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Assessing adaptive capacity through governance networks: The elaboration of the flood risk management plan in Austria

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A R T I C L E I N F O

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A B S T R A C T

One of the consequences of climate change is the increase in the frequency and entity of extreme weather events, including floods. Any strategy dealing with the various impacts of climate change must focus not only on mitigation aspects, but also on improving on the level of adaptive capacity. Over the past decades there has been an increase in the frequency and intensity of floods in Europe, a fact which has prompted the European Union (EU) to put forward the Directive 60/2007 (the 'Floods Directive'), requiring Member States to produce a comprehensive Flood Risk Management Plan (FRMP) by 2015. The purpose of this paper is to assess how the implementation of the 'Floods Directive' has contributed to the level of adaptive capacity in Austria, a EU member State hosting an important river basin. By relying on the existing literature, the paper first describes the governance system associated with flood risk management in Austria prior to the elaboration of the FRMP. Subsequently, based on collected primary data, the paper studies the governance structure associated with the elaboration of the FRMP in Austria by using descriptive social network analysis (SNA) and discusses the implications in terms of adaptive capacity of flood governance. The elaboration of the FRMP has had the merit of coordinating the pre-existing regional legislation into a coherent national framework, under the leadership of the Federal Ministry of Agriculture and Environment. A limited number of other public administration stakeholders act as brokers, but the overall governance structure appears centralized and exhibits low modularity. Such a structure, moreover, is exclusively composed of public administration actors with no de facto participation of other stakeholders (e.g., NGOs and private companies). The incorporation of a wider set of organizations in the earlier phases of the policy cycle is welcomed, in order to make the whole process less technocratic and effectively improve the overall level of adaptive capacity.

1. Introduction

One of the predicted consequences of climate change is the increase in both the intensity and frequency of extreme weather events, including floods (IPCC, 2014). In Europe an increase in the number of flood events and major flood events (i.e., flood events with registered casualties larger than 70 and/or direct damages larger than 0.005% of GDP) has been recorded over the period 1970–2005 (see Barredo, 2007). Between 1998 and 2009 over 200 major floods have occurred in Europe with overall economic damages estimated at 52 billion euros (European Environment Agency, 2011). Particularly damaging floods have occurred in the year 2002, affecting mainly the Elbe river in Germany, the Moldau and Elbe rivers in the Czech Republic and the Danube in Austria. More recently, a devastating flood affecting both the Elbe and the Danube occurred in June 2013. The largest economic damages occurred in Germany and Austria, with an estimate of over 1 billion euros and 870 million euros respectively (ICPDR, 2014).

The surge in the frequency of floods events and the increasing economic impacts associated with them, has been one of the factors which has prompted the European Commission to put forward the Directive 60/2007 (the 'Floods Directive') with the objective of reducing and managing the risks posed by floods to human lives, health and economies. The directive requires Member States (MS) to: a) carry preliminary risk assessment by 2011 and identify river basins and coastal areas at risk of floods; b) to elaborate detailed flood risk maps for the identified areas by 2013; c) to produce a comprehensive flood risk management plan (FRMP) by 2015. Although not explicitly mentioned in the 'Floods Directive', the concept of resilience is of relevance with respect to flood risk management. Because of the inherently dynamic nature of floods, the management of current and future risks is

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important to secure adaptation in the context of a changing climate (Priest et al., 2016).

Ecological resilience reflects the maximum shock a system can absorb without experiencing a regime shift (Folke, 2016; Walker et al., 2004; Holling 1973). This definition of resilience expressly acknowledges the possibility of multiple locally stable equilibria, novelty and change. For the purpose of this paper, it will be useful to refer to the concept of adaptive capacity when dealing with climate change adaptation. Adaptive capacity reflects the ability of a system to change and present innovative solutions in the face of disturbances (Armitage, 2005). Adaptation is a process of change in response to external stimuli and stress, while preserving the essential characteristics of a system (Nelson et al., 2007). In this sense adaptability crucially differs from transformability, whose emphasis is on creating new development pathways (for the system under consideration) in response to external shocks (Walker et al., 2009).

The objective of this paper is twofold. First, by relying on the existing literature, the paper describes the governance system associated with flood risk management in Austria prior to the elaboration of the FRMP. In this way, critical aspects are identified. Second, the paper assesses how the elaboration of the FRMP contributes to the adaptive capacity of Austrian institutions dealing with flood risk. To accomplish this second objective, first the FRMP is briefly presented in order to determine its influence on the flood risk management strategies. Subsequently, based on collected primary data, the governance structure associated with the elaboration of the FRMP in Austria is analyzed by using social network analysis (SNA). Although we acknowledge that the practical management strategies are important in determining the level of adaptability, in this article we focus our attention on the structure of the institutional network responsible for developing such strategies. The underlying hypothesis is that such a structure is also relevant in determining adaptive capacity (Carlsson and Sandström, 2008). Regarding the definition of governance, two aspects (as discussed by Stoker, 1998) are useful in the present context: a) governance refers to a set of institutions that go beyond government (thus including also non-governmental organization and eventually civil society); b) governance does not rest on the coercive powers of government, but sees the latter as capable of steering and guiding a process in order to achieve a desired common goal. Governance is thought of as a process, which is affected by the networks of political and social agents, in ways that can only be comprehended by analyzing the pattern of their relations (Christopoulos, 2017).

The rest of the paper is organized as follows. In the second section, the existing literature on adaptive capacity and network configurations of SES is briefly reviewed. In the third section, first a description of the Austrian governance structure up to the elaboration of the FRMP is presented, followed by a discussion on the main measures introduced by the FRMP and its incorporation into the Austrian flood risk management structure. In the fourth section, the methodological aspects of SNA and the data collection procedures are illustrated. In the fifth section, the empirical results are presented and discussed. In the last section, final conclusions are drawn.

2. Adaptive capacity and network configurations

The vast literature on governance networks and adaptive management of a coupled socio ecological system (SES) focuses on a number of network metrics like density, centrality, reachability, modularity, and cohesion (e.g., Chaffin et al., 2016; Valente, 2012; Sandström and Rova, 2009; Bodin et al., 2006; Janssen et al., 2006; Bodin and Norberg, 2005). For example, Sandström and Rova (2009) study the network structure of a fish management area in Sweden and report how the low degree of centrality negatively affects the ability to form rules, an important aspect in adaptive capacity. Chaffin et al. (2016), in the context of river basin management, report how increased density may indicate increased trust, increased communication sharing and possibly increased trust, all properties that correlate positively with the level of adaptive capacity.

In order to foster adaptive capacity, polycentric governance arrangements, structured around a number of different actors and institutions spanning across levels and connected through networks are necessary (Dietz et al., 2003). In particular, polycentricism allows for the redundancy necessary to buffer against unexpected changes (Huitelma et al., 2009). Governance structures should allow switching between two alternative modes (Folke et al., 2005): (1) maintaining the diversity necessary to prepare for change (e.g., favoring decentralization) and (2) promoting centralized coordination necessary to respond to changes. The configuration that best serves these purposes is one of a network partitioned in a number of modules (here generally defined as sub-parts of the whole network), to provide diversity (here generally defined as heterogeneity of actors, perspectives, resources); such modules should ideally be densely connected within and have a number of bridging ties connecting across, to provide coordination and promote collective action (Newman and Dale, 2005). Similarly, Carlsson and Sandström (2008) report that the network structure better equipped to ensure adaptability require both closure (i.e., density of within-group ties to ensure coordination) and heterogeneity (to ensure access to different resources). The literature reported here provides a backcloth against which our empirical results will be interpreted. We believe that three structural network aspects are particularly useful to assess the level of adaptive capacity in the present context, namely centrality, modularity and brokerage.

2.1. Centrality

Centrality measures refer to individual nodes. One of the most universal measures of centrality, betweenness, constitutes our measure of relative structural position. Betweenness "measures the number of times an actor is located on the path between two other actors in the network. Actors with high betweenness centrality could be brokers or entrepreneurs as they occupy a potentially privileged position in network structure" (: 494).

Another measure of centrality is indegree eigenvector centrality, which estimates centrality by weighting the relative centrality of all actors to whom the focal actor is connected to (Wasserman and Faust, 1994). It is in that respect a global centrality measure and provides an impression of the relative popularity of actors. In policy terms, it offers a good indication of those towards whom actors attempted to exercise influence.

2.2. Brokerage

A broker, in a network, is the actor who occupies a 'bridging' position, thus connecting otherwise unconnected actors. In order to analyze brokerage, we rely on Burt's measures of structural holes. Structural holes emerge when an actor's contacts are weakly connected between them, thus putting the actor in question in a brokerage position. These brokerage statistics offer an overview of the structural advantage or potential handicap from occupying specific network positions. The key statistics are effective size and constraint (Burt, 1992). The former is the number of alters, that an ego is directly connected to, minus a "redundancy" factor if those actors are already connected to one another (Burt, 2005). A high score implies an actor connects otherwise unconnected clusters and in its extreme score resembles a hub and spoke structure with ego being the hub.

Burt's constraint captures the degree to which an actor's network is "concentrated in one contact", the degree to which they are constrained and potentially exploited by brokers (Burt, 2005: 26). It can also be seen as the extent to which all of ego's relational investments directly or indirectly involve a single or few alters (ibid). The more constrained the actor, the fewer opportunities for action. Two other statistics include efficiency and hierarchy (see table S2 in SI for definitions). These