

# A Values-Based Approach to Vulnerability and Adaptation to Climate Change. Applying Q methodology in the Ebro Delta, Spain

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## ABSTRACT

Outcome and context-focused approaches to climate change adaptation dominate the relevant literature. Taking into account values and perceptions of affected actors and decision-makers is a fundamental and necessary prerequisite for a more effective, legitimate and fair climate policy and has not been given the necessary consideration. This paper uses Q methodology to explore such values in the context of climate change in the Ebro Delta, in Catalonia. The delta is an area highly vulnerable to climate change, mainly because of its topography, but also as a result of human intervention. The study identifies five discourses on vulnerability and adaptation held by delta inhabitants and decision-makers. Social justice and security comprise shared values behind arguments; however, discourses differ in their approaches concerning the proper scale for applying these values with adaptation policy. Our results serve to improve policy dialogue and suggest that the adaptation policy agenda should focus on pursuing consensus over the crucial issue of scale. Our use of Q methodology to advance the incipient literature on value-based climate change vulnerability and adaptation is innovative and suggests that the approach has a capacity to contribute to advancing deliberative environmental decision-making on adaptation. Copyright © 2014 John Wiley & Sons, Ltd and ERP Environment

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## Introduction

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CLIMATE CHANGE EFFECTS ARE ALREADY ALTERING SOCIO-ECOLOGICAL SYSTEMS, AS A RESULT OF WHICH ADAPTATION HAS become an important aspect of policy and research agendas side by side with mitigation.<sup>1</sup> Climate change adaptation involves modifying socio-ecological systems through policy to deal with the climate change and persist over time (Barnett, 2001). Socio-ecological systems are differently affected by climate change and have distinct capacities to respond to these effects. As both climate change effects and context are crucial for determining

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<sup>1</sup>Matos Silva M. 2011. Urban flood adaptation through public space. In DeltaNet International Conference Deltas and Wetlands; 13.

differential vulnerability and adaptive capacity, policy-oriented research efforts have to date mostly focused on mapping climate change outcomes or contextual socio-economic and political factors that determine vulnerability to climate change (O'Brien *et al.*, 2007). However, assessing only these aspects is not enough for dealing with vulnerability to climate change and deciding adaptation measures to handle vulnerability. The exercise of setting priorities as regards vulnerabilities that need be considered and policies implemented, i.e. what needs to be protected and how, is one inherently connected with and dependent upon social values. In other words, deciding on what to protect and how depends on the values that inform such a decision-making process (O'Brien, 2009). Nevertheless, and although values are crucial for advancing towards legitimate and effective adaptation policies, this approach has been understudied (O'Brien and Wolf, 2010).

This issue is highly relevant for the study of environmental governance within ecological economics. The field has long argued the normative importance of including plural values in environmental decision-making (see, e.g., Norgaard, 2008), and the consequent analytical importance of empirically identifying these values (see, e.g., Zografos and Howarth, 2010) in order to include them in decision-making processes. Such inclusion is important in terms of producing and implementing environmental policies that are sustainable in the long run due to their increased legitimacy and likelihood of being accepted (Barry and Proops, 1999). Some ecological economists have specifically pointed out that the identification of multiple values in environmental issues, e.g. in environmental conflicts, allows use of these values as input in deliberative decision-making processes (Davies *et al.*, 2005; Zografos and Howarth, 2008). A promising way of doing this, i.e. identifying multiple environmental values that can be integrated in deliberative decision-making, is with the Q method, a method used to explore subjectivity in a scientific way (Brown, 1993). With the joint employment of Q methodology and deliberative decision-making literature to study environmental issues, ecological economics can provide methodological tools and conceptual expertise that can be used to promote a values-based study of climate change vulnerability and adaptation governance.

Our study uses Q methodology to explore (a) what are the key relevant aspects of vulnerability and adaptation to hydro-climatic change prioritized by different discourses on the topic and (b) the relevance of anthropocentric, biocentric, and eco-centric values in creating different understandings of vulnerability and adaptation responses. We do this in the context of a case study in the Ebro Delta in Catalonia, Spain. This region is highly vulnerable to climate change, mainly because of its topography, but also because of human impacts such as urbanization and upstream dams. Moreover, it is an area where how to adapt to these changes is currently being discussed in the public and policy domains (Fatorić, unpublished master's dissertation).

The following section presents a short outline of the theoretical context, mainly focusing on explaining the relevance of a values based-approach for understanding climate change vulnerability and adaptation. The study methodology is then explained, followed by a presentation of the main characteristics of the case study site, the Ebro Delta, before moving on to present study results. We then embark on a discussion of the implications of these results for understanding and mediating vulnerability both as regards the study site but also at a more conceptual level, before closing with a reflection on our approach and its limitations.

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## Theoretical Considerations: a Values-Based Approach for Climate Change Vulnerability and Adaptation

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Scientific evidence suggests that changes in climate extremes and effects are expected to become more intense even if emissions are kept constant (Church *et al.*, 2013). This has brought adaptation, side by side with mitigation, to prominence in the climate change policy agenda, in an effort to mediate and deal with vulnerability to climate change. Vulnerability comprises 'the characterizations of a person or group and their situation that influences their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard' (Wisner *et al.*, 2004). Thus, it is not only the probability of being affected (exposure and susceptibility to damage) but also the response capacity (capacity to face and recover) that needs to be considered (Barnett, 2001). This brings to the fore the importance of adaptation policy. Adaptation in the broadest sense means 'modification' or 'fitting to suit' (Barnett, 2001). Institutional arrangements and the knowledge and awareness of the situation are fundamental elements for adaptation and adaptive capacity (Adger, 2010), and so are risk perceptions and perceived adaptation capacity (Grothmann and Patt, 2005). Adaptive measures include investments in infrastructure such as transport systems, water storage

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and flood protection. However, adaptation often involves changes in the behaviour of affected households, and thus implies uncoordinated actions of households, firms etc. but also collective action at local, national and international levels (Paavola and Adger, 2006). These measures also have effects on stakeholders' lives and well-being (O'Brien and Wolf, 2010).

Although important, 'outcome' and 'contextual' approaches to the study of vulnerability are limited for addressing social adaptation where financial, cognitive and institutional barriers hinder adaptive actions. The outcome-focused approach concentrates on reducing the direct and indirect impacts of climate change. It normally identifies specific impacts and consequently plans sectorial interventions. Contextual approaches, on the other hand, focus on underlying social, economic, political, institutional, cultural and environmental conditions that influence vulnerability and adaptive capacity. However, psychological, religious and spiritual factors are neglected in these approaches, and this has prompted O'Brien and Wolf (2010) to conceptually develop and suggest a value-based approach to study climate change vulnerability and adaptation. A values-based approach to vulnerability and adaptation pays attention instead to the subjective dimensions about what ought to be protected and what can be tolerated as 'acceptable change', which itself depends on moral reasoning (Renn and Schweizer, 2009). O'Brien and Wolf (2010) state that values play a significant role in the climate change debate, in the sense that how to respond to the impacts depends importantly on what the effects of climate change mean to those affected. Therefore, considering values and perceptions contributes to a more integrated understanding of climate change and should lead to a more successful adaptation to it through deliberative processes. This approach discusses vulnerability and adaptation in terms of subjective values and helps understand the limits of adaptation by taking into account that some values are more recognized than others when deciding adaptations to planning and that political power can influence whose values are prioritized (O'Brien and Wolf, 2010). The value focus is necessary not only because it is more effective in the long run, since it considers what affected people believe is important, but also in the belief that it is a fairer and more just approach (O'Brien and Wolf, 2010). Here justice is understood as distributive and procedural, emphasizing putting the most vulnerable first and the principle of equal participation for all (Paavola and Adger, 2006).

The term values is used to refer to interests, likes, preferences, moral obligations, desires, goals, needs etc. Values guide not only our actions, but also our judgments, choice, attitude, evaluations and arguments (O'Brien and Wolf, 2010). Values are deeply rooted and determine people's worldviews. Values do not exist randomly but are organized in coherent structures or systems linked to motivations (Schwartz and Sagie, 1994). Edward-Jones *et al.* (2000) explain that anthropocentric and intrinsic value arguments provide the two main categories of arguments regarding the moral consideration of nature. These are important in ecological economics, because these conceptualizations provide a basis for valuing nature and a rationale for making public decisions as regards human use of natural resources. *Anthropocentrism* is focused on humans who are considered the reason for giving value to the environment. There are two different arguments that are relevant here. First, welfare arguments link human well-being to the preservation of the environment. For example, the precautionary principle gives value to nature due to the possible inadvertent damage of ecological processes on which humans rely. Second, virtue arguments give value to nature due to its influence upon human development, and have conservationist, preservationist, and productivist variants. Intrinsic value arguments ascribe value to non-humans independently and beyond their importance for humans. Two variants are the most important here, *biocentrism* and *ecocentrism*. Biocentrism focuses on the intrinsic values of non-human individuals, and its main conceptualizations are teleological biocentric arguments, which define moral considerability to living individuals, and animal welfarism, which defines it with reference to sentience (Edward-Jones *et al.*, 2000). Finally, *ecocentrism* involves a more systemic view that places the focus of moral concern on collections or communities of individuals, such as ecosystems.

Given the special characteristics of the Ebro Delta, which includes a landscape where entire ecosystems (e.g. river ecosystem), specific productive activities (e.g. rice agriculture) and sentient non-human individuals (e.g. specific protected animal species such as flamingos) are valued, in this study we have decided to focus on the relevance for vulnerability and adaptation of anthropocentric, biocentric and ecocentric values. These different approaches to ascribing value to nature can produce different prioritizations of vulnerability aspects that need be addressed by adaptation policies. In order to design legitimate adaptation policies likely to be adopted by policy stakeholders, different prioritizations need to be first fleshed out to then consider their differences as well as possible points of convergence in the design and implementation of inclusive governance processes. In what follows, we illustrate how Q methodology can be used to flesh out these differences and commonalities when examining climate change vulnerability and adaptation under a values-based approach.

## Methodology

Introduced in the mid-1930s, Q-methodology applications have expanded to many research areas and lately to social science research related to environmental issues (see, e.g., Duenckmann, 2010; Zografos, 2007; Addams and Proops, 2000). Nevertheless, to our knowledge the methodology has not been used to explore values related to vulnerability and adaptation to climate change. The main goal of Q is to pursue the scientific study of subjectivity, i.e. its study in an objective and structured manner by combining statistical analysis with the use of factor analysis and qualitative information using in-depth interviews – for basic details on Q see, e.g., Barry and Proops (1999) or Brown (1993). In contrast to conventional factor analysis ('R' analysis), which looks for correlations between variables across a sample of subjects, Q looks for correlations between subjects across a sample of variables. R analysis therefore tries to explain *what* patterns exist, while Q tries to explain *why* these patterns exist (Robbins and Krueger, 2000).

Q is usually implemented in five stages (Zografos, 2007).

- First, one identifies the areas of 'discourse', defined as a way of seeing and talking about something (Barry and Proops, 1999).
- Second, a pool of statements concerning the issue under investigation is generated. Statements refer to opinions, plans, questions, options or strategies (Eden *et al.*, 2005). This is known as the 'concourse', a set of interrelated claims about the domain question.
- Third, participants are asked to sort the statements to a scale of 'mostly agree' to 'mostly disagree' on a template (the 'grid'), usually designed to force responses to the form of a normal distribution in order to facilitate comparison between individual Q sorts.
- Fourth, statistical analysis (principal component analysis) of results from several statement sortings is performed in order to discern discourses among respondents.
- Fifth, results are interpreted to outline discourse characteristics by concrete statements that each discourse mostly supports and rejects, as well as by highlighting differences and similarities among discourses (Table 1).

For the concourse generation stage of this study, we revised relevant academic and popular literature with the aim of preparing preliminary interviews. Semi-structured interviews were also conducted with representatives of the public administration, a local action group and irrigators. The main goal was to achieve diversity in the statements, ensuring proportionality of relevant positions. Following standard practice (Barry and Proops, 1999), we used a  $5 \times 3$  matrix defined by 'discourse element' and 'type of claim' to reduce the number of statements to 26, which were then used for the study. This matrix is known as the 'concourse matrix'.

We interviewed 19 participants for this study, including 11 Ebro Delta inhabitants and eight public administration officers involved in water management. Participants were chosen for comprehensiveness and diversity in views, rather than representativeness or quantity (Eden *et al.*, 2005). For participant selection we used a combination of snowballing and purposive sampling techniques based on our expert knowledge and engagement with the case. Unlike standard survey analysis (sometimes known as R methodology), Q methodology is interested in establishing patterns *within* and *across* individuals rather than patterns across *individual traits*, such as gender, age, social class etc. (Barry and Proops, 1999), which also explains why the method does not require large numbers of participants to produce valid results (Ellis *et al.*, 2007).

Three ethical perspectives	Ecocentrism	Biocentrism	Anthropocentrism
Subtopics from interviews			
Adaptation	2	1	3
Vulnerability	2		2
Water transfer	4		4
Property rights		1	1
Decision-making	2	1	3

**Table 1.** Matrix used for obtaining the Q-set

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In Q it is not the ‘constructors’ – the participants – who are the focus of the approach but the ‘constructions’ themselves (Eccleston *et al.*, 1997), in other words, people are variables and Q statements are cases. This is the reason why representativeness in Q is measured not by the extent to which respondents correspond to a representative sample of the population but by the extent to which statements are representative of the diversity of views over the topic in question. This explains the method we have followed to generate a pool of statements that would be *representative of views* related to adaptation and vulnerability, specifically choosing participants who could express opinions as diverse as possible over our topic and by complementing this with statements from the relevant academic and popular literature to ensure that the maximum possible diversity of views over our topic was covered. Or, as Nicholas (2011, p. 2) explains,

One important notion behind Q methodology is that only a limited number of distinct viewpoints exist on any subject. With Q methodology, statistical reliability or the ability to generalize sample results to the general population is of less concern. In a Q methodological study, the results are the distinct subjectivities about a topic that are operant or measurable. Q methodological results are not the percentage of the sample or the general population that adheres to any of the operant subjectivities.

So as regards representativeness in terms of what is required in Q, our study’s first phase of in-depth interviews was used to generate statements that would be as comprehensive as possible of the diversity of views on our topic, i.e. vulnerability and adaptation in the Ebro Delta. However, as some participant characteristics may have an influence on behaviour and attitudes (Robbins and Krueger, 2000), efforts were made to interview actors from diverse stakeholder groups. Two factors explain why more respondents were drawn from the regional and local scales. First, initial interviews indicated that views expressed locally and regionally were more diverse than those at other scales. For example, rice farmers hold diverse and at times conflicting views about environmental change due to the history of the delta, where rice farming conversion has had a differentiated spatiotemporal impact on local livelihoods. Second, given the geographical focus of our study, i.e. the Ebro Delta, we were interested in including and representing more local and regional voices from an area (Southern Catalonia) frequently marginalized in environmental decision-making processes (Zografos and Martínez-Alier, 2009).

Data collection was completed between May and June 2011 (Figure 1).

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### **Results: Discourses on Vulnerability and Adaptation in the Ebro Delta**

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The Ebro Delta is located in the Province of Tarragona, its territory divided between the comarcas<sup>2</sup> of Baix Ebre and Montsià, in Catalonia, Spain.

Over 80% of the delta surface has been anthropogenically altered, specifically for rice cultivation. Nevertheless, the delta hosts exceptional biodiversity, due to the existence of a variety of wetland types, and its ecological importance has been internationally recognized.<sup>3</sup> Although rice-paddies occupy most of its surface, fisheries are also important and provide around 15% of Catalonia’s annual production; shellfish farming is another significant economic activity, and tourism is becoming increasingly important, with expectations for green tourism to become one of the main engines of the socio-economic revitalization of the delta (Figures 2–4).

According to the Ebro River Basin Authority (CHE,<sup>4</sup> 2010) there are many morphological alterations within the Ebro catchment, including 260 dams and 16 water transfers. As a consequence of extensive damming and channel alterations, the delta’s development has changed from being shaped by the dynamic combination of fluvial and marine (wave) activity to being shaped only by the latter. Moreover, the deltaic plain undergoes a process of subsidence, which results in a relative sea-level increase. Subsidence processes are not directly

<sup>2</sup>The term ‘comarca’ is a territorial–administrative division one level below the province and one level above the municipality level in Spain; it is roughly equal to the UK term ‘county’.

<sup>3</sup>Wetland of International Importance in 1993 under the Ramsar Convention; Special Protection Area for Birds (Directive 79/409/EEC); SCI (Site of Community Interest) in the context of the Natura 2000 Network; Natural Park since 1986.

<sup>4</sup>Spanish acronym for Confederación Hidrográfica del Ebro.

Strongly disagree				Neutral				Strongly agree
-4	-3	-2	-1	0	1	2	3	4

Figure 1. The grid

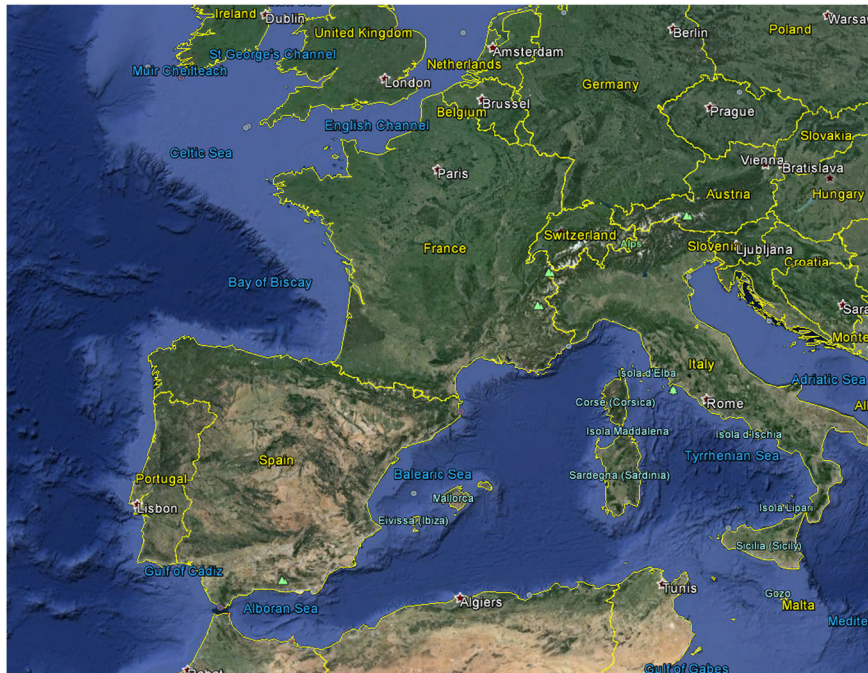


Figure 2. Spain – Catalonia – Ebro Delta (Google Earth, 2013, data SIO, NOAA, US Navy, NGA, GEBCO)

linked to climate change but exacerbate its effects: subsidence is the result of natural delta activity combined with anthropogenic intervention, specifically dam construction upstream that blocks sediment transport to the delta, hence increasing relative sea-level rise (Ibañez, 2004).

An increase in sea-level and a decrease in the flow of the Ebro River are expected to occur as a result of climate change. These effects would be synergistic with respect to the salt wedge, and both would enhance the presence and permanence of salt water (Ibañez, 2004). Local government studies on adaptation (Generalitat de Catalunya, 2008) based on studies by the Intergovernmental Panel on Climate Change (Trenberth *et al.*, 2006) consider two possible scenarios: one for 2050 with a sea-level rise of 15 cm and the other for 2100 with a rise of between 40 cm and 1 m – although new (IPCC AR5) IPCC expectations (Church *et al.*, 2013) are even more pessimistic, projecting a sea-level increase of 40 cm for the best scenario (RCP2.6). This implies a high risk for coastal lagoons, rice fields, vital infrastructure and ports as well as an increase in agriculture’s water requirements and health problems.

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**Figure 3.** Spain – Catalonia – Ebro Delta (Google Earth, 2013, data SIO, NOAA, US Navy, NGA, GEBCO)



**Figure 4.** Ebro Delta (Google Earth, 2013, data SIO, NOAA, US Navy, NGA, GEBCO; Institut Cartogràfic de Catalunya; DigitalGlobe)

Past state initiatives for water transfers from Ebro to other parts of Spain have been a controversial issue, which has resulted in the creation of the local activist group Plataforma en Defensa de l'Ebre (PDE<sup>5</sup>), which opposes transfers. Mini-transfers to the city of Tarragona were approved by law back in 1981, and the National Hydrological Plan (PHN<sup>6</sup>) of 1989–1993 approved the emergency transfer of water to Mallorca from the port of Tarragona in 1994. The second PHN, which planned the transfer of 1050 cubic hectometres to Barcelona, Valencia, Murcia and Almeria, was repealed by the National Government – Congress (Royal Decree-Law 2/2004 of 18 June, and Law 11/2005) after several spectacular public protests back in 2001. Action from social movements together with academics and

<sup>5</sup>Platform in Defence of the Ebro, from its initials in Catalan (Plataforma en Defensa de l'Ebre).

<sup>6</sup>National Hydrological Plan, from its initials in Spanish (Plan Hidrológico Nacional).

environmental NGOs forced the government to replace the water transfer plan with a new desalination program in Valencia, Murcia and Barcelona, which is supposed to 'solve' supply problems. This response aimed at addressing the EU's Water Framework Directive (Directive 2000/60/EC) as well as creating high efficiency sea-water treatment facilities that can be activated whenever necessary<sup>7</sup>. The water transfer proposal was also cancelled due to the arrival of late and intense rainfall (Arrojo Agudo, 2003).

The combination of subsidence, salinization, sea-level rise and possible water transfers generate complexity as regards sources of threat to the delta, which in turn translates to a high degree of disagreement about the causes and relative importance of challenges faced as well as how they should be faced. Understanding the roots of such disagreements could help advance effective and legitimate climate adaptation policy. To this effect, we employ the Q method.

The PQ Method software was used to analyse Q sorts, via a principal component analysis (PCA) followed by varimax and manual, judgmental rotations, whose results were compared in order to choose the more meaningful data explanation solution. As a result, five factors were kept for rotation, a solution that accounted for 67% of the variance. Table 2 presents the 26 statements with scores on each of the five discourses and Table 3 shows which participant loads on which factor. Factor 2 and Factor 4 are bipolar factors, which means that they are formed by individuals who attach importance to the same statements but from opposing viewpoints.

### Discourse 1. The 'Local' in Focus

This discourse is characterized by an emphasis on the importance of locality, and in particular of the locality as it currently stands, for understanding vulnerability and adaptation. Its distinctive views support the idea that water, a crucial resource for local development, ought to stay in the catchment (S17<sup>8</sup>: +2), and includes scepticism as to whether the relatively new economic activity of fish farming has the potential to substitute traditional and well-established rice cultivation as a measure of adaptation (S4: 0). Table 4–8

Furthermore, the discourse emphasizes the need to consider Delta conservation in decision-making (S8: +4) as well as the vulnerability of local systems, particularly rice agriculture, to climate change (S21: -4), themselves important due to their key role in the maintenance of the local ecosystem.

If we are deprived of the water that belongs to the delta for rice crop irrigation, the delta will be destroyed due to salt intrusion. (Q Interview 1, Irrigator).

Discourse-holders oppose water transfers and the idea of basin connection (S15: -3), while also requesting justice, decision-maker sincerity and responsibility in water management. The discourse favours hard-engineering measures to save the delta from threats faced and supports auto-adaptation (S11: +3), rejects any loss of coastal land due to climate change (S3: -3) and believes that water should not be considered as anyone's property (S24:+3).

### Factor 2. Bipolar Factor

Factor 2.1 represents the views of those who loaded positively on factor 2. Factor 2.2 represents the views of those who loaded negatively. Their opinions are essentially opposite to each other.

#### Discourse 2.1. Challenging Mainstream Visions

This discourse is characterized by a perception of high vulnerability and strong attitudes concerning ways of dealing with this. It shows strong opposition to dunes as a solution (S2: -2). Instead discourse-holders defend dam management as the real key to improving the situation (S1: +2). Two main sources of vulnerability are identified: first, the direct, physical exhaustion of water supplies. Water is claimed as no one's property (S24: -1) and hence should not be treated as a commodity, as it currently is. Blaming those vulnerable for defending their territory, which operates at the psychological level, is identified as a second source of vulnerability (S26: -3). Ebro Delta inhabitants participating in this discourse feel they are accused of appropriating water but in fact are victims of a system that

<sup>7</sup>Instituto Español de Comercio Exterior. 2007. La desalinización del agua en España. Cuadernos Sectoriales. January 2007. Madrid.

<sup>8</sup>S stands for the word 'statement'.



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No.	Statement	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	The management of the dams is the real solution to decrease the regression of the delta and adapt to climate change	-2	2	0	-2	0
2	Dunes are a good solution as an adaptation measure to climate change	1	-2	0	2	0
3	I accept a loss of coastal lands	0	-4	1	1	-3
4	Fish farming is a potential alternative to rice for adapting to climate change	-4	-2	-3	-1	0
5	Providing that villages are safe, I do not mind if some settlements have to be moved because of climate change	2	-3	0	0	-1
6	Environmental management needs a solid base of knowledge. Professionals (scientists) must be taken into account more seriously	1	0	2	1	1
7	In my opinion, local people should make the decisions although they may have less academic qualifications	0	1	-3	0	0
8	When taking decisions in the delta, the natural conservation of the river must be prioritized	2	1	1	3	4
9	When taking decisions in the delta, the economy must be prioritized	-1	2	0	4	1
10	There is no integrated policy about what has to be done in the delta. In fact everyone acts separately. I would like this to change	3	3	3	-3	2
11	Auto-adaptation should be promoted because public administration will not be able to cover everything regarding climate change	1	-2	0	-4	3
12	When a water transfer is made I do not mind how the water will be used; I do care that there are sustainable flows in the river	-3	0	0	2	-2
13	When a water transfer is made, I must know the use of the water. There are some acceptable uses such as water to drink	1	0	-2	-2	2
14	A sustainable territorial management must be established at a local level. It is not fair to transfer water	-2	1	2	-1	1
15	I am in favour of connecting catchments and I do not understand that each catchment must have its water and nothing else	-1	-1	-4	-2	-4
16	I am as unsupportive when I say no to Barcelona as when I say no to Murcia for golf courses	0	2	-1	1	-1
17	When there is a water transfer it is always worse when the water is taken out of the catchment than when it is still in the catchment	0	0	1	0	2
18	A proposal of taking water to Barcelona, as in 2008, is still a threat	-1	4	3	-1	0
19	Water transfers are made depending on the political party in power. One supports water transfers and the other a more reasonable water management	0	-1	-2	-1	1
20	The vulnerability to climate change depends on the management made in the delta	3	3	-2	1	0
21	Regarding vulnerability to climate change the irrigation of the rice fields is not under risk	-2	0	-1	0	-3
22	Natural systems are not vulnerable because they have response capacity	-1	-1	-1	2	-2
23	In the short term, the delta is not vulnerable to climate change	-3	1	-1	0	-1
24	Water is a resource which is not the property of anyone	3	-1	4	3	3
25	It seems that irrigators have more right to water than the ecosystem	0	0	2	-3	-2
26	There is a feeling of appropriation of water by the inhabitants of the Ebro Delta	0	-3	1	0	-1

**Table 2.** Factor Q-sort values for each statement

QSORT	1	2	3	4	5
1 Irrigator (Right_Bank)	<b>0.7119X</b>	0.2052	-0.2046	0.0510	0.3451
2 Shellfish_Farmer	0.3841	0.0895	0.2364	<b>0.7362X</b>	-0.0924
3 Conservationist_NGO	0.2386	-0.0807	<b>0.6928X</b>	0.1902	0.2554
4 Natural_Park_Officer	0.1465	0.0994	<b>0.7092X</b>	-0.2811	0.0835
5 Rice_Farmer	<b>0.6759X</b>	0.1301	0.1599	-0.0218	0.0830
6 Camping_Manager	0.1501	<b>0.8027X</b>	-0.0119	-0.0326	0.1888
7 Rice_Cooperative	0.3980	<b>0.7866X</b>	0.0032	0.1808	0.0494
8 Fisher	<b>0.7127X</b>	-0.1969	0.0989	0.1619	0.2000
9 Hunter	<b>0.6151X</b>	0.3158	0.0602	-0.0771	0.4677
10 Rice_Farmer	<b>0.7186X</b>	0.0477	0.2719	-0.0849	-0.3103
11 Env_Technic_Council	0.3328	0.1335	<b>0.7822X</b>	0.2212	0.1390
12 Research_Institute	-0.1534	0.0354	<b>0.7707X</b>	0.0927	0.0352
13 Ebro_Defense_Plat.	0.0082	<b>0.5869X</b>	0.5609	0.0503	0.0582
14 River_Basin_Authority	-0.0942	-0.2388	-0.0116	<b>0.7844X</b>	0.2101
15 Water_Manag_Company	0.4043	0.1366	0.0821	-0.0311	<b>0.7355X</b>
16 Climate_Change_Autonomic_Adm	0.3573	-0.2882	0.0088	-0.6491X	0.2257
17 Coastal_Manag_Statal_Adm	-0.0470	-0.1515	0.3418	0.0334	<b>0.7344X</b>
18 Water_Consortium_Tarragona	0.0581	-0.5719X	0.2357	0.3633	0.3027
19 Water_Manag_Agency_Autonomic_Adm	0.4749	-0.6218X	0.2133	0.0088	0.1460
Number of participants in factor	5	5	4	3	2
% expl. var.	18	14	15	10	10

**Table 3.** Loading of the interviewed persons on the five factors. Numbers in bold, accompanied by an X, indicate statistically significant defining sorts

Most agreed statements	Most disagreed statements
8. When taking decisions in the delta, the natural conservation of the river must be prioritized (+4)	21. Regarding vulnerability to climate change the irrigation of the rice fields is not under risk (-4)
11. Auto-adaptation should be promoted because public administration will not be able to cover everything regarding climate change (+3)	15. I am in favour of connecting catchments and I do not understand that each catchment must have its water and nothing else (-3)
24. Water is a resource which is not the property of anyone. (+3)	3. I accept a loss of coastal lands (-3)
**17. When there is a water transfer it is always worse when the water is taken out of the catchment than when it is still in the catchment (+2)	*4. Fish farming is a potential alternative to rice for adapting to climate change (0)

**Table 4.** Salient and distinguishing statements for factor 1  
Numbers in parenthesis indicate the statement score within the factor.

\*Significance at  $P < 0.05$ ;  
\*\*significance at  $P < 0.01$ .

harms them, and hence display signs of fear of dispossession of water resources from water transfers which block local development (S18: +4).

This discourse differs from the rest in the assumption that the delta is not vulnerable in the short term (S23: +1), reflecting confidence in human ability to achieve adaptation to climate change (S20: +3), although it shows suspicion about current policies and organizations that do not facilitate it (S10: +3). These standpoints reflect traditional values, such as accepting one's position in life, in a sense of resignation. Finally, the discourse opposes resettlement as a response to climate change (S5: -3), and objects to further losses of coastal land (S3: -4).

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Most agreed statements	Most disagreed statements
*18. A proposal of taking water to Barcelona, as in 2008, is still a threat (+4)	3. I accept a loss of coastal lands (-4)
20. The vulnerability to climate change depends on the management made in the delta (+3)	*5. Providing that villages are safe, I do not mind if some settlements have to be moved because of climate change (-3)
10. There is no integrated policy about what has to be done in the delta. In fact everyone acts separately. I would like this to change (+3)	**26. There is a feeling of appropriation of water by the inhabitants of the Ebro Delta (-3)
*1. The management of the dams is the real solution to decrease the regression of the delta and adapt to climate change (+2)	**24. Water is a resource which is not the property of anyone (-1)
*23. In the short term, the delta is not vulnerable to climate change (+1)	**2. Dunes are a good solution as an adaptation measure to climate change (-2)

**Table 5.** Salient and distinguishing statements for factor 2  
Numbers in parenthesis indicate the statement score within the factor.

\*Significance at  $P < 0.05$ ;

\*\*significance at  $P < 0.01$ .

Most agreed statements	Most disagreed statements
*24. Water is a resource which is not the property of anyone (+4)	15. I am in favour of connecting catchments and I do not understand that each catchment must have its water and nothing else (-4)
10. There is no integrated policy about what has to be done in the delta. In fact everyone acts separately. I would like this to change (+3)	**7. In my opinion, local people should make the decisions although they may have less academic qualifications (-3)
*18. A proposal of taking water to Barcelona, as in 2008, is still a threat (+3)	4. Fish farming is a potential alternative to rice for adapting to climate change (-3)
*11. Auto-adaptation should be promoted because public administration will not be able to cover everything regarding climate change (0)	**20. The vulnerability to climate change depends on the management made in the delta (-2)

**Table 6.** Salient and distinguishing statements for factor 3  
Numbers in parenthesis indicate the statement score within the factor.

\*Significance at  $P < 0.05$ ;

\*\*significance at  $P < 0.01$ .

Uncoordinated public policies are sometimes on purpose. During the drought in 2008, in the same week that they were asking for water because of necessity, they set up the Territorial Plan of Barcelona, with 800 000 new homes and 150 000 ha of new irrigated areas.... Unfortunately, there is an integrated policy of lobbies, such as electric companies and banks that are extremely coordinated and dictate the rules of policies (Q Interview 13, Local NGO).

### Discourse 2.2. Let's Be Realists

Although sharing the same values as discourse 2.1, such as justice and responsibility over water use, this discourse focuses differently on the scale of the issue and vulnerability.

Regarding adaptation preferences, the discourse supports soft measures such as sand dunes (S2: -2), and in relation to dam management understands that this could contribute but is not a solution in itself (S1: +2). This discourse considers the ecosystem as the most vulnerable aspect in the short term (S23: +1) and that people can adapt as they have done throughout history. In consequence, it accepts resettlement and coastal land-loss as a result of further sea level rise (S5: -3) (S3: -4). The discourse is less concerned about water scarcity and more about local water possession (S26: -3),

Most agreed statements	Most disagreed statements
9. When taking decisions in the delta, the economy must be prioritized (+4)	11. Auto-adaptation should be promoted because public administration will not be able to cover everything regarding climate change (−4)
8. When taking decisions in the delta, the natural conservation of the river must be prioritized (+3)	**10. There is no integrated policy about what has to be done in the delta. In fact everyone acts separately. I would like this to change (−3)
24. Water is a resource which is not the property of anyone (+3)	25. It seems that irrigators have more right to water than the ecosystem (−3)
**22. Natural systems are not vulnerable because they have response capacity (+2)	
**12. When a water transfer is made I do not mind how the water will be used; I do care that there are sustainable flows in the river (+2)	

**Table 7.** Salient and distinguishing statements for factor 4  
Numbers in parenthesis indicate the statement score within the factor.

\*Significance at  $P < 0.05$ ;

\*\*significance at  $P < 0.01$ .

Most agreed statements	Most disagreed statements
10. There is no integrated policy about what has to be done in the delta. In fact everyone acts separately. I would like this to change (+4)	4. Fish farming is a potential alternative to rice for adapting to climate change (−4)
20. The vulnerability to climate change depends on the management made in the delta (−3)	12. When a water transfer is made I do not mind how the water will be used; I do care that there are sustainable flows in the river (−3)
24. Water is a resource which is not the property of anyone (+3)	*23. In the short term, the delta is not vulnerable to climate change (−3)

**Table 8.** Salient and distinguishing statements for factor 5  
Numbers in parenthesis indicate the statement score within the factor.

\*Significance at  $P < 0.05$ ;

\*\*significance at  $P < 0.01$

considering that policies that promote security should ensure that everybody's water needs are covered (S24: −1). Similarly to the previous discourse, traditional values are reflected in this discourse through acceptance of one's position in life, but in this case as something positive related to attitudes towards water transfers (S18: +4).

Some water transfer may be absolutely necessary and must be done (Q Interview 19, autonomic administration officer).

### Discourse 3. Science and Ecology First

This is the only discourse that demonstrates biocentric and ecocentric positions, regarding equilibrium with nature as well as considering the rights of ecosystems and species. This discourse is concerned about decision-making processes and particularly about the force of lobbies, managers, policy formulation procedures and the impacts of decisions upon ecosystems. This is reflected by disagreement with the position that vulnerability to climate change depends on local delta management (S20: −2) and the emphasis on the view that local people with less academic qualifications are not in a position to make decisions (S7: −3). Interviews reflect that the latter affirmation implies not that locals should not be considered and listened to, but that scientists have to be given more power because delta inhabitants are not objective or do not know enough about climate change.

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The discourse is also characterized by a strong opposition regarding water privatization (S<sub>24</sub>: +4). There is a marked opposition to the connection of river basins (S<sub>15</sub>: -4), not considering it useful, arguing that it goes against social justice and democracy concerns, and recalling the needs of ecosystems.

Basin connection implies that development is distributed according to human and not nature's needs... Not only is this unsupportive to other localities but also unsustainable and ultimately destroys the planet. Water is not just a resource: the river is an ecosystem (Q Interview 3, NGO conservationist).

### **Factor 4. Bipolar Factor**

Factor 4.1 represents sorts that loaded positively and factor 4.2 represents those that loaded negatively in factor 4. Similarly to Factor 2, views expressed in these factors are essentially opposite to each other.

#### **Discourse 4.1. Productivism**

This discourse presents strong anthropocentric features, considering that natural systems are not vulnerable and have a high response capacity (S<sub>22</sub>: +2). This is further emphasized by strong support for the view that the economy must be prioritized (S<sub>9</sub>: +4).

After the pollution produced in 1964, cockles and clams were lost. After a few years, when the administration forbade some products, these species recovered again (Q Interview 2, shellfish farmer).

Anthropocentrism does not reflect local or national scale concerns but rather own interests, highlighting the importance of sustainable flows in the river and not so much the importance of water transfers (S<sub>12</sub>: +2). It is different from the rest of the discourses because it is the only one emphasizing the importance of government intervention in search of successful solutions. It shows optimism regarding existing policy (S<sub>10</sub>: -3), considering that people work together and results are acceptable.

I believe there is an integrated policy. It may not always be consistent but decisions are taken in an integrated and consensual way. There has been a plan, the Integral Plan of Protection of Ebro Delta (PIPDE<sup>9</sup>), which included measures proposed by all sectors. It implied a strong unifying effort (Q Interview 14, Ebro River Basin state administration officer).

The discourse does not support self-adaptation (S<sub>11</sub>: -4), reflecting again its trust in government intervention for a proper adaptation and reduction of vulnerability.

#### **Discourse 4.2. Conservationism**

This discourse emphasizes that natural systems are very vulnerable (S<sub>22</sub>: +2) and response capacity does not ensure their survival, while it trusts man's ability to adapt to climate change.

It gives high importance to how the water is used after a transfer (S<sub>12</sub>: +2), emphasizing its importance for the ecosystem but allowing some exceptional circumstances in which these transfers could be legitimate.

In contrast to 4.1, it believes that policies relevant to delta development are not integrated (S<sub>10</sub>: -3), although it is not as critical as other discourses. This focuses on other informal stakeholders' responsibility in the adaptation process (S<sub>11</sub>: -4) and states that administration is sometimes overloaded with tasks.

"The delta comes first but later other ecosystems will be affected... the limiting factor is the budget. Budget is the first thing to think about and then distribute it in the best way possible" (Q Interview 16, climate change autonomic administration officer).

The discourse maintains a neutral approach regarding nature and human protection. When posed with the dilemma of whether to show preference to nature or society as regards conservation, this discourse

<sup>9</sup>Integral Plan of Protection of Ebro Delta, from its initials in Spanish (Plan Integral de Protección del Delta del Ebro). Ministerio de Agricultura, Alimentación y Medio Ambiente (MAGRAMA). 2006. Plan Integral de Protección del Delta del Ebro. Ministerio de Medio Ambiente.

holds that nothing should be prioritized because there should be equilibrium and integration of everything (S8: +3) (S9: +4).

### Discourse 5. Things Are Pretty Bad, but Water Is for All

This discourse presents a mixture of many of the arguments held by other discourses but differs from the rest on its belief about the urgency of delta vulnerability (S23: -3). Although the discourse states that in the short term the Ebro Delta is very vulnerable to climate change, it also emphasizes man's ability to adapt to climate change (S20: +3). Nevertheless, the possibility that an integrated management policy (S10: +4) would delay the process is put into doubt.

The discourse also strongly opposes the view that aquaculture could be an alternative to rice cultivation (S4: -4) due to climate change. This is questioned in both economic and environmental terms, as discourse-holders consider that after extensive man-made effort to shape the delta in its current state the economic sectors now established there are fine-tuned with the ecosystem.

Finally, the discourse puts some emphasis on the issue of water ownership. Here, the discourse stresses the common character of water (S24: +3) and user responsibility to make good use of it (S12: -3).

“Inexistence of ownership does not mean that you do not have any responsibility. If you do not use it appropriately it must be removed from you” (Q Interview 15, water management company officer).

Overall, results reveal discourses that are clearly anthropocentric except from the ‘science and ecology’ one, which represents biocentric and ecocentric perspectives and is the one that urges decision-makers the most to take scientists more seriously into account and consider ecosystems and species in public decisions. The ‘productivism’ discourse is characterized by uncertainty aversion, which implies an emphasis on government intervention as well as use of the precautionary principle to legitimize arguments. The ‘local in focus’ discourse is characterized by self-achievement values, reflected in a belief in auto-adaptation and the prioritization of hard measures to avoid loss of coastal land and maintain current socio-economic activities. Discourse-holders appreciate greater freedom to devise their own adaptation measures, and although they welcome guidance from the public administration and scientists they currently perceive public administration intervention more as an obstruction. Factor 2.1 discourse-holders are sceptical about political interference, and in some cases it makes them unite and resist such intervention. Real actions considering their claims, instead of words or compensating offers, would help to change these perceptions. Their stance is based on establishing the ecological flow of the Ebro River and listening to the scientists who have already determined it. Some of them also ask for public management of dams and some hard measures such as dikes in places where they are deemed appropriate. Q results and interviews reveal that the ‘local’ and ‘challenge mainstream’ discourses support the defence of coastal lands. However, a coalition between them is unlikely, as interviews revealed that views expressed by the ‘local’ discourse seem opportunistic to holders of the ‘challenge mainstream’ discourse, and views expressed by the latter are considered too anti-establishment by the ‘local’ discourse.

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## Discussion

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Our results show that local stakeholders are mostly represented by the ‘local in focus’, ‘challenging mainstream visions’ and ‘science and ecology’ discourses, whereas the ‘let’s be realists’, ‘conservationism’ and ‘water for all’ discourses mostly reflect views expressed by the public administration. The ‘productivism’ discourse is mixed, in the sense of being held by both local and public administration stakeholders. We take this difference between public administration and locally held discourses on vulnerability to climate change to suggest that *proximity* to the site of climate impacts, the Ebro Delta, is a factor shaping different notions of vulnerability. Proximity implies that locally held discourses emphasize the risk and relevance to vulnerability of water transfers more than the public administration does. They also see delta inhabitants as the most vulnerable element in the system and consider their exposition to risk as morally wrong and as a security threat. The ‘challenging mainstream visions’ discourse in particular appeals to justice and territorial equilibrium as normative concepts, which relate to concerns about the unequal distribution of environmental impacts

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between 'centres' and 'peripheries' and which are relevant for understanding environmental conflicts in the broader area of Southern Catalonia (Zografos and Martínez-Alier, 2009). Locally expressed concerns about the risk of water transfers reflect a fear of being dispossessed of resources (water), and reveal feelings of increased vulnerability and a serious threats to human security (Gasper, 2005) from the effects of climate change.

As regards adaptation measures, locally held discourses agree with each other concerning the need to ensure security and land conservation but hold different perceptions about the meaning of hard measures. For some dikes are 'big dunes' with the additional benefit of being more solid and at an appropriate height, while for others constructing dikes means destroying the rich local ecology and landscape. Notwithstanding this, results show more unity of views among discourses held by local groups than within the public administration, whose perceptions about vulnerability and response capacity, the image of irrigators, self-adaptation and the importance given to the use of water after a transfer differ among them. For example, the 'productivism' and 'conservationism' discourses share an antagonist vision about the success of policies and water access and management and the 'water for all' discourse also differs strongly from 'productivism'. The former holds that the local ecosystem is the most vulnerable element in the short term, while the latter considers that natural systems are not vulnerable due to their high response capacity.

An important dimension of the proximity parameter involves the fact that a key difference between discourses held mostly locally and those held mostly by public administration differ from each other not so much as regards the values that they espouse but regarding the *scale* of reference they consider relevant for applying these values. In this sense, we observe that some values seen as relevant for policy-making and locals are the same, e.g. social justice in the sense of everybody's right to water and responsibility over water use, but, while the public administration (including some public utilities) gives a national (Spanish state or Catalan Autonomous Community) scale dimension to the issue, locally held discourses conceive justice to involve maintaining a balance of rights between the delta and regions outside this.

Beyond the proximity point, a second key point of our results concerns policy intervention. Here, we observe different perceptions as regards the capacity to respond to climate change and a concern with the lack of commitment towards project proposals and policies. Such worries are expressed by different claims regarding water management and the role of participatory processes in policy formulation. Our study found that there is no questioning of the existence of climate change or the speed of its effects, but differences in understanding vulnerability relate to different concerns as regards water transfers inside and outside the Ebro Basin and Catalonia. At first sight, all factors are against water transfers (basin connection), but the 'challenging mainstream visions' and 'science and ecology' discourses emphasize such rejection and water transfer threats, denying even consideration of the appropriateness of uses of water from a transfer and holding a strict attitude on this matter. Those two discourses see water transfers as an attack on popular democratic values and an abuse of economic power. On the other side of the spectrum are the 'realist', 'conservation' and 'water for all' discourses, this latter mostly representing the public administration, stating that extreme necessity could provide legitimate grounds for water transfers. As revealed by interviews, such postures are regularly interpreted locally as signs of lack of commitment of the administration towards the locality, which creates rejection and potential for policy implementation bottlenecks. Something similar occurs as regards participatory processes. Although participation took place in the formulation of water and broader delta management plans (e.g. Ebro River Basin Management Plan, Integrated Plan for the Protection of the Ebro Delta), these processes are locally seen as ineffective because in practice the inputs of these plans are not taken into account in policy-making. Moreover, interviews revealed a local concern in that these plans incorporate mainly economic values, thus downplaying any other type of value. Despite this, local stakeholders welcome these initiatives and keep on participating in them.

A relevant point concerns the observation that all discourses agree that the opinion of scientists should be seriously taken into account in policy and decision-making. Trust in the integrity of the scientific community obtained consensus by all discourses. Although this is important, particularly so as regards the importance of scientific opinion for deciding upon crucial issues closely related to climate change vulnerability such as environmental flow, an overdependence on the opinion of only one group of stakeholders may produce de-politization of environmental decision-making by reducing public decisions to administrative ones and a situation where decision-making is increasingly considered to be a question of expert knowledge and not political negotiation. In this sense, special care must be taken to avoid the replacement of ideological or 'dissensual' contestation by techno-managerial planning and expert management (Swyngedouw, 2010). Nevertheless, and after contrasting Q results with interview data, we find that all discourses give great importance to the collective character of decision-making and emphasize the importance of taking into account local views. Importantly, some of the emphasis on the significance of the scientific community

seems to stem from concerns with past experience of the public administration overlooking scientific evidence in deciding crucial issues, such as water transfers within the context of PHN in 2001.

Both the proximity point and our observations regarding policy intervention hold important implications for climate change governance in the delta. More specifically, they reveal a host of issues that should be integrated into the policy agenda in order to proceed to effective and legitimate policy-making processes. Specifically, adaptation plans should make explicit links between climate change vulnerability and water transfers and the challenges these pose for adaptation measures not only in their diagnosis of delta vulnerability but also in the consideration of alternatives to deal with it. Beyond the delta, this means that adaptation plans should consider the implications that climate change side by side with locally generated environmental change has for vulnerability.

The policy agenda should also incorporate an open debate focused on the issue of what is the proper scale of reference for justice and responsibility when responding to climate change with adaptation measures. This debate would need to consider disparate local views as regards the meaning of hard-engineering interventions as well as disparate public administration views on response capacity, self-adaptation and the relevance of water transfers for climate change vulnerability. At a more general level, policy-makers should realize that local concerns about lack of public administration commitment to water transfer policies and participatory processes not only reflects perceptions but also risks diminishing response capacity, by creating low levels of trust and credibility, and hence low levels of success for any future policy implementation. To deal with this issue, debates could be conducted within the framework of deliberative forums, which could form part of processes already taking place, e.g. in the context of the Catalan Climate Change Adaptation Plan, which could integrate such discussions in phases of plan revision and update.

Nevertheless, it is important to remind ourselves that deliberative processes run the risk of establishing situations where there is cooperation without agreement and institutionalize subordination of priorities. For example, Zeitoun and Warner (2006) explain that water projects have proven an effective incentive for cooperation, under a mutually beneficial 'shared interest' framework, which reinforces unequal situations. Coalitions of discourses are many times based on power relations and asymmetrical knowledge, which at the same time create the discourses themselves (Robbins, 2006). Moreover, there is no guarantee that collective deliberation alone will lead to an agreed best solution (Davies *et al.*, 2005). Nevertheless, in conditions of uncertainty that are particularly relevant when considering climate change, it is easier for those in power to consider some knowledge as illegitimate and elevate their own opinions based on national social justice and economic arguments (Robbins, 2006). Deliberation can help reconstruct problems and make decision-making fairer. Moreover, as Dryzek (2008) explains, Q is a tool that could contribute to this by providing opportunities for people to communicate and express their ideas in a meaningful way in decision-making processes.

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## Conclusions

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This paper argues that taking into account values and perceptions of affected people and decision-makers is a fundamental and necessary issue for more desirable policies. The application of Q allows us to understand what people disagree on and why and offers the possibility of finding on what there is agreement. Policy-wise, building on consensus and negotiating disagreement can help improve accountability and pursue common solutions. Social justice and security are the most relevant values in the Ebro Delta case, but the scale of reference for enacting these values differs between public administration and Ebro Delta inhabitants. Our approach sheds light on the importance of understanding and considering these differences on vulnerability scale perception in order to pursue an acceptable compromise between them through deliberative decision-making. Deliberation can produce common understanding and new options for climate action and solutions by discovering common grounds for action. In this way, our approach opens space for dialogue to bridge differences between those affected by and those in charge of climate change adaptation decision-making processes.

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