Managing the impacts of climate change on water governance

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THE WICKED WATER PROBLEM: COPING WITH CLIMATE CHANGE

The sustainable governance of water resources in times of global change is one of the most pressing challenges of the 21st century. Although globally, freshwater resources are not yet scarce, their unequal distribution at different scales can provide multiple sources of tension. In addition, global warming and related climatic changes are likely to considerably affect the amount, timing, and frequency of precipitations, and hence the hydrological cycle, thus impinging on the quantity and quality of water sources and evidently impacting on economic growth, land use, and urbanization.

Nevertheless, while the challenges presented by climate change over the next century are overall increasingly well-understood by the scientific community, not enough work has been done to investigate how to cope with its potential impacts on the water environment, especially at the local level. Despite concerns for international water wars, in fact, evidence shows that water governance has traditionally taken place *within* national territories, among communities that, throughout history and throughout time, have found sustainable solutions to the "commons dilemma" by creating sets of principles and rules for sharing water in an equitable and transparent manner that minimized social conflict.

Current climatic and socio-economic changes require water governance systems to be highly adaptable, which means that they must be ready to effectively and rapidly respond to uncertainty and surprise. As a consequence, there is an urgency to understand how multi-level water governance systems can arrive at best managing prospected changes, and to identify under which conditions these complex processes act in concert to achieve a sustainable governance of water resources that avoid potential conflicts between water uses and users in particularly vulnerable local contexts.

In the field of water resources management, and facing forecasted climate-related and socio-economic challenges, policy developers and decision makers are unavoidably confronted with a number of problems. First of all, water resources management is made complex by the intricate nature of ecosystems dynamics, the impact of thresholds and feedback loops, and different human dimensions. Secondly, societies are increasingly compelled to deal with situations of uncertainty and change; science is still incomplete and often not integrated, and today's findings and understandings may prove to be wrong tomorrow. Finally, the current governance landscape suffers from a high fragmentation, which translates into disequilibria between centralized and decentralized approaches, the exclusion of relevant users and constituents from decision-making processes, and a lack of coordination between regulations and policies, as well as institutions and stakeholders. Therefore, it is important that water governance approaches become sufficiently adaptive to address complex interactions and to manage uncertainty and change. The crucial question is how to realize this transformation.

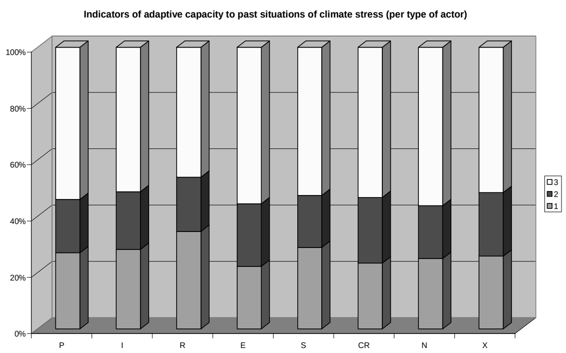
HOW TO INCREASE THE ADAPTIVE CAPACITY OF WATER GOVERNANCE SYSTEMS?

Given the issues that water governance systems are likely to face in the near future, adaptability represents a necessary feature they *must* come to embed. But what does adaptability mean with reference to water governance? In order to answer this question, an analysis has been performed on the Po River basin (Italy), thereby considering the responses that have been put in place in this specific geographical area for coping with climate-related changes. More specifically, a number of relevant stakeholders have been selected for each economic sector that uses water as a critical resource (i.e. agriculture, industry – including hydropower, tourism, and households), and belonging to three major categories: government, external actors, and civic society. The chosen subjects have been submitted a survey of 15–20 questions aiming at identifying what specific characteristics of the existing water governance system had proved crucial in the past to cope with situations of climate stress, such as events of floods or droughts. Other stakeholders were involved at a later stage by means of semi-structured interviews, with the objective of assessing whether the supposed indicators of adaptive capacity were effectively in place, and whether they would have remained valid for responding to future climate-related changes, also accounting for modifications of the socio-economic context within which water management is framed (see Table 1).

Table 1 Answers to the survey per typology of actor.

Indicator	Did it increase the capability of the water governance system to adapt to climate stress in the past? Yes				Do you think it will increase the capability of the water governance system to adapt to climate stress in the future? Yes				Total
	1	2	3	Total	1	2	3	Total	
P	10	7	20	37	11	7	20	38	75
I	11	8	20	39	12	8	20	40	79
R	9	5	12	26	10	5	12	27	53
E	6	6	15	27	6	6	16	28	55
S	11	7	20	38	12	7	20	39	77
CR	7	7	16	30	9	7	16	32	62
N	8	6	18	32	9	8	18	35	67
X	8	7	16	31	9	7	16	32	63
Total	70	53	137	260	78	55	141	271	531

Legend: 1, Government; 2, External factors, 3, Civil Society.
P, Participation; I, Inform sharing; R, Representation; E, Equality of decision making; S, Resources; CR, Control and regulatory mechanisms; N, Network; X, Experience.
No. of respondents: 1 = 12; 2 = 8; 3 = 20; Total 40.



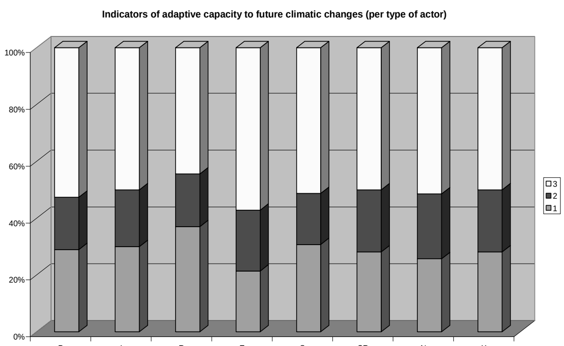


Fig. 1 Indicators of adaptive capacity to past situations of climate stress (per type of actor).

KEY LESSONS

The analysis conducted in the selected case area of the Po River basin (Italy) suggests that adaptability requires the presence of a number of conditions in order to be implemented. First of all, institutions deputed with water resources management need to be representative of all water users' interests and demands. This is a particularly important condition for governmental actors, and for both the cases of responses to past situations of climate stress (see Fig. 1) and responses to future changes (see Fig. 2). Secondly, and especially for civic society actors, the water governance system must provide for the actual participation of all stakeholders in decision making. According to the majority of interviewees, participation will be even more crucial to respond to forecast climate-related challenges (Fig. 2). Mechanisms for information sharing, monitoring and regulation are also necessary in order to guarantee the correct and fair performance of water management arrangements. It is fundamental that decision making happens in conditions of equality, and that all involved actors possess the required technical experience to perform their assigned tasks at best. Experience is highlighted as a fundamental condition especially by external actors. An adequate infrastructure, including funds and technology, is another precondition for achieving sustainable and efficient water resources management in the long-term for all categories of interviewee. And finally, networks between stakeholders and institutions can encourage the exchange of best practices thus facilitating the learning process that is required for water governance systems to perform their functions effectively (see Figs 1 and 2).

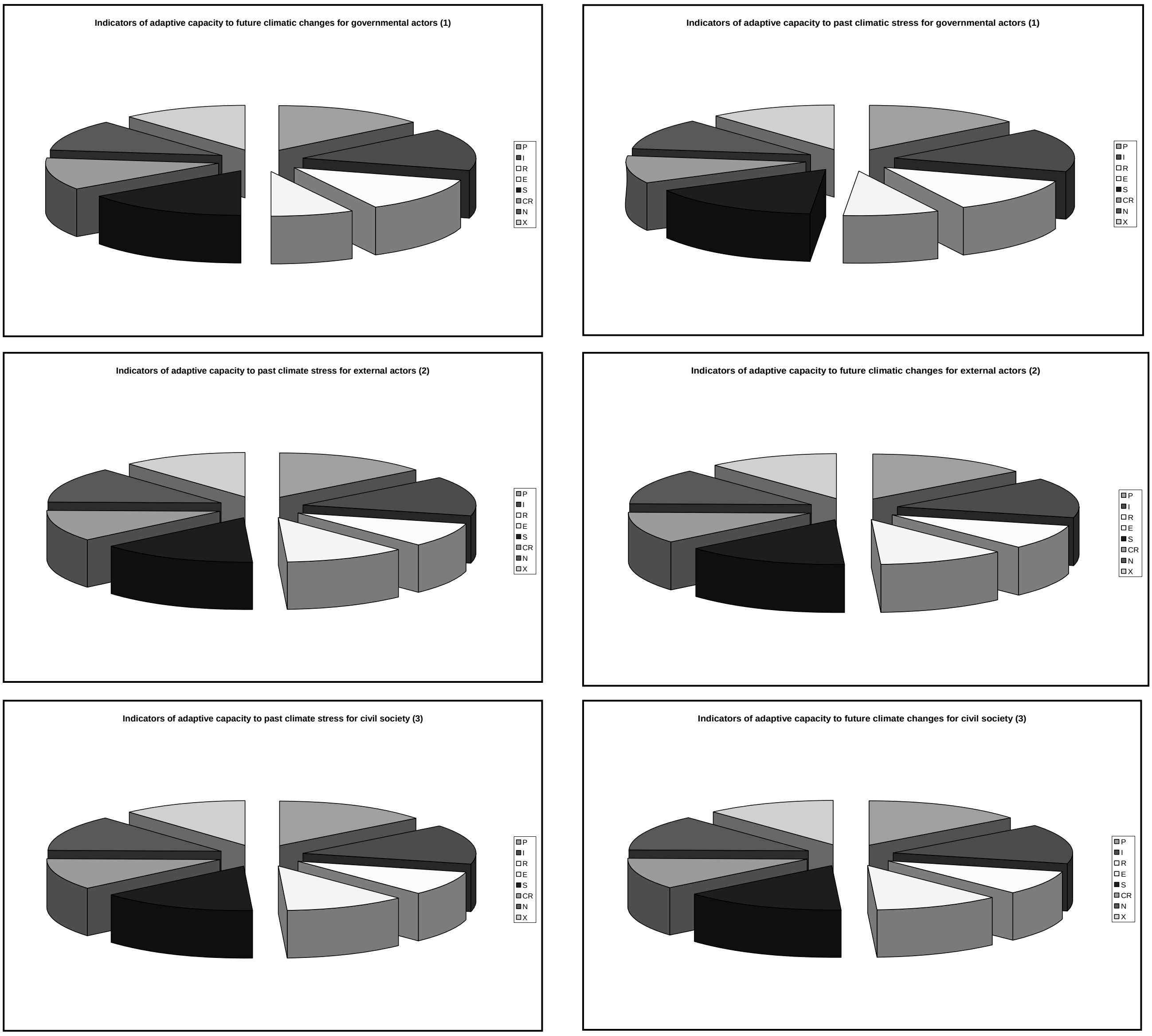


Fig. 2 Indicators of adaptive capacity to future situations of climatic change (per type of actor).

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