Adaptive co-management in the Venice lagoon? An analysis of current water and environmental management practices and prospects for change

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Abstract

Adaptive co-management (ACM) is often suggested as a way of handling the modern challenges of environmental governance, which include uncertainty and complexity. ACM is a novel combination of the learning dimension of adaptive management and the linkage dimension of co-management. As suggested by Armitage et al. (2007)*, there is a great need for more insight on enabling policy environments and conditions of adaptive co-management success and failure. Picking up on this agenda our paper will provide a case study of the world famous Venice lagoon in Italy. We address the following questions: first, to which extent is adaptive co-management currently practiced in the Venice system? Second, to which extent is learning taking place in the Venice system? And third, how is learning related to the implementation or non-implementation of adaptive co-management in the Venice system?*

Our analysis is based on interviews with stakeholders and archive data. The paper demonstrates that the prescriptions of adaptive co-management are hardly followed in the Venice lagoon, but some levels of cognitive learning do take place, be it very much within established management paradigms. Normative and relational learning is much rarer and when it occurs it seems to have a relatively opportunistic reason. We pose that especially the low levels of collaboration (the system was deliberately set up in a hierarchical and mono-centric way) and the limited possibilities for stakeholder participation are implicated in this finding as they cause low levels of social capital and an incapacity to handle disagreements and uncertainty very well.

Key words: governance, co-management, institutions, learning, adaptiveness, Venice lagoon

Introduction

These days it is hard to find anyone disagreeing with the notion that social-ecological systems (Berkes & Folke 1998) exhibit many 'wicked' traits such as non-reducibility, spontaneity and variability (Dryzek 1987). Those wanting to manage such systems face surprise, unpredictability, and the possibility of unexpected 'tipping points' (Lenton et al. 2008). The literatures on adaptive management (Gunderson & Holling 2002) and co-management (e.g. Wondolleck & Yaffee 2000) speak to these challenges and these two literatures are currently seen as converging into a literature on adaptive co-management (Olsson et al. 2004; Armitage et al. 2007). Adaptive management emphasizes learning and uses structured experimentation in combination with flexibility as ways to achieve this. Co-management emphasizes the sharing of rights, responsibilities, and power between different levels and sectors of government and civil society. Adaptive co-management, then, is a novel combination of the learning dimension of adaptive management and the linkage dimension of co-management (Olsson et al. 2004; Armitage et al. 2007).

The literature on adaptive co-management contains four institutional prescriptions that should be followed to enhance adaptability. As these have been discussed by Huitema et al. (2009), here we only need to briefly summarize them. Our discussion will concentrate on the assumed benefits of following these prescriptions. We are aware that any of these prescriptions also implies certain difficulties (also discussed by Huitema et al. 2009), but find them less relevant for our present purposes.

The first prescription revolves around polycentricity. Polycentric governance systems are defined as systems in which "political authority is dispersed to separately constituted bodies with overlapping jurisdictions that do not stand in hierarchical relationship to each other" (Skelcher 2005 p. 89). The literature on polycentric governance initially focused on the importance of local self control, making governance fit with local political preferences (e.g. Ostrom et al. 1961). More recent literature (e.g. McGinnis 1999; Oakerson 1999; Dietz et al. 2003; Karkkainen 2004; Ostrom 2005) suggests that polycentric governance systems are more resilient and better able to cope with change and uncertainty. The reasons for this are, first, that issues with different geographical scopes can be managed at different scales. Secondly, polycentric systems have a high degree of overlap and redundancy, and this makes them less vulnerable: if one unit fails, others may take over their functions (see e.g. Granovetter 1981; Perrow 1999). Finally, the large number of units makes it possible to experiment with new approaches so that the units can have the opportunity to learn from each other (Ostrom 2005 pp. 181-182).

The second prescription relates to public participation. We define public participation as the taking part, by ordinary citizens or their collectives, in the processes of government and/or governance; we refer to situations in which a (substantial) number of citizens play a part in the process by which leaders are chosen and policies are shaped and implemented (Birch 2007). Typical advantages of public participation are almost all - directly or indirectly - associated with various forms of learning. Public participation is expected to contribute to a better understanding of the social-ecological system - as all relevant sources of information are used, to greater reflexivity - as actors learn to understand how others understand the issues, to result in increased legitimacy and support for decisions taken -as actors are less likely to oppose decisions they have taken themselves, and in greater accountability and transparency - as decisions need to be publicly explained and motivated (see e.g. Renn et al. 1995; Coenen et al. 1998; Huitema 2002; Ridder et al. 2005; Mostert et al. 2007).

The third institutional prescription, experimentation, is about planned interventions in the social-ecological system and the monitoring of their results (e.g. Lee 1999; Richter et al. 2003). Full blown experiments are characterized by explicit hypotheses about relation between interventions and their effects, and by comparison with reference situations where no intervention was made. These are difficult to implement in real world governance settings, if only because treating two comparable situations differently results in opposition (Fischer 1995). This is why most experiments in reality are "quasi-experiments", which refers to the fact that either a control group was not present or that no explicit hypothesis was formulated about the effects of the interventions beforehand. Interpreted this way, any intervention or policy can be seen as an experiment and a way of testing hypotheses (see e.g. Walters 1997; Pahl-Wostl 2006) and opportunity for learning. Indeed, learning is a key goal of experiments. In the policy sciences, experimentation is viewed as one of the most rigorous methodologies for factual learning, but the prospects for more reflexive forms of learning are often deemed to be somewhat dimmer (see for instance Fischer 1995; Greenberg et al. 2003). There is however a group of authors who suggest that experiments can function as "boundary objects" (Huitema & Turnhout 2009) for bringing in multiple stakeholders. Even though the experiment might have only a factual learning agenda, greater reflexiveness might be an additional effect as those involved in the experiment can improve network relations through repeated interactions and the emergence of trust (Lejano & Ingram 2009). This in turn is expected to increase their capacity to deal with uncertainty and change (e.g. Moberg & Galaz 2005).

The fourth prescription of adaptive co-management is to organize management at the bioregional level such as a river basin, also when such a bioregion crosses administrative boundaries. Among governance scholars, the creation of institutions at the appropriate scale is discussed as a matter of "optimization" (Ahn et al. 1998) or "fit" (Young 2002). Both concepts refer to the congruence or compatibility between ecosystems and institutional arrangements (Young 2002 pp. 20-22). The arguments speaking in favor of the creation of a bioregional approach are mainly related to the perceived failures of existing resource management institutions. These include lack of recognition of interdependencies at the river-basin scale; lack of cooperation between institutions; lack of transparency, making the institutional structure difficult to understand for "outsiders" and thereby limiting (public) participation; overlooking of problems that do not fit in established programs; and finally, the existence of a lax management setting in which special interests such as farmers and industry can dominate (Schlager & Blomquist 2000 pp. 2-3). River-basin-scale institutions are supposed to address these.

Adaptive (co-)management is attractive as an idea but very hard to introduce and sustain in practice (Lee 1999). Different responses to this conclusion are possible. One is to submit adaptive co-management as a Weberian "ideal type", declaring it only a hypothetical concept in the abstract and a subjective notion which might inspire practice but will never be fully realized. Another is more empirical; this would entail questions about what holds back the introduction of adaptive co-management in real life settings, but also an assessment of the consequences of non-implementation. This article is meant in the second vein. Thus we follow Armitage et al. (2007 pp. 6-10), who pointed to the need to move beyond "the limits" of adaptive co-management, and suggest "policy implications" as a key theme for research, pointing to the need for more insight on enabling policy environments and "conditions of adaptive co-management success and failure." Questions to be answered under these headings relate to ways to establish cross-level linkages, the conditions for partnerships that really share power, and ways to move from instrumental learning to learning about appropriate goals.

One way to empirically learn more about enabling environments for adaptive co-management is to focus on case studies where the concept of adaptive co-management potentially has much added value but is not fully applied, or not fully applied yet. This article presents just such a case study, as we focus on the world famous Venice lagoon in Italy. The Venice lagoon presents a case study where the importance of water and environmental management is profound and uncertainties about future developments loom large.

The present article attempts to bring the discussion about the feasibility and efficacy of adaptive co-management further by answering three questions, centered on the management of the Venice lagoon in Italy:

- To which extent is adaptive co-management currently practiced in the Venice system?
- To which extent is learning taking place in the Venice system?
- How is learning related to the implementation or non implementation of the prescriptions of adaptive co-management?

In the next section of this paper we describe our methodological approach. In the third section we introduce the social-ecological context of our case study. Then, in sections four to seven, we apply the adaptive co-management prescriptions i as a normative framework for assessing the ongoing water and environmental management efforts at safeguarding the Venice lagoon. In so doing, we provide a critique of the current safeguarding measures that are being implemented in this world famous city.

But just assessing the ongoing efforts in the Venice lagoon does not suffice. Furthering the analytical agenda related to ACM also requires understanding about the consequences of the implementation or non-implementation of the prescriptions in terms of the central goal of learning. To analyze the level of learning that is taking place in the management system of the Venice lagoon, we apply the typology of learning that was described in this journal by Huitema et al. (2010). This means we pay attention to cognitive, normative and relational learning that takes place in the management system. An elaboration of this typology can be found in section eight. In section nine, ten and eleven we apply the typology to the Venice lagoon; in section twelve then we relate the levels of learning we have found to the implementation of the prescriptions. We conclude this article by discussion our findings and providing several suggestions for improving the management system so as to increase the possibilities for learning (section thirteen).

Data and methodological approach

The empirical findings presented in this article are based on a number of methods. We have performed secondary analysis of existing scientific accounts of Venetian water management (such as Dente et al. 1998; Giupponi et al. 2001; Suman et al. 2005), we have done archive analysis (studying several policy plans, assessment and thematic reports of national, regional and local agencies, research centers and

NGOs such as the Venice office of Italia Nostra and Ambiente Venezia), have gone through the relevant local newspaper articles on flood protection in Venice between 2004 and 2010 (e.g. Il Gazzettino, La Nuova Venezia, Il Corriere del Veneto), and have held a set of sixteen interviews with key policy makers and stakeholders in the basin between March and June 2010.

All our interviewees have extensive knowledge about the safeguarding of the Venice lagoon and in particular on water and environmental management. The interviewees were selected on the basis of their working position (we wanted to cover all level of government and the main sectoral agencies dealing with water and environment), their expertise, and their views on the safeguarding of Venice. The interviewees requested to remain anonymous, and therefore a list of interviewees is not provided and the interviewees are only referred to here by their position. One person we approached, an NGO representative, declined to be interviewed and referred us to the website of her organization. In the interviews, a semi structured set of questions was used to elicit knowledge on climate change and governance of the Venice lagoon. The questions we asked our interviewees included the options and challenges for the safeguarding of Venice, the effectiveness and the impacts of the existing institutional arrangements, the visions for the future of Venice and the policy needs to reform the current institutional system.

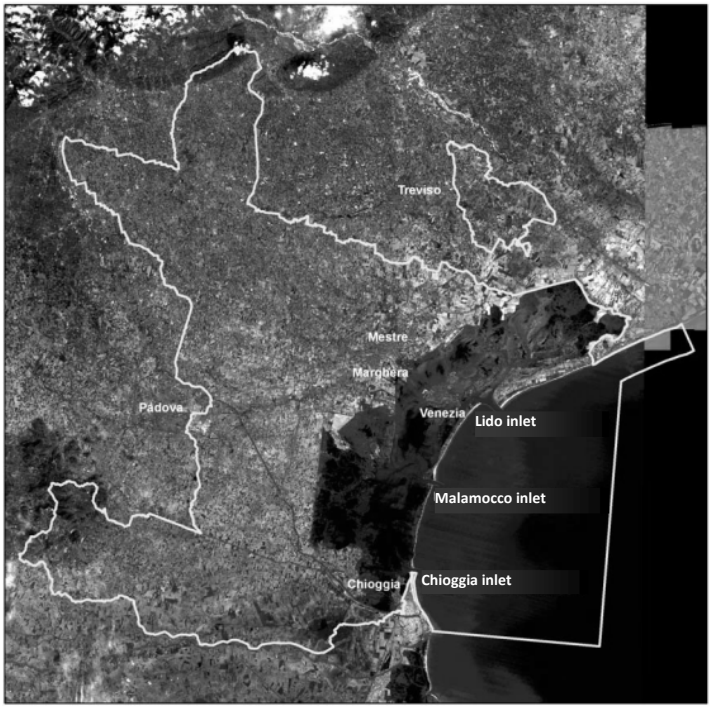
To answer all research questions, we have drawn on the interviews, the legal documents, the key organizations' policy, programs and plan documents, the NGOs documents and the newspaper articles. By analyzing this material we gained understanding about actors' perspectives, their networks and coalitions, authority and power relations, informal rules, and discourses on the safeguarding of Venice and their evolution in time. All this information was used to assess the level of implementation of adaptive co-management and policy learning. The interpretation of the results was facilitated by the fact that the first author has firsthand experience on the functioning of the Venice system having worked for 6 years in the role of member of the technical secretariat of the *Ufficio di Piano* (UdP). This is a technical committee advising the national government on priorities to safeguarding Venice and its lagoon from a physical, environmental and socio-economic perspective. The first author performed participatory observation, in the sense that she was involved in the preparation of and attended all 67 UdP meetings from October 2004 to December 2010. In this capacity she had a range of informal interactions meetings with the members of the committee and the experts invited to report at the UdP. Finally, she was involved in the drafting of all the UdP advisory documents and thematic reports. Most of this information (minutes, notes, presentations) is confidential and cannot be directly quoted here (however

UdP advisory documents and reports are publicly available in Italian from: http://www.magisacque.it/uff_piano/uff_piano.htm.

The Venice lagoon system

The Venice lagoon is the largest coastal lagoon of the Mediterranean region. About 60 km of sand strips, separate the lagoon from the Nord Adriatic Sea. Three inlets allow exchange of water with the sea. An intricate network of rivers, streams and artificial channels spanning on about 2,000 km^2 of catchment basin ensure the inflow of freshwater into the lagoon through several estuaries. About 87% of the total 550 km^2 lagoon surface is open to the tide, with the closed surfaces occupied by fish farming. Land covers about 8% of the lagoon and is spread over more than one hundred islands, coastal strips, reclaimed land and banks (see figure 1).

Figure 1 - The Venice lagoon, its catchment basin and the near-shore sea according to the Special Law



Source: Regione Veneto - Piano Direttore 2000

The lagoon has a great variety of ecosystems. Typical coastal and marine environments such as beaches and dunes stretch along the littoral strips. Salt marshes, mud flats and shallows cut by a dense network of tidal creek characterize the brackish lagoon basin, particularly the northern lagoon and the central-southern internal edge. Sea grass meadows grow on deeper lagoon beds, mostly along the coastal strips,

near the inlets. Typical fresh water environments colonized by reed and cattail are commonly found along waterways and rivers estuaries flowing into the lagoon.

The world-famous city of Venice is located at the heart of the lagoon. The magnificence of its architecture and art and the natural environment that support it have been recognized by UNESCO which included Venice and its lagoon in the World Heritage List in the year 1987. The second biggest center is the historical city of Chioggia in the southern lagoon. The city has a small commercial port, a large fishing fleet and a beach area. The population in the lagoon islands has been declining from 170,000 inhabitants in the 1950s down to 90,000 inhabitants at present time. Inhabitants mostly moved to the nearby mainland, in the cities of Mestre and Marghera that are part of the municipality of Venice (see figure 1). Since the 1930s Marghera has a chemical and petrochemical industrial area ("Porto Marghera"), which has grown to about 2,000 ha. Nowadays the area is heavily contaminated, some industrial plants have been abandoned and a cleaning up plan is being implemented under the responsibility of the Ministry of the Environment. Outside the cities, agriculture is the prevailing use of land in the catchments basin.

Humans, water and nature are profoundly interrelated and influence each other to a great extent in the Venice lagoon. Nowadays, morphological instability and water level variation represent the two major threats for the physical survival of the lagoon. The lagoon morphology depends on the equilibrium between the amounts of solid material brought by the sea and the rivers and the erosive forces of waves and tidal currents inside the lagoon basin. The diversion of the major rivers and the reconfiguration of the inlets morphology (started in the 16th century) and the dredging of deep navigation channels in the 20th century along with wave motion and modern clam harvesting techniques have caused severe erosion and the progressive transformation of the lagoon into a marine environment. In the last decades alone, the surface area of the salt marshes (typical lagoon morphological structures) has been reduced by one third (Mag.Acque-Thetis 2006). Water level variation in the lagoon is a phenomenon driven by tides and storm surges occurring mainly between November and February. Due to natural and human induced subsidence and sea-level rise, frequency of high water events that flood more than 10% of the city of Venice (up to 99%, depending on the event) has increased from an average of 1 event every 2 years in the period 1872-1955 to an average of 4 events per year in the period 1955-2010. Each high water event floods the lagoon urban centers for a few hours causing damage to the economy, discomfort for inhabitants, and degradation of urban infrastructure. High waters are major source of urban degradation which is visible in the aging of historical buildings foundations, bridges and urban

infrastructures. The loss of typical habitat and biodiversity is the major consequence of the construction of touristic infrastructures on the coast, clam harvesting techniques and motorboats transit. In the 1980s, bloom of algae and anoxia phenomenon revealed significant water and sediment contamination while severe land contamination in the industrial area of Porto Marghera has been addressed in more recent times. At present, climate change is considered one of the possible major drivers of the future alteration of the lagoon ecosystem and of more frequent high waters in the city of Venice.

The governance system

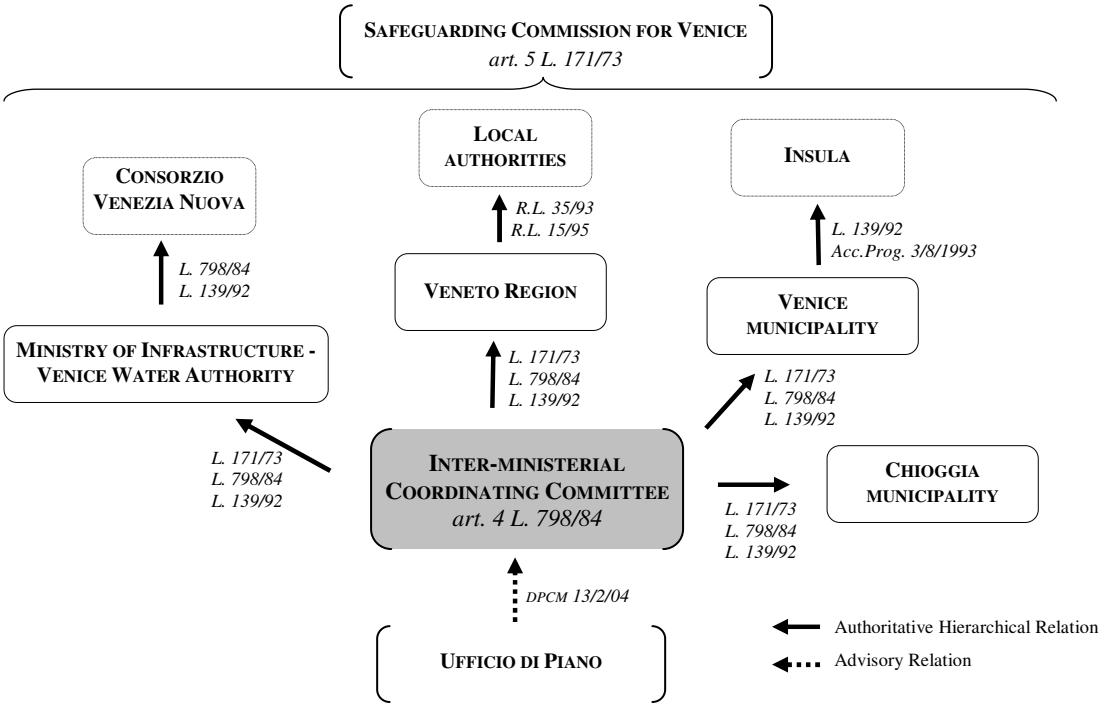
National and local governments have started to systematically address the safeguarding of Venice and its lagoon, i.e. human safety, urban degradation and environmental deterioration, since the early 1970s. At that time the Italian government established a specific safeguarding regime known as the Special Law for Venice (see figure 2). The regime set objectives, responsibilities, instruments, measures and economic resources for carrying out safeguarding activities in Venice. Major goals were the protection of urban centers from floods, the protection of coastal strips from erosion and sea storms, the re-establishment of the hydro-geo-morphological equilibrium of the lagoon, the abatement of water pollution both in the catchment basin and the lagoon basin, and the promotion of socio-economic development of the historical lagoon settlements (Law n. 171 of 16 April 1973; Law n. 798 of 29 November 1984). An integrated system of storm surge barriers at the inlet and local defenses (i.e. raising public pavements and restoring banks) to protect the urban centers from high waters are two major infrastructural works under construction.

At the national level, the Ministry of Infrastructure and Transport is involved in the management of the lagoon through its local branch, the Venice Water Authority. Dealing with water management and navigation control in the lagoon since 1907, the Authority is also in charge of the planning and execution of the safeguarding works delegated by the Special Law (Law n. 171 of 16 April 1973; Law n. 798 of 29 November 1984; Law n. 139 of 5 February 1992). Works are carried out by a private concessionaire of the Ministry of Infrastructure and Transport, named *Consorzio Venezia Nuova* (CVN). The CVN is building the storm surge barriers, the local defenses and the coastal defenses. It also implements a plan for morphological restoration including reconstruction of morphological structures and natural habitats. Scientific studies and systematical monitoring of the lagoon environment are also part of the CVN activities.

The Special Law implies that the Veneto Region, the Venice Municipality, the Chioggia Municipality, and the Safeguarding Commission for Venice are involved in the management of the lagoon. The Veneto Region is in charge of abating water pollution in the catchment basin of the lagoon. This is an area of 2,000 km^2 counting 4 provinces, 108 municipalities (including the Venice and Chioggia Municipality) and more than 1 million inhabitants. The region allocates the Special Law funds to local authorities (e.g. municipalities, water bodies, land reclamation consortia) in the territory of the catchment basin. The Venice and Chioggia municipalities are in charge of the maintenance of historical, cultural, architectural heritage and of supporting local socio-economic development, even through their own private companies. Finally, the Safeguarding Commission for Venice expresses its binding advice to project developers and approving authorities on all building works and territorial transformation planned by private and public bodies within the Venice lagoon.

Decisions about major safeguarding works and allocation of financial resources are taken by an Inter-ministerial committee (*Comitatone*) in which also the regional and local governments are represented (Law n. 798 of 29 November 1984). In 2004, the Italian government decided to support the Comitatone with a technical advisory Committee, called *Ufficio di Piano* which is a mixed committee of national and international experts and local policy-makers. To increase the effectiveness of some interventions, the administrations implement joint actions through specific inter-institutional legal agreements. From 1984 to 2009 the government has allocated about 10.2 billion Euros to achieve the safeguarding objectives, of which 8.8 billion Euros have already been spent. It is now assessed that another 6.1 billion Euros are needed to enable the completion of the safeguarding activities as intended at the time the Special Law regime was passed (Ufficio di Piano 2010).

Figure 2 - Institutional setting established by the Special Law for Venice and other related regulations



Source: Munaretto et al. 2010, forthcoming

Beside the Special Law regime, the Italian Water Law (Law n. 183 of 18 May 1989) established regional water boards. Because the water law kept the competences of the Venice Water Authority untouched, the Alto Adriatico water board that comprises five river basins, including Venice, has little authority over the lagoon. The new law (Legislative Decree n. 152 of 3 April 2006) transposing the EU Water Framework Directive changed the water governance system. The water boards are to be replaced with Water District Authorities having jurisdiction over much larger districts. In the interim, the water boards together with the regional administrations are responsible for the management of the water districts. The Venice lagoon falls into the Alpi Orientali District that encompasses 13 river basins stretching over three regions and two autonomous provinces and two water boards i.e. the Alto Adriatico and the Adige. The Venice Water Authority competences over the lagoon are unchanged.

In the next sections we review to which extent this governance regime is in line with the prescriptions of the adaptive co-management, the extent to which learning is taking place, and what is the connection between the prescriptions and learning. In the section that follows, we analyze the extent to which the Venice lagoon management regime conforms to the prescriptions of the adaptive co-management

literature, starting with the idea that governance regimes should be polycentric, and then moving to the issues of participation, experimentation and an approach at the ecosystem level.

Implementing adaptive co-management in the Venice lagoon: polycentric institutions?

The complex division of responsibilities and the extensive set of public and semi-public authorities involved in the management of the Venice lagoon suggest that the system indeed exhibits a certain degree of polycentricity in the sense that power is shared between many actors with overlapping responsibilities. Polycentricity is not only about the sharing of control; it is also about the freedom of local authorities to apply policies fitting with local preferences. In this respect the system does not exhibit polycentric features as a national agency, i.e. the Venice Water Authority, and its concessionaire the CVN are influential actors in the system. Furthermore, for effective polycentric institutions wide cooperation is crucial. The system does not exhibit such cooperation however. Our interviewees suggest that a hierarchical approach to decisions and lack of trust that stems from unresolved institutional disputes have led to a breakdown of the cooperation among public actors.

By empowering the Venice Water Authority and the CVN to carry out most of the safeguarding works, the Special Law took away local power. In fact, although these two organizations are operating purely at the local level, they base their activity on the national agenda. They directly bring their project proposals and their request of funding to the national government via the Inter-ministerial committee. Although represented in the committee, the local authorities have not as much influence as the national authorities. More room exists for the Venice municipality to influence decisions within the Safeguarding Commission for Venice, which is made up of local experts. In this decision-making arena the municipality however succeeded only a few times to make its position prevail.

Orchestrating all institutions in the system requires a lot of collaboration which is difficult to accomplish because governments have different levels of influence on decisions. The Venice Water Authority and its concessionaire successfully network within the national government but do not see fit to link with the local authorities and the community. Having a direct relationship with the national government contributed to ignorance of the need to create local support for national decisions. In addition, as technical organizations made up and headed by technical expertise, their mission is to have safeguarding works done more than building bridging and bonding social capital. In reaction to that, local authorities, particularly the Venice Municipality and several environmental groups, developed an

opposing and sometimes ideological attitude towards most national decisions, the Venice Water Authority and the CVN (*Interviews: national agency officers, practitioners, June 2010)*. The defensive strategy of the Venice Water Authority and the CVN and the offensive strategy of the Venice Municipality often created several disputes. As these were never resolved, they have become a major barrier to cooperation as trust among actors has eroded. This situation impaired the possibility to build consensus over major safeguarding works such as the storm surge barriers. On the national political agenda since the mid 1980s, this project has always been opposed by the Venice Municipality, environmental and citizens groups and a number of local scientists. Their main objections focus on the threat to the lagoon's ecological balance. On this point extensive scientific studies have been carried out over the years by the project proponent and third parties. Scientific evidence has been politicized by both supporters and opponents; in the end the position of the government prevailed.

Cooperation requires a culture of willingness to work together. The Italian government culture is however very different. Every government agency is out to assert its leadership by adopting a hierarchical approach and seeking to 'streamline' decision procedures in such a way that other actors are essentially overridden (Arian & Barnes 1974; Keating 1997; Mack Smith 1997; Huysseune 2003). The idea of a hierarchical approach is embedded even more strongly in the Venice lagoon, as it is a unique case in Italy where a national governmental agency (the Venice Water Authority) still has water management competences whereas in the rest of the country they have been passed to the regions. But the Veneto Region has water management competences in the entire surrounding territory of the lagoon, and challenges the national control. On its turn, the municipality of Venice calls for greater freedom to decide safeguarding policies over its territory. The overall effect of this competition for control is that cooperation becomes very difficult. Inter-institutional agreements by which costs of works are shared and official procedures simplified are the vehicle for formally arranging the collaboration between government actors. This form of agreement is used not as often as necessary, however and those deals that have been reached, required very long negotiations, and were only possible because there was a clear benefit for the parties involved and principled questions related to responsibilities are avoided. For example the inter-institutional agreement of 3 August 1993 between the Venice Water Authority, Venice Municipality, Veneto Region on flood protection and urban infrastructure maintenance, was reached because the Special Law charged the municipality with the responsibility of building local defenses in Venice and this task was overlapping with the responsibilities of the Region and the Venice Water Authority. Even after long negotiations, not all agreements are fully implemented. The inter-institutional agreement of 31 October 2003 between the Veneto Region and the

Venice Water Authority on environmental monitoring in the lagoon, for instance, has not yet resulted in a single water monitoring system.

Implementing adaptive co-management in the Venice lagoon: public participation?

Turning to the issue of public participation, we can observe that there is no tradition of public participation and the decision making culture in the lagoon is not favorable to it (Dente et al. 1998; Giupponi & Brochier 2001; Giupponi et al. 2001; Sors 2001). Despite some progress in encouraging public involvement in decision making (also in fulfillment of EU requirements) past experiences did not produce successful outcomes (Sors 2001) in the sense that either the participative processes were not taken to an end or feedback was not provided to the participants. In both cases the result is that people feel frustrated and lose motivation to participative processes (*Interview: scientist, June 2010*). According to Giupponi et al. (2001) factors contributing to the failure of participative processes in Venice include the endless debate on Venice future, the complex decisional and institutional context, the high number of actors involved and the numerous conflicting interests. Findings of Dente et al. (1998) indicate that the public consultation process is dominated by environmental groups. This is a pity because other societal actors also have a high level of awareness of local issues (Giupponi et al. 2001) and their participation in management decisions could be beneficial for understanding the functioning of the Venice social-ecological system. Another aspect that may discourage public participation is that the center of coordination for the most relevant safeguarding decisions is far removed from the local community. All meetings of the Inter-ministerial committee, in fact, have always taken place in Rome. Meeting in Venice would have been a signal of openness towards the local community but all requests of the local authority to discuss important decisions (for example about the storm surge barriers) in Venice were ignored.

Although in principle open to all relevant stakeholders, public participation regarding the safeguarding of Venice remains at the level of what Arnstein (1969) calls 'tokenism'. This is because participatory forums are not organized often and most arguments brought forward by participants are commonly ignored. In this regard, the ongoing discussion about the Special Law is the most recent example. In the year 2010 the national government appointed the Minister of Public Administration and Innovation to consider options for reforming the law. Though the Minister invited comments from both governments and societal organizations, the draft law was not presented to societal stakeholders and no

opportunities for comments were offered, which meant they had to turn to the media to express their opinions. The number of contributions (about forty) and the limited debate on the web forum are also indicative of the not yet established culture of public participation in the system. When a group of citizens and environmentalists wanted to attend the presentation of the draft law by the Minister, they were refused access with the argument that the meeting was only for the authorities (Mencini 2010). Thus while 'informing' and 'consulting' took place, follow-ups or further information were not provided and it is not clear how and to which extent the different contributions were considered in the draft law. It can be hypothesized that a three month process with only two short meetings plus written comments will be far from sufficient to solve the complex issue of the governance of Venice.

The fact that opportunities for interaction, representation and dialogue are so limited has a sad consequence in that a number of disagreements about decisions turn into conflicts and are subsequently brought to the courts. Initiators of court cases have almost always been environmental groups whose comments had been disregarded; sometimes they were joined by other actors, most often the local authority. For them, the court is the last resort to try to have an influence on decisions, i.e. try to improve the quality of the decision. Sometimes, however, going to court is only an action for obstructing decisions (because as a case is in court all decisions are on hold) rather than a way to improve them. The case of the storm surge barriers is emblematic of the described situation. During the years, environmental groups - who are in fact often joined by the municipality of Venice - have brought nine appeals against the construction of the barriers to the Administrative Regional Tribunal (TAR) and the Council of State. All appeals were rejected but in 2003 the case was brought to the attention of the European Commission by WWF and other environmental groups, claiming violation of the Bird and Habitat directives (79/409/CEE and 92/43/CEE). In the year 2005 the European Commission decided to open an infraction procedure against Italy on this case with the motivation that measures to prevent pollution and deterioration of the EU protected habitats were not sufficient. Finally, in 2009, the procedure was closed after the Italian government committed to fund a plan of compensation measures of about 200 million Euros and accepted that an independent party would be monitoring the works. For environmentalists bringing the case to the court was the only chance to prevent the barriers to be constructed. However, their stance can be criticized too as they were as uncompromising as the proponents of the barriers. By taking this approach they lost important opportunities for achieving project changes that might have been beneficial to the community. At several development stages of the project, in fact, the project developer and the local community engaged in the discussion of multifunctional uses of this infrastructure such as the possibility to use the underwater tunnels of the

barriers' housing to connect the littorals to the main land through a metro line. These however remained only ideas as the local authority had not been willing to compromise (their position has always been to oppose the barriers) thus losing the opportunity to improve linkages between the project and possibilities to improve local services and the economy.

Implementing adaptive co-management in the Venice lagoon: experimentation?

The third prescription we are interested in is experimentation. Experimentation as research methodology to provide scientific basis for environmental management do exist in the Venice system. In general, experiments are mostly confined to scientific domains such as water, ecosystems management and related technical and technological studies, whereas evaluation of policies (considered themselves experiments) is limited. Furthermore, the interpretation and use of knowledge is often questioned and sometimes politicized.

The morphological restoration and the reuse of dredged sediment in the lagoon are two key examples of experiments leading to new scientific knowledge and in the case of the morphological reconstructions also to improved environmental management practices. In over fifteen years of morphological reconstructions the Venice Water Authority through the CVN has tested different construction techniques and materials, monitored the natural ecological evolution of the new morphological structures, and studied the effectiveness of these elements in protecting the lagoon shallows from erosion. This wide body of experience and technical and scientific knowledge has been used to update the 1993 morphological restoration plan. The result is a new plan (to be finalized in 2011) that adopts an ecological perspective in the reconstruction of morphological structures by integrating a morphological model with an ecological model. The reuse of dredged sediment in the lagoon is another example of extensive experimentation conducted in the field of environmental management in the lagoon. These experiments by the Venice Water Authority were meant to test the possibility to safely use lightly polluted sediment dredged from the lagoon navigation channels for the morphological reconstructions. Unlike in the case of the morphological plan, evidence that using this sediment can be considered safe has not led to improved management practices yet. This happened because the involved authorities cannot agree on procedures for revising the current agreement for dredged sediment re-use and allocation (namely the Protocol on environmental safety criteria for the excavation, transportation and re-use of sediment from the Venice lagoon channels of 8 April 1993).

Thinking of policies as experiments and consequently adjust them according to the level of attainment of the outcomes is not common in the Venice Lagoon system. The Special Law is the foremost example. The establishment of the Special Law for Venice is the biggest intervention made in the system in the past decades. The underlying philosophy is steeped in a hierarchical government tradition, assigning great responsibilities to experts. Ideally, the Special Law itself would be evaluated occasionally from a range of perspectives. The closest example to an evaluation like that is the study of Dente et al. (1998), which suggests that the centralistic government system set by the Special Law has substantially failed, mostly because the coordinating institutions (i.e. the Inter-ministerial Committee and the Safeguarding Commission) add up to the decision-making process instead of simplifying it. The authors also suggest adopting a governance approach grounded on a shared vision of the future (Dente et al. 1998). The current process of reforming the Special Law is based neither on such ideas nor on any other systematic evaluation, however.

Finally, there is a fair degree of discussion about the science underpinning the management of the lagoon. For instance, a long lasting scientific dispute broke out about the validity and interpretation of scientific knowledge range from the mathematical models for the representation of the lagoon system and the possible solutions to prevent high water and the typology and technology of the mobile barriers (*Interviews: scientists, policy-maker, April and June 2010*). Sometimes these disputes have also been politicized, particularly those regarding the mobile barriers. One major reason for this situation is that there are a high number of organizations generating scientific knowledge in the system and no forum to discuss findings and to coordinate resources. To bring such coordination an organization (called CORILA) was established but it does not have the mandate to play a coordinating role. Here too, the various individual organizations (we counted nine) act on their own and are not always willing to share data and information with others. In addition, they often lack confidence in each other's scientific results.

Implementing adaptive co-management in the Venice lagoon: a bioregional approach?

Finally, we look at the bioregional approach as last feature of adaptive co-management. The first attempt to adopt a bioregional approach in the water management sector in Venice dates back to the sixteenth century. At that time the Republic of Venice established the Venice Water Authority with water management responsibility over a broad territory to ensure hydraulic safety and maintenance of navigation in the lagoon. Spanning from the Alps to the lagoon the territory included several watersheds

influencing the hydraulics of the lagoon itself. After the end of the Republic in 1797, the Venice Water Authority saw its competences and covered territory changed several times. In the year 1907, finally it was re-established as local agency of the Ministry of Public Works with water management competences over the lagoon of Venice and the watersheds related to its hydraulics. With the establishment of the regions in the 1970s, environmental management competences were gradually transferred to this level of government. The Venice Water Authority lost its river management competences to the regional level in the 1980s. At present its jurisdiction is limited to the lagoon basin and some other areas outside. According to Rusconi (2002) the Venice Water Authority, in its old configuration, was a successful example of the river basin management approach. He also argues that the current fragmentation of the competences led to less effective hydraulic safety. Particularly, he points to important services that were unitarily provided such us flood control and regulation of water uses. Now that these services are supplied by different authorities, the limited available resources are spread on many small uncoordinated interventions instead of unitarily planned, thus – according to him- reducing the overall safety of the region.

With the establishment of the water boards in 1989, the concept of management at a river basin scale entered or re-entered Italian public law. The water boards, however, did not obtain formal decision-making power over the lagoon, that remained under the jurisdiction of the Venice Water Authority. In more recent times, the European Water Framework Directive (2000/60/EC) followed a similar logic as it requires planning at the river basin scale in all European countries, including Italy. The implementation of this directive in Italy is lagging however. The establishment of a Venetian sub-district that spans the lagoon, the catchment basin and the near-shore sea is hindered by issues of leadership, authority, tasks and debates about responsibilities. Both the Veneto Region and the Venice Water Authority demand the leadership of the River Basin Organization. Although a plan was jointly developed by the two organizations, the issue of leadership was not settled. In the interim the existing water boards will implement the plan.

Now that we have analyzed the water and environmental management practices in the Venice system according to the prescriptions of adaptive co-management, we want to investigate the consequences of the implementation or non implementation of the adaptive co-management in terms of learning. To guide our analysis, we first conceptualize learning.

Conceptualizing policy learning

In this article we are interested in the learning that is taking place in the governance system surrounding the Venice lagoon. One of the key activities of the governance system is the production of policies that will steer its interventions in the ecosystem. Thus we are interested in policy learning, which we can define as "relatively enduring alterations of thought or behavioral intentions that result from experience and that are concerned with the attainment (or revision) of public policy" (Sabatier 1998).

Apparently a distinction between different degrees of learning is useful as many authors suggest typologies on this basis. Most authors distinguish between a technical level and one or two "conceptual" levels at which learning can take place(cf. Foil & Lyles 1985; Hall 1993; Argyris & Schön 1996). Relevant here is the conceptualization of Argyris and Schön, for whom single-loop learning is "when a mismatch is corrected without changing the underlying values and status quo that govern the behaviors" (see Argyris 2003). Double-loop learning, by contrast, implies the mismatch being "corrected by first changing the underlying values and other features of the status quo" (Ibid.). The similarity between this type of learning and "moral development" as just discussed is obvious. Deutero-learning, finally, reflects on the institutional context for learning within an organization, and pertains, among other things, to the awareness that the organization needs to learn in the first place (Ibid.).

Within the literature three critical aspects of learning have been identified, namely: who learns, what is learnt, and to what effect? (Bennett & Howlett 1992). The literature is fairly imprecise over what exactly is meant by these three aspects (Armitage et al. 2007). However, they provide a useful framework around which we can understand how learning in an appraisal process may lead to more reflexive critiques of policy goals.

As to the question about who learns, the basic distinction is between policy makers and societal actors. Some authors, such as Hall (1993), largely focus on the lessons that policy makers draw from their experiences, whereas others have shown greater interest in the way in which (groups of) societal actors, such as "advocacy coalitions" (Sabatier 1988) or "epistemic communities" (Haas 1992), learn, whether in interaction with policy makers or not. Obviously, the way the general public learns about policies is also relevant, but this is the topic of a different literature, the literature on agenda formation and agenda setting (see Wanta 1997; McCombs 2005).

As for "what is being learned," most writings on policy learning distinguish between different types and different degrees of learning (see Swartling & Nilsson 2007). Regarding the types of lessons learned, we can mention Webler et al. (1995), who suggest that there is a difference between the "cognitive enhancement" of parties—i.e., the acquisition of knowledge—and their "moral development"—how individuals come to be able to make judgments about right and wrong. Others have pointed to the importance of what we may refer to as "relational learning." This type of learning relates to issues such as trust building, changes in the ability to collaborate, and changes in the ability to understand another party's goals and preferences (see e.g. Imperial & Hennessey 1999; Imperial 2005).

Table 1 Types of policy learning measured

Typology of policy learning	
Cognitive learning	Factual learning without changing underlying norms, values, belief systems
Normative learning	Learning encompassing a change in norms, values, and belief systems
Relational learning	Enhanced trust, improved understanding of mindsets of others

Source: Huitema et al. 2010

As to "what effect" policy learning is intended for, the overview of Bennett and Howlett (1992) suggests that most authors associate policy learning with policy change, in the sense that they only want to speak of policy learning in cases where policies have been modified or new policies have been adopted. In our opinion, this is a dubious assumption, for two reasons. The first is that policy change is often a result of other factors than policy learning. One can think of changes in government, bargaining between parties in the policy process, the emergence of powerful lobby groups, etc. Secondly, even if policy learning does occur, it does not always express itself in the form of policy change, but may equally well result in a better foundation for existing policies. This could also be seen as a form of policy learning, as the evidence base for the current policy would have increased in such a case.

In the following three sections we analyze the level of learning taking place in the Venice system. We focus on what is learnt according to the cognitive, normative and relational learning framework and to who learns, i.e. policy-makers, scientific community and general public.

Cognitive learning in the Venice system

Cognitive learning is observable in the Venice management system, and takes place mostly within the scientific community. Large investments of national, regional and local governments in scientific research have led to improved environmental management practices (e.g. the morphological restoration). Problem framing and solving are approached at a very technical and engineering level. Solutions consist of infrastructure with high technical and technological knowledge content (e.g. the storm surge barriers). Specialized experts, most commonly engineers coming with years of field practice, cover high level decision-making positions in the field of water and environment management at all level of government (e.g. water boards, Veneto region, Venice Water Authority, Venice province and municipality). The general public and part of the scientific community in Venice perceive this approach to environmental management to be too much technically oriented and lacking of an interdisciplinary perspective able to integrate the ecological and the social dimensions of the lagoon system (*Interviews: practitioners, scientists, April 2010)*.

For years, part of the scientific community has questioned much of the scientific knowledge regarding the Venice system (e.g. mathematical models of the lagoon) arguing that it is not comprehensive and fully objective because it is functional to the infrastructural works (*Interview: scientists, April 2010*). These scientists call for a more integrated management approach of the lagoon not only limited to study the system for the purpose of infrastructural works. The new morphological restoration plan goes in this direction. Developed by an interdisciplinary group of scientists, the measures of the plan are in fact based on ecological considerations and the relation between the measures and the economic activities in the lagoon (e.g. erosion due to the use of motor boats) are taken into account in the planning of the actions.

Unfortunately, the cognitive learning that occurs within the scientific community does not always cross over to other groups. Policy-makers tend to learn from scientific evidence as long as this stays within the established paradigm. Whenever the consolidated practice is questioned, lack of trust among actors instills doubts on the new scientific knowledge thus making cognitive learning difficult as in the case of the protocol on the reuse and disposal of dredged sediment in the lagoon.

Cognitive learning outside the small circle of scientists and policy makers is limited due to a certain level of secrecy. Scientists and policy-makers are generally not open to share knowledge with the public either because there is no culture of participation or because they want to avoid long discussions.

Opportunities for the general public to learn are restricted to those occasions where legal procedures require that the authorities solicit input from the public (for example in the context of the water management plan). Even on such occasions however, room for the public input is restricted to written comments, with few opportunities for in depth discussion. Lack of resources also limits opportunity for the public to develop its own knowledge. Increasingly, collectives of citizens organize themselves to gather scientific information on the functioning of the lagoon ecosystem and on impacts of all on going infrastructures via non-institutional channels (*Interview: scientist, April 2010*).

Court cases may be an opportunity for at least some modicum of factual learning. This is because the parties to the case will be motivated to provide the court with the most accurate and updated scientific evidence proving their arguments (Huitema 2002). Some theorists contend that this skewed way of presenting argument and subsequently battling disagreements out in court may in the end provide a founded and complete knowledge basis for making decisions (ibid.). However, in the Venice lagoon we found little evidence of cognitive learning inspired by the rivalry between competing interests. Court trials against the construction of the mobile barriers are a case in point. On the one hand, the Venice Water Authority and the CVN dispose of substantial national resources to develop studies and projects for the safeguarding of Venice (including the barriers) and therefore they could support their arguments in court with extensive scientific evidence; on the other hand, resources available to environmental groups and the local authority to conduct scientific studies were little if compared with those of the Venice Water Authority. The only opportunity for more in depth scientific research was the national environmental impact assessment procedure of the project which provided evidence towards disfavoring the project over ten years ago. Additional scientific evidence suggesting not to build the barriers was developed by scientists on a voluntary basis or little paid work after work (*Interviews: scientists, April 2010*). Opponents of the barriers have mostly used that scientific evidence to support their arguments in court over the years as they could not afford paying additional studies. Because of the uneven distribution of resources research supporting the construction of the barriers was far more exhaustive than that proving arguments for not building them with the result that court cases were always won by the project proponent.

Normative learning in the Venice system

We found little normative learning within the three groups. Within the scientific community some scientists claim that the new morphological plan does not fully challenge the old approach of framing problems and solutions although a broad group of scientists was involved in the process of revising the plan. This is because a free flow of ideas was not always possible among involved scientists as the whole process of knowledge generation was controlled and results had to be processed and approved before being shared (*interview: scientists, April 2010*).

Among policy-makers it looks like old solutions are revived more often than new ideas are developed. Now that the discussion about the most controversial infrastructure, i.e. the storm surge barriers, has come to a resolution, the Venice Water Authority and the Venice Municipality have started changing perspective about the safeguarding of Venice. In recent times, they raised on the media the issue that two of the three goals of the Special Law can be considered achieved as most hydraulic infrastructures are either completed or under construction and the environmental protection is in progress although there are some delays. Conversely, interventions to support the local economy have been inadequate to achieve the third goal of the law (i.e. socio-economic development) and need to be redefined. They therefore call for reforming the Special Law and set the new agenda which includes the construction of one new big infrastructure that is an off-shore petrochemical and container-ship harbor. Bringing up this idea now reveals an attitude of local public actors to solve problems by means of the same type of solution, i.e. by building massive infrastructure which solves in one time several problems. In this case the new harbor will increase the port activity, local firms will have new work and the local economy will benefit from new jobs and businesses. In addition, although it was not a main priority, this project will increase environmental protection as taking the petrochemical ships out of the lagoon will reduce the likelihood of oil spills in the lagoon. The latter argument is used by policy-makers to gain the consensus of the general public on this project. Local environmental groups, however, criticize the new perspective adopted for reforming the Special Law and oppose the construction of new major infrastructure, calling for more socio-economic incentives for the development of the region.

Looking to the public, normative learning seems limited by the culture of going to the court to solve disputes. By going to court these people show unwillingness to question their values and their reasons. They also do not engage in a constructive discussion as in court evidence is distorted, selectively treated and some information is left out. More evidence of the dearth of normative learning is demonstrated by

the fact that some environmentalists still call for suspending the construction of the barriers and revising the project (Italia Nostra 2010).

Relational learning in the Venice system

As for relational learning, we see that reciprocal trust and understanding do not improve and networks do not evolve that much across the three groups. Some of the reasons for this to happen are that scientific knowledge is not fully shared, the governmental system is rather stable and not much open to new people, and court cases annihilate trust among actors.

Looking at the scientific community, in general, we found that collaborative networks and trust have not improved that much over the years. One reason is that part of the local scientific community still opposes the storm surge barriers, even now that they are in an advanced stage of construction. This failure to accept what has become reality hinders a constructive discussion on the future management of this infrastructure. It does however definitely also not help that scientific knowledge in the system does not freely flow. In this regard, the updating of the morphological plan was a missed opportunity because the limited flow of information did not allow improving trust and understanding of each other knowledge among the numerous scientists involved in the project (*Interviews: scientists, practitioners, April 2010*).

The Special Law has shaped networks and coalitions in the field of water and environmental management for more than thirty years. Particularly during the past ten years the government system has been characterized by a lot of stability. High level policy-makers have not changed (e.g. in the Veneto Region, Venice Province, Venice Water Authority, Port Authority) or have come back into power (e.g. Venice Municipality). These people had time to develop and consolidate networks with policy-makers, the scientific community and the local community over the years. They also built institutional memory in the field of environmental management. This situation of stability ceased between the 2009 and 2010, when several policy-makers either retired or were replaced. On the one hand, institutional memory suddenly disappeared; on the other hand, a window of opportunity for new people to enter the governance system and develop new coalitions and networks opened. However, a number of these policy-makers did not leave the system but had a position in other local public organizations, therefore a real change did not occur and room for improving relational learning remained limited. What may turn into more relational learning in the future are the new alliances that seem to be emerging within this

new configuration of governmental actors. In particular, the construction of the off-shore petrochemical and container-ship harbor is now supported by the Venice Municipality, the Venice Water Authority and the Port Authority. This project has come back to the attention of the local governments (it was already included in the 1984 Special Law) thanks to the Port Authority which aims to increase its shipping activity. On the one hand, this new alliance reveals a smart strategic reorientation of governmental and private organizations. Since interests aligned on this project the historical political opposition between the Venice Municipality and the Venice Water Authority about the storm surge barriers seems no longer an issue. On the other hand, this new coalition may lead to improved relational learning. It is, however, too soon to say. Initially the emergence of this new coalition has been facilitated by the fact that the new President of the Port Authority has built a broad national and international network during his past political activity as mayor of Venice, minister of Infrastructure (to which the Venice Water Authority belong) and President of the Committee on Transport and Tourism of the European Parliament. Real relational learning would imply more cooperation and enhanced trust among these actors. The fact that these new leaders have known each other for long time may, however, be a barrier to better understanding of reciprocal goals and preferences.

Finally, it is important to highlight that court cases are a missed opportunity to improve relational learning because in court the parties learn how to place themselves in opposition to each other without respect for reciprocal knowledge. This attitude undermines already low levels of trust, and do not support reciprocal understanding as the parties behave strategically and uncooperative. The fact that the courts often provide the only forum for the local community and for scientists to be heard in Venice has the consequence that networks have not improved and trust was gradually eroded across the three groups in the region.

Linking learning and the implementation/not implementation of the adaptive co-management prescriptions

In this section we analyze the causal links that might exist between the implementation of the adaptive co-management prescriptions and the level of learning we have found. We have summarized the main findings and pointed out the connections in table 2. In the following, the analysis is organized around the four prescriptions of adaptive co-management, even if there is a certain level of interference between the prescriptions and their consequences.

In our opinion, the degree to which the prescriptions on *polycentricity* and *participation* are followed dominate the relatively low learning levels we have found. The management system of the lagoon, although fragmented to a large degree, has clearly not been set up with polycentric governance in mind. The levels of local control over decision processes are too small for that, and the permeating design principle is one of top-down control, and management takes place from the perspective of a limited set of goals - essentially building protective infrastructure. There are possibilities for participation but these have not really opened up the system to alternative voices as comments and criticisms are largely ignored. The management community can in this sense be compared to an epistemic community (Haas 1992) which is closed to outsiders and works on the basis of an established paradigm, which must not be challenged. Outsiders, lacking a productive venue for entering debates, resort to the courts, where discussions normally focus on established positions and discrediting the contentions of the "opponents" (Huitema 2002). The degree of normative learning to emanate from a system like that is low, as was to be expected. The only possible exception to this finding is the higher importance of economic development on the agenda of those who have built the flood safety infrastructure. Here, we should probably be careful to apply the term learning however, as the developments that have happened here look relatively opportunistic and the changed priority of economic development for the Venice Water Authority could easily be interpreted as an organization that has achieved its primary goal, but is looking for a new challenge where the same approach can be applied. Constructing or expanding a harbor is obviously related to creating a large scale flood safety infrastructure and fits established lines of working, so this might actually be an example of a solution looking for a new problem (Kingdon 1995) rather than learning. However, as a consequence of the new agenda, former opponents are now starting to appreciate each other more, starting to collaborate, and new coalitions are forged. Here too, the term (relational) learning might be overly complimentary as the new coalitions coalesce around established interests and do not emanate necessarily from new insights.

There is a certain level of experimentation going on in the system. This refers to experiments in a literal sense, meaning that physical interventions in the lagoon have taken place and their effects were evaluated thoroughly. As a consequence, new facts about hydro-morphology and the effects of reuse of contaminated sediment in the lagoon have emerged. These have affected policies to a certain degree, but it does appear that the policy system is lagging somewhat in the uptake of these insights. The new morphological plan is an example of experiments that have partially succeeded to improve policies as the new plan adopts a more integrated management approach. Conversely, the reuse of dredged sediment in the lagoon is an example where scientific knowledge has accumulated much more rapidly than the policy system could absorb. These experiments, however, have not served as "boundary objects" that were able to draw multiple stakeholders to the debate about the lagoon, and their set up has been largely technocratic rather than participatory. And there is no experimentation in the lagoon going on in the sense of "policies as experimentation", as the openness to alternative problem definitions or the arguing of alternative policy priorities is very limited. The environmental impact assessment of the storm surge barriers, for example, was carried out by a restricted and rather closed scientific community, in the first place. The prescriptions of the assessment committee then were only partially considered in further developments of the project (*Interview: scientist, April 2010*). The effect of this on the learning levels is visible, as cognitive learning takes place, but it only takes place amongst those involved in said experiments and the experiments do not fundamentally challenge policy paradigms (as predicted by Fischer 1995). This is not only a matter of the way experiments are designed and the questions that drive them, it is clearly also influenced by the way the experiments are interpreted (compare Huitema et al. 2009). In the case of the sediment disposal for example, the outcomes of the experiment would change the power balance in the management of the lagoon and this is not acceptable to those that will have their influence diminished.

Finally, management at the bioregional level is what used to qualify the regime of the Venice lagoon, but with the advent of regional government in Italy, this situation has changed. It is interesting to observe how long the "institutional" memory from that period has lasted, to both the advantage and disadvantage of the management system. It has been advantageous in the sense that most people working in a fragmented set of water organizations still know their former colleagues well and they can therefore easily reach for each other. The disadvantage is, however, that almost anybody working in the management system purports to provide "the" bioregional view, which means that there is actually contestation of authorities. This factor has complicated the implementation of the European Water

Framework Directive, which is supposed to work with river basin organizations. In the Venice lagoon, the leading role in this process has not been decided. Effectively there is thus not much of active an operational basin wide management approach, but we have not been able to detect much effect on learning levels, except for the cognitive learning that results from the easy exchange of information between former colleagues. As this network of former colleagues becomes less dominant in the various successor organizations, the exchange of information across the basin might become more complicated as information is clearly also a strategic resource for those involved in the management of the lagoon.

The scientific community and to some extent policy-makers seem to learn from experiments but only within a shared paradigm whereas the local community finds it difficult to gain factual knowledge because of no real participation and insufficient communication. The little relational and normative learning we found within and across the three groups (scientists, policy-makers and the public) could be explained by the limited opportunities for actors to interact and the existence of a stable, centralized governance system that keep actors disconnected and suspicious. Policy-makers, scientists and also citizens are in fact split in coalitions that have been opposing each other believes and values in the formal decision-making arenas, in the court and on the media for years.

Against this background, we conclude that in general the water and environmental governance system in the Venice lagoon exhibits limited implementation of the adaptive co-management prescriptions. This has the consequence of a low level of learning in the scientific, policy-making and civic community. As predicted by governance scholars (e.g. Fischer 1995), cognitive learning in the scientific community is the only exception. As long as shared paradigm and experimental design is not questioned scientific knowledge and management practices keep improving.

Table 2 Adaptive co-management, learning and connections in the Venice system

Adaptive co-management prescriptions	Learning	Connections between co-management and learning
Polycentricity (-) • Highly hierarchical and mono-centric governmental system • National agenda and limited local power: leadership and authority claimed • Little incentive to public actors interaction • Official institutions meet and cooperate only when there is dependency (especially resource dependency) • Inter-institutional agreements are venues for interaction but used only in situation of dependency *Participation (-)* • No tradition of participation and decision-making culture is not favorable to it • EU regulation brought some formal participation • Participation as tokenism (Arnstein, 1969): public is informed and consulted but there is no follow-up, no mechanism to integrate public knowledge • Limited venues for participation generates frustration that turns into court cases • Public is not organized: environmental groups and other groups act often individually *Experimentation (+/-)* • Experimentation as research methodology has led to improve water and environmental management technology and practices (e.g. morphological restoration, mobile barriers) • Policies are not considered as experiments	*Cognitive learning (+/-)* • Established in the scientific community within a normative paradigm: well developed scientific and technical knowledge • Not well established in the policy-making and social community because: ○ No complete free flow of information in the system ○ Knowledge is not always trusted ○ Cases brought to court to stop policy effects or works, not for learning *Normative learning (-)* • Not well established in the scientific, policy-making and social community because: ○ No complete free flow of information in the system ○ Knowledge is not always trusted ○ Disputes brought to court • Institutional memory may be an obstacle to change • Shift in policy agenda from physical and environmental protection to economic development is opportunistic because it does not bring new ideas and values but re-use old ideas for keep the system work *Relational learning (+/-)* • Not well established in the scientific, policy-making and social community until recent times because of stable governmental system, with stable coalitions, not open to other actors • In the last two years change of a number of leaders in public institutions opened window of opportunity for	*Polycentricity and learning* • Hierarchical mono-centric structure lead to overlook interdependency; therefore opportunities for interaction and cooperation are limited to the minimum, when dependency is evident. This lead to limited relational learning • The existence of coalitions that are more influential than other, the presence of a national agenda with a narrow mandate, and the existence of very closed networks hamper relational learning as there is no interest in meeting among actors • Lack of polycentricity leads to no reflection and no change of perspectives therefore no normative learning; *Participation and learning* • The frustration generated by the low level of participation do not incentive relational and normative learning • Going to court to suspend policy effects or works is a sign of unwillingness to all form of learning • Because of not complete flow of information in the system no cognitive learning of public *Experimentation and learning* • Experimentation taking place within normative paradigm allow cognitive learning but not normative and relational learning • Experiments are boundary objects to discuss things together but it works only within shared paradigm, then no mechanisms to challenge values and allow new ideas and people to enter

• Interpretation and use of scientific knowledge and experiments is sometimes politicized; validity and objectivity is questioned; knowledge is distrusted by actors *Bioregional approach (+/-)* • Water management at bioregional scale existed in the past through the Venice Water Authority; in the 1970s regions took over competences; now WFD re-establish river basin approach • Issues of leadership and authority claimed (Region vs. Venice Water Authority) hamper the transition to river basin management	new coalitions, new relations; too soon to tell if it will lead to relational learning • Not complete renovation, some instances of change of position and not arrival of new people • Loss of institutional memory with people left	the discussion • The way experiments are designed and conducted affect how much they are trusted and therefore policy change *Bioregional approach and learning* • Past experience in river basin management led to build institutional memory as well as cognitive and relational learning to some extent because actors have worked together, created relations and knowledge*;* • Institutional memory about past experience of bioregional management limit normative learning as actors tend to act according to the memory they have about the system; institutions that used to rule the system, have knowledge and control still tend to act according to those values and belief that • Collaboration and learning at bioregional scale occur if people expect it; if there is memory of one institution having control and knowledge relational and normative learning cannot improve • Dealing with existing coalitions and institutions become problematic when new institutions are created over a bioregion

Evaluation scale:
(-) limited; (+/-) to some extent; (+) present

Limitations

The methodological approach that led to the findings of this study proved to have both advantages and disadvantages. On the one hand, the involvement of the first author in meetings of the Ufficio di Piano may have introduced a bias towards either favoring or disfavoring the outcome. However, we think our perspective goes beyond the policy dominated views of the administrations and the government because the Ufficio di Piano is a technical advisory committee with a majority of independent members from Italy and Europe that gained information from all different public and private organizations in charge of safeguarding Venice lagoon. On the other hand, the participatory observation gave the unique opportunity to gain a thorough understanding of the Venice formal and informal institutional system, which was crucial for the interpretation of the data. In addition to that, the fact that we could not interview environmental activists might be considered a limitation of our study. On this point, we think the abundant number of NGOs reports and articles we collected together with the newspaper articles allowed us to have a wide representation of the NGOs perspectives about the safeguarding of Venice. Most importantly, the refusal to engage in an interview by this environmental group was also informative for our study. We figured that they might not want to talk with people working for a public authority (i.e. the first author). This explanation is consistent with the findings of this study as it confirms the lack of trust of the citizenry in an institutional system that most often fails hearing the voice of the community.

Conclusions

In this paper we analyzed the level of implementation of the adaptive co-management prescriptions (i.e. polycentricity, participation, experimentation and bioregional approach) and we investigated the degree of cognitive, relational and normative learning taking place in a complex social-economic system, i.e. the Venice lagoon. We then searched for connections in the findings with the ultimate goal of identifying avenues for improvement in the governance of the Venice system.

The analysis suggested that the Venice system exhibits a limited degree of polycentricity and participation mostly due to a centralized, hierarchical government tradition lacking of a participation culture. Experimentation in the field of water and environmental management takes place only within the established scientific paradigm, while the adoption of a bioregional approach to water management suffers from issues of leadership, authority, tasks and responsibility distribution. We also found that there is not sufficient learning taking place within the scientific, policy-making and

the civic community in the Venice system. Well established management practices and availability of resources allow cognitive learning within the scientific community and to some extent the policy-making community but only within the established paradigm. Relational and normative learning are limited within and across the three groups because of difficulty to share and trust knowledge, existence of stable and closed actors' networks and a tendency to regenerate solutions. The fact that disputes are often brought to court does not encourage learning. The degree to which the prescriptions on polycentricity and participation are followed dominate the relatively low learning levels we have found. Experiments as physical interventions have generated a lot of scientific knowledge but it appears that the policy system is lagging somewhat in the uptake of these insights. Institutional memory of past river basin management makes relations among public officers easier but also increases contestation of authority. The main conclusion of this study is that in the Venice system the existence of a system of central control inhibits participation and real polycentricity, makes it difficult to change policy in accordance to experiments results, and find it difficult to deal with problems at bioregional scale. As consequence of that, learning is highly instrumental and restricted to environmental management practices whereas networks, values and beliefs hardly evolve in the region.

The case study of Venice brings to light two main points of discussion along with questions for future research. A first interesting observation can be made about the role of institutional memory. The literature of resilience and that of adaptive governance highly evaluate institutional memory. The case of Venice shows that institutional memory can also be a limiting factor to learning. Policy makers used to manage a large water basin have been resisting the re-establishment of a river basin governmental setting unless this would re-assert their authority. Policy learning is here clearly hampered by policy-makers' values and beliefs which are rooted on memories of the times the organization had control over a wide bioregion. Our next step would then be asking: what is the normative value of institutional memory in the context of adaptive co-management? Whether institutional memory is good or bad depends on people's values and beliefs about past actions and governance experiences. Because of an intrinsic human bias towards valuing past experiences more positively than they really was (by taking away bad memories and over-evaluating good ones) there most likely is a tendency in people with a strong institutional memory to push for going back to past institutional settings. This supports the argument that strong institutional memory may not be such a positive attribute of adaptive governance systems in a wide range of situations.

The second point deals with more general considerations about the ACM as normative governance approach. In our study we found the ACM to be helpful for diagnosing a given governance system,

i.e. to identify salient features and to understand the basic character of a situation (Young 2007). However, we advocate the relative value of following the ACM. Armitage et al. (2007 pp. 6-10) recently pointed to the need for more insight on "conditions of adaptive co-management success and failure." We, indeed, support the need to investigate more fundamental attributes as pre-condition for the ACM to take place and be effective and we raise the following research question: what are the basic social and cultural requirements for adaptive co-management to take place and be successful? The ACM framework, in fact, assumes certain social and cultural contexts which are not present everywhere. Making these conditions explicit would allow prioritizing actions for ACM successful implementation. Focusing, for example, on policy change needed to make the governance system more polycentric would be no sense if the conditions to make that policy change to happen are not there.

The Venice lagoon case study is emblematic of this need to indentify and address the fundamental attributes that make ACM success. The analysis made explicit one of these fundamental attributes. This condition is trust and reciprocal respect among actors. In the Venice case the lack of trust among actors proved to be reason for limited communication and shared of knowledge and insufficient institutional cooperation which turned into insufficient learning in all societal groups. The Special Law regime seems to be at least in part responsible for this situation as it established a centralized, hierarchical governmental system that has kept actors disconnected. Together with knowledge and experience, actors in Venice have developed resentment and mistrust for each other over the years under the Special Law regime. Stable patterns of people engagement have developed from these feelings that have crystallized in closed coalitions and networks that make policy change difficult. In general, there is a problem of social capital which is not sufficiently developed also because there might be an interest in keeping people disconnected. Disconnected people do not easily succeed to be heard and to provoke substantial policy change. There are also cultural elements that prevent for example successful participatory experience. It is clear that building trust again in the Venice system is a pre-condition to any policy change. In this regard, windows of opportunity open when a change occurs in key positions in the governance systems (if it is not just "musical chairs", i.e. shuffling the same people among various locations). The advent of new people is beneficial to the governance system as they carry their own networks (i.e. new people) and ideas and they do not have the burden of resentment and mistrust. In Venice the new configuration of public actors that have emerged in the last two years can be an opportunity to improve trust by creating new linkages. By engaging in new patterns of relations the local actors may success to reform the Special Law and

design a polycentric, participative and adaptive governance system dealing with problems at bioregional scale. We would recommend performing a comprehensive social, economic and environmental evaluation of thirty years of Special Law regime as foundation of the new regime.

As the Venice case shows, a certain degree of social capital, cooperation and trust among actors are fundamental to make adaptive co-management operational in presence of a number of public organizations having overlapping water and environmental management responsibility over a bioregion. In particular, conditions and mechanisms to increase opportunities for interaction of actors so as to increase social capital and in particular trust are issues to further explore by adaptive co-management scholars.

In conclusion, at present there is little implementation of the ACM prescriptions in the Venice lagoon which turns into insufficient learning (particularly relational and normative learning) within and across the scientific, policy-making and civic communities. Does the adaptive co-management have potential to change the situation in Venice? The core problem is a lack of trust among local actors which needs to be solved to make any policy change possible. Providing opportunities for actors to interact can help improving trust and all form of learning. Participatory experiences offer these arenas for interaction. Acting at bioregional scale also allows interaction as different organization come to work together to achieve common goals. The same applies for polycentricity. A real polycentric system is highly cooperative meaning that there are many opportunities for actors to meet. Experiments, finally, can serve as “boundary objects” able to draw multiple stakeholders to the debate about the lagoon.

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