is deemed highly valuable from both ecological and social-economic points of view. The central focus of the case studies was to understand the roles of knowledge in the emergence and functioning of environmental governance arrangements. The data collection was performed by means of 69 semi-structured interviews and 4 focus groups with key actors. Furthermore, relevant documents such as policy documents, meeting reports, and research reports were analyzed to provide additional data and validate the results of the interviews and focus groups. The cases were analyzed separately with software for qualitative data analysis (NVI-VO 10), using an inductive coding strategy with setting-specific codes that were constructed on the basis of the issues brought up by the respondents (Lofland et al., 2006). The detailed methods, results, and analyses of the three case studies are provided separately (see chapters 2-4). Subsequently, the three cases were analyzed together using the conceptual framework that has been described in section 5.2.

5.3.2 Introduction to the cases

5.3.2.1 THE TRANSITION OF THE MUSSEL FISHERY

The mussel fishery in the Dutch Wadden Sea was the object of a long-standing and often heated conflict between the mussel sector, the Dutch government, and a coalition of environmental protection NGOs. This conflict, which went through some of its most intense phases between 1990 and 2008, revolved around the question whether the mussel fishery could be reconciled with nature conservation and if so under what conditions. A series of legal cases instituted by the NGOs between 2004 and 2008 forced the mussel sector to switch to fishing methods with a lower ecological impact. As a result, a governance arrangement was started in 2008 in which the mussel sector, the NGOs, and the government participate. This arrangement combines a nature restoration program for the Dutch Wadden Sea with a stepwise transition towards mussel fishing methods that do not harm the seabed.

5.3.2.2 RECREATIONAL BOATING ON THE WADDEN SEA

The rise of recreational boating on the Wadden Sea in recent decades has caused concerns among nature conservationists and policy-makers about

its impact on bird and seal populations. In order to control this impact, several governance arrangements have been implemented since the 1980s. These arrangements include centralized legal regulations, collaborative agreements between governmental and societal organizations, and self-regulatory initiatives. The implementation of regulations has spurred conflicts between recreational boating organizations, environmental NGOs, and the government concerning both the effectiveness and necessity of nature conservation measures. In recent years, ongoing deliberations and governance renewal have reduced the level of conflict between these parties.

5.3.2.3 SAND NOURISHMENT

In 1990, the Dutch government implemented the coastal protection strategy of “dynamic preservation”, which focuses on countering coastal erosion by means of sand nourishment. The latter entails collecting sand from deeper parts of the North Sea and depositing it close to the shoreline or on the beach. Sand nourishment is thought to be an effective way of countering erosion that utilizes the natural dynamics of sand and water and that also facilitates adapting to sea-level rise. Dynamic preservation is a form of adaptive management that involves the ongoing monitoring of coastal erosion and responding to this erosion in a periodically updated sand nourishment program. Environmental protection NGOs have criticized this sand nourishment program because they argued that it was unregulated and did not take the ecological effects of sand nourishments into account. After several legal actions the Dutch Government and the NGOs started a collaborative governance arrangement. A key element of this arrangement is a research program on the ecological effects of sand nourishments. This program is to provide knowledge on how to optimize sand nourishments with respect to nature conservation.

5.4 RESULTS

5.4.1 Building regulatory capacity

5.4.1.1 THE MUSSEL FISHERY

Until 2008 the conflict on the Wadden Sea mussel fishery was fought out in legal proceedings, in which a coalition of NGOs challenged the fishing permits that the Dutch state had granted to the mussel sector. The playing field of this conflict shifted between 2004 and 2008 when, due to

legislative changes and several court rulings, the mussel sector became obliged to provide impact assessments that proved that their fishery did not significantly interfere with legal nature conservation objectives; these impact assessments were subsequently disputed by the NGOs. In 2008 the mussel fishing permit was nullified by the Dutch Council of State because such proof of no effect could not be provided. This created the leverage to start a governance arrangement that encompasses a transition process towards fishing methods with a lower ecological impact. A key epistemic element of the transition process is a monitoring and research program that provides knowledge concerning the status of the mussel stock and the results of the transition efforts. Thus, in this case a shift occurred from systematically challenging environmental impact assessments as a means of wielding power that was deployed by the NGOs involved, to joint knowledge creation as an enabling force for collaborative governance.

Besides a shifting role of knowledge in governance, these events reflect a shift of the normative orientation concerning the use of natural resources in the Wadden Sea area. The shifting regulations and jurisprudence show that nature conservation objectives have gradually gained primacy over resource use. Mussel fisheries and other forms of resource use have become forms of “human co-use” of nature that are only possible within the limits that are set by nature conservation objectives, notably those that have been laid down under the regulatory framework of Natura 2000.

Furthermore, these events reflect a shifting social order as the mode of governance shifted. Before 2008, the conflict focused on the question whether the centralized permit regime and the fishing permits it produced were legitimate; this conflict was fought out by means of the legal rules of the game. The shifting legislation and jurisprudence empowered the NGOs to introduce their nature restoration agenda in the fishery management. Moreover, it created a situation in which the NGOs, the mussel sector, and the government were enabled to collaborate on relatively equal terms, according to mutually agreed upon and negotiated rules, towards the shared objective of sustainable fishery. Consequently, a strongly interactive form of governance was introduced as a complement to the centralized permit regime.

5.4.1.2 RECREATIONAL BOATING

In recent decades, the governance of recreational boating on the Wadden Sea has been aimed at finding a balance between two key normative objectives: conserving nature by means of preventing the disturbance of birds and seals, and promoting the freedom to enjoy and experience nature in

a responsible manner. The efforts to find this balance have resulted in a gradual shift of governance towards decentralized, interactive, and self-governance. This shift has entailed a decreasing prominence of centralized command-and-control regulation, a rising prominence of societal organizations in governing, and the empowerment of individual sailors by means of self-regulation. Moreover, it has entailed a shift from legal rules to the application of voluntary and less formal rules, such as covenants and codes of conduct. There are two key motivations for this shift of governance. Firstly, nature conservation and recreational boating organizations have initiated various self-governance initiatives as alternatives for, and out of dissatisfaction with, rigid state-led regulation. Secondly, this shift has been motivated by the idea that sharing knowledge and building awareness among sailors on how to prevent disturbances is an effective way of protecting wildlife. Consequently, knowledge has increasingly been used as a regulatory instrument for nature conservation.

5.4.1.3 SAND NOURISHMENT

Initially, coastal protection by means of sand nourishments was focused on the normative objectives of countering coastal erosion and safeguarding long-term coastal safety. This sand nourishment practice was challenged by a coalition of environmental protection NGOs. Firstly, they criticized the unregulated character of this practice, as the Dutch government did not request permits under the Nature Conservation Act (NCA) for the execution of sand nourishments. Secondly, they argued that more knowledge was needed on the ecological effects of sand nourishments in order to attune coastal protection to nature conservation. Consequently, they took various formal actions to incite Rijkswaterstaat⁸⁷ (RWS) to request permits for sand nourishments under the NCA, as this would impose a formal decision-making and consultation procedure on sand nourishments. Moreover, this would impose the requirement to create and apply knowledge concerning the ecological effects of sand nourishments, as the NCA prescribes that a scientific assessment of such effects is to be part of the decision-making. After sustained pressure from the NGOs, the RWS started applying for permits under the NCA. Furthermore, RWS and the NGOs signed a covenant in which they agreed to exercise restraint in taking any further legal actions, and to participate in a collaborative research program on the ecological effects of sand nourishments. This program aims at providing knowledge for the optimization of sand nourishments with respect to nature conservation.

⁸⁷ Rijkswaterstaat is the executive department of the Dutch Ministry of Infrastructure and the Environment.

The initiatives of the nature conservation NGOs resulted in the emergence of an interactive form of governance in which they collaborate with the government. Furthermore, a combination of legal rules (the permit regime) and negotiated rules (the covenant) was applied in order to steer the practice of sand nourishments towards the objectives of nature conservation.

5.4.1.4 CROSS-CASE PATTERNS

In all three cases governance arrangements have emerged that are aimed at attuning human interventions in nature, such as fisheries and coastal protection, to nature conservation. The normative “driving force” behind this attunement appears to be twofold. Firstly, the cases indicate that knowing, appreciating, conserving, and restoring nature have gradually gained prominence in thinking about how human activities and interventions in coastal nature should be governed. Secondly, the cases show an emerging focus on balancing the utilization and conservation of nature in such a way that the level of conflict between these two objectives, and between the actor coalitions who promote these objectives, is kept as low as possible. In other words, these governance arrangements are normatively oriented towards harmonizing the intervention in and protection of coastal nature.

The regulatory capacity aimed at realizing such harmonization was built by combining these normative objectives with interactive forms of governance and the deployment of knowledge as a steering mechanism. This shift towards interactive governance is a shift of social order that has encompassed empowering stakeholders, starting collaborations between societal and governmental actors on relatively equal terms, governing according to negotiated and mutually agreed-upon rules of the game, and refraining from taking legal action in dealing with conflicts. Furthermore, knowledge has been deployed as a steering mechanism in several ways. These include using the legal requirements regarding environmental impact assessments as a means of wielding power, applying joint research and monitoring as a means of steering human interventions towards the aims of nature conservation, and using the dissemination of knowledge and the building of awareness as means of promoting ecologically responsible behavior.

5.4.2 Building adaptive capacity

5.4.2.1 THE MUSSEL FISHERY

The normative objective of the mussel transition is to replace traditional “seabed disturbing” mussel fishing methods with methods that collect mussel spat in the water column, thus inflicting no damage to the ecology of the seabed. The guiding principle of the transition process is “learning by doing”, which means that the transition process has a step-by-step, iterative process design in which learning from experiment and experience is a key element. The new collection method is scaled up stepwise; once a new transition step has yielded enough mussels a part of the fishery according to the old method is abandoned. The latter involves both lowering the quota for the traditional fishery and closing off areas in which wild mussel beds are likely to settle. Thus, the transition is an adaptive process in the sense that its speed is contingent upon both natural variability (the natural process of mussel spat fall) and innovation success (the amount of spat that the new technology manages to collect). In order to enable this adaptive process, a monitoring program is executed that provides knowledge on the mussel stock in the Wadden Sea, the yield of mussels produced by the new collection technology, and the development of mussel beds in the areas that have been closed off for nature restoration. Moreover, experimentation with new spat collection and mussel cultivation methods has been promoted as a means of enabling the transition towards sustainable mussel fishery. In sum, learning, adaptive management, and iterative and flexible forms of social organization have been combined in order to achieve the normative objective of a more sustainable mussel fishery.

5.4.2.2 RECREATIONAL BOATING

The governance of recreational boating has evolved in the last three decades due to an ongoing accumulation, renewal, and replacement of governance arrangements. A key driving force behind this change process has been the will, notably among stakeholders, to make governance more flexible, adaptive, and participatory. There is a strong normative orientation towards adapting to natural variability among various groups of actors involved because adaptive management is thought to improve both the effectiveness of nature conservation and the possibilities of recreating on the Wadden Sea. Adaptive management for instance allows for attuning conservation measures to the ongoing moving around of birds and seals

in the area; simultaneously, it allows for throwing open specific areas at times when there is no wildlife present, thus creating space for recreation.

This ongoing renewal of governance towards increased adaptivity has been enabled by means of temporary and flexible governance arrangements in at least two ways. Firstly, the application of various temporary arrangements, such as covenants with a fixed duration of e.g. four years, has spurred governance renewal and learning as it has incited participants to evaluate, identify improvements, and reformulate the rules of the game. Secondly, this renewal of governance has been enabled by pilots and experiments, such as pilots in which forms of self-regulation and adaptive management were tested in collaboration between sailors and government officials.

5.4.2.3 SAND NOURISHMENT

Dynamic preservation is an adaptive form of coastal engineering that requires ongoing feedback between monitoring erosion and programming and executing sand nourishments. The research program on ecology-oriented sand nourishment is embedded in the research and monitoring infrastructure that is to provide knowledge for the adaptive execution of sand nourishments. In this sense, it is one of the elements of a larger adaptive management practice. The program is aimed at learning about how adaptive coastal management by means of sand nourishments can be improved with respect to nature conservation. The participants in the program have given shape to this learning process by setting up and performing experimental “green sand nourishments” at the island of Ameland. This experiment encompassed designing and executing ecology-oriented sand nourishments, and monitoring their ecological effects for several years. Therefore, like the mussel transition this program has applied a learning-by-doing approach. Moreover, the research has been set up as a learning process by adaptively programming and focusing research activities on the basis of progressing insight and ongoing deliberations between the NGOs, researchers, and civil servants involved.

5.4.2.4 CROSS-CASE PATTERNS

The three cases suggest that adaptive capacity is a crucial aspect of governance for various reasons. The literature has often argued that adaptive capacity is needed in order to effectively respond to uncertain circumstances that are caused by natural variability; our cases confirm this. Furthermore, our cases suggest that adaptive capacity facilitates working

towards a shared normative objective, such as sustainable fisheries, under conditions that make it unclear how exactly that objective may be reached. Finally, adaptive capacity enables the improvement of governance in the long run by means of observing the effects of governance and if necessary altering the mode of governing.

In these cases, adaptive capacity was built by deploying knowledge creation for learning in several ways. Firstly, observing change by means of monitoring is has been a precondition for learning. Secondly, experimenting, for instance in the form of pilots or learning-by-doing approaches, has enabled both adaptation and the improvement of governance. Thirdly, organizing feed-back loops between governance and knowledge creation has facilitated learning and adapting in several ways. In these cases such feed-back loops were created by applying flexible and iterative process designs, and by working in temporary governance arrangements that were followed by evaluations.

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5.4.3 Building integrative capacity

5.4.3.1 THE MUSSEL FISHERY

The mussel sector and the environmental protection NGOs have conflicting normative and epistemic perspectives on the mussel fishery and its relation to nature. Whereas the mussel sector sees the traditional seabed-based mussel fishery and cultivation as a sustainable form of resource use that bears resemblance to organic farming or agricultural nature management, the NGOs see traditional mussel fishery as an obstacle for the recovery of the Wadden Sea ecosystem towards a richer and more pristine state. Thus, although sustainable mussel fishery is a shared normative objective of the mussel transition, the participants have diverging perspectives on what sustainability actually entails. Moreover, these parties have conflicting perceptions of risks, for instance concerning the introduction of invasive exotic species in the Wadden Sea as a result of shellfish transport. These conflicting perspectives have resulted in many knowledge disputes, for instance on scientific reports and impact assessments concerning the ecological impact of the mussel fishery.

In this case, frequent interactions and deliberations between the participants were organized in order to find common ground between their clashing perspectives. These have included organizing joint fact-finding processes and executing a joint research and monitoring program in order to create shared knowledge. These processes have been focused on creating facts that are deemed relevant and reliable by representatives of both

the mussel sector and the NGOs. Moreover, the involvement of trusted experts and independent process facilitators has supported these processes. Finally, knowledge reviews by independent experts have been applied to deal with conflicting interpretations of knowledge, for instance concerning ecological impacts of the mussel fishery.

5.4.3.2 RECREATIONAL BOATING

Efforts at attaining the two objectives of conserving nature and enabling the freedom of recreationists on the Wadden Sea have led to conflicts between governmental agencies, environmental protection NGOs, and recreational boating CSOs. These conflicts have revolved around diverging interpretations as to the gravity of wildlife disturbances and the necessity of particular conservation measures. The latter notably include the temporary or permanent closing off of parts of the Wadden Sea to recreational boating. Since the mid-2000s, a gradual shift has occurred from relatively polarized positions on these matters to a shared normative perspective between the parties involved. The gist of this shared perspective is that experiencing and protecting the Wadden Sea can go together well.

The emergence of this shared perspective has been enabled by a combination of factors. Firstly, sustained participation and deliberation in several collaborative governance arrangements has resulted in network-building and rapprochement between the various groups of actors involved. This rapprochement notably came about between environmental protection and recreational boating organizations, who for instance became aware of their shared dissatisfaction with rigid centralized regulations by collaborating in a covenant. Secondly, various initiatives of joint knowledge creation and knowledge exchange have contributed to this shared perspective. These initiatives include collaborative monitoring practices in which government officials, conservationists and recreationists have participated. Thirdly, conflicts on the gravity of wildlife disturbances and the necessity of conservation measures have gradually lost priority because pragmatic and adaptive ways of preventing disturbances have been implemented that meet the demands of both recreationists and conservationists. These include a voluntary code of conduct for sailors and adaptively closing off and throwing open protected areas.

5.4.3.3 SAND NOURISHMENT

Like the other two cases, the conflict on sand nourishment between RWS and the coalition of environmental protection NGOs involved a clash of

two perspectives. The dominant policy perspective on coastal protection by means of sand nourishment focused on coastal safety and morphology. The NGOs propagated an alternative perspective on sand nourishments, which focused on the ecological aspects of coastal protection. These perspectives were brought together in two ways. Firstly, after sustained legal pressure by the NGOs RWS started requesting permits under the NCA in 2008. Consequently, ecological impact assessments became a formal part of the decision-making on sand nourishments. Secondly, the collaborative research program on ecology-oriented sand nourishment introduced ecological aspects in the knowledge development on sand nourishments. In this research program, the ecological concerns of the NGOs were translated into research questions. In order to ensure that the ongoing research matched these concerns, an interactive research process has been followed with iterated feed-back and deliberation between the NGOs, civil servants and researchers.

5.4.3.4 CROSS-CASE PATTERNS

In all three cases, governing nature has involved dealing with the conflicting normative and epistemic perspectives of various groups of actors involved. Moreover, in all three cases integrative capacity has been built by re-arranging social order through setting up governance arrangements that provide for the sustained and iterated collaboration and deliberation between various groups of stakeholders. Within these arrangements knowledge has served as a connective element in several ways. Firstly, joint knowledge creation processes have been deployed in order to produce knowledge that is deemed relevant from the different perspectives involved. Secondly, knowledge exchange between stakeholders has facilitated finding common ground between diverging perspectives. Thirdly, the involvement of independent experts has contributed to dealing with conflicting perspectives, for instance by providing independent reviews of the available knowledge.

5.5 DISCUSSION AND CONCLUSION

Like environmental governance initiatives in many places around the world, the governance arrangements analyzed in this paper have sought to attune various human interventions in nature to the conservation and restoration of nature. These arrangements have aimed to reach this objective by means of settling conflicts between governments, resource users,

and conservationists, and by means of working towards objectives that meet the various concerns of these groups of actors.

This paper has argued that settling such conflicts and working towards sustainable human-environment relations is a multifaceted process that encompasses various forms of capacity building. Firstly, our analysis suggests that the regulatory capacity towards such aims may be built by engaging in interactive governance, which involves the active involvement and empowerment of societal stakeholders and negotiating and implementing mutually agreed-upon rules. Moreover, it suggests that such interactive governance processes do not replace but rather complement more hierarchical, centralized forms of governance such as governance arrangements that are connected to nature conservation legislations. Secondly, our analysis highlights various ways in which adaptive capacity may enable the sustainable governance of nature. For instance, adaptive capacity may enable responsive forms of governance that are able to adapt to dynamic natural systems, and may facilitate working towards shared objectives under conditions of uncertainty and lacking knowledge. Moreover, adaptive capacity may enable the long-term improvement of governance through the ongoing evaluation and renewal of temporary governance arrangements. Thirdly, the three cases show that integrative capacity may be built by means of governance arrangements that provide for the sustained and iterated collaboration and deliberation between various groups of stakeholders. My findings suggest that building integrative capacity requires both the reflection on diverging epistemic and normative perspectives among interested actors and a shared desire among these actors to somehow bridge or integrate their perspectives. Such bridging and integration may be facilitated by interactive knowledge processes such as knowledge exchange and joint knowledge creation. From this analysis may be concluded that settling disputes about natural resources and working towards a sustainable equilibrium between conserving and utilizing nature can be enabled by means of interactive and flexible governance arrangements that complement centralized governance and that provide spaces for joint knowledge creation and knowledge exchange. However, sustaining such arrangements may be challenging because it requires the long-term, intensive, and often voluntary involvement of various groups of actors with diverging interests.

The relations between environmental knowledge and various forms of environmental politics and action, such as management, policy-making, and governance, have received ample scholarly attention in recent decades. A prominent tradition within this scholarship conceptualizes these relations in terms of the boundaries and interfaces between environmen-

tal knowledge and governance. From this perspective, realizing well-informed governance requires the successful organization and management of interfaces between for instance experts and decision-makers or scientific and political institutions. However, there is more to knowledge-governance relations than the organization and management of interfaces. This paper has aimed to elaborate an additional perspective that provides an analytical sensitivity to aspects of knowledge-governance interrelations that have received less attention in the literature. The rationale of this perspective is that knowledge can be understood to be an intrinsic part of governance; moreover, knowledge can be understood to be a constitutive element of the various capacities that are needed in order to govern sustainable human-environment interactions.

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The results indicate that this additional perspective on knowledge-governance interactions has several merits. Firstly, it incites us to rethink the very notion of environmental governance. The literature often emphasizes that governance is a collaborative process of policy-making and regulation in which both governmental and non-governmental actors are involved. However, this paper suggests that it is also an essentially epistemic process. This means that environmental governance encompasses various forms of knowledge, various ways of knowing, and various knowledge-related dynamics and processes. Secondly, it helps to identify particular ways in which knowledge constitutes environmental governance capacities. My findings suggest that knowledge may serve as a steering mechanism for governance, for instance by using environmental impact assessments as a tool for improving the ecological soundness of human interventions in nature, or by using the building of knowledgeability and awareness as nature conservation instruments. Furthermore, well-informed environmental governance is constituted by learning, which may involve experimenting, learning by doing, and using temporary governance arrangements to enable governance renewal. Finally, knowledge may serve as a connective element of environmental governance. In the cases analyzed here, notably joint knowledge creation, knowledge exchange, and the involvement of experts have enabled collaborations between actors with different normative perspectives on how to utilize and conserve nature.

The framework of governance capacities that this paper has employed is an operationalization and application of the notion of the coproduction of knowledge and social order (Jasanoff 2004). Jasanoff has argued that coproduction is not a “fully fledged theory, claiming lawlike consistency and predictive power”, but rather “a way of interpreting and accounting for complex phenomena” (Jasanoff 2004: 3). Likewise, the framework of the epistemic, normative, and social aspects of governance capacities is not

a model with lawlike consistency or predictive power but rather a way of reasoning about the makings and workings of environmental governance. My findings suggest that this framework is useful for identifying the heterogeneous elements of knowledge, values, and social order that together constitute governance capacities. This paper has distinguished between regulatory, adaptive, and integrative capacities. This triad of governance capacities is notably applicable to environmental governance arrangements that face the challenges of dealing with dynamic and complex natural systems and dealing with a diversity of interested actors with diverging perspectives. Such challenges may occur in a variety of environmental governance domains, but need not always be as expressly present as in the cases I have studied. Consequently, not all three capacities are necessarily needed in all environmental governance arrangements; moreover, the framework may be expanded with other governance capacities that did not play prominent roles in the cases studied here. Still, such additional capacities may be argued to be constituted by epistemic, normative, and social elements.

A practical consequence of the way of reasoning I have elaborated in this paper is that building well-informed environmental governance arrangements is not just a matter of managing the interfaces between knowledge and governance; it is also a matter of capacity-building in order to enable the reflexivity of governance arrangements. Here, reflexivity has a twofold meaning. Firstly, it signifies the capacity to identify diverging normative and epistemic perspectives and to connect these perspectives to collaborative action with respect to the environment. Secondly, it signifies the capacity to gain insight into complex and dynamic natural systems and to respond to changes in an adaptive manner. My findings suggest that governance arrangements that combine these two forms of reflexivity may be enabled by a combination of negotiated rules, joint knowledge creation and knowledge exchange, adaptive and experimental governance, and interactions and deliberations between interested stakeholders.