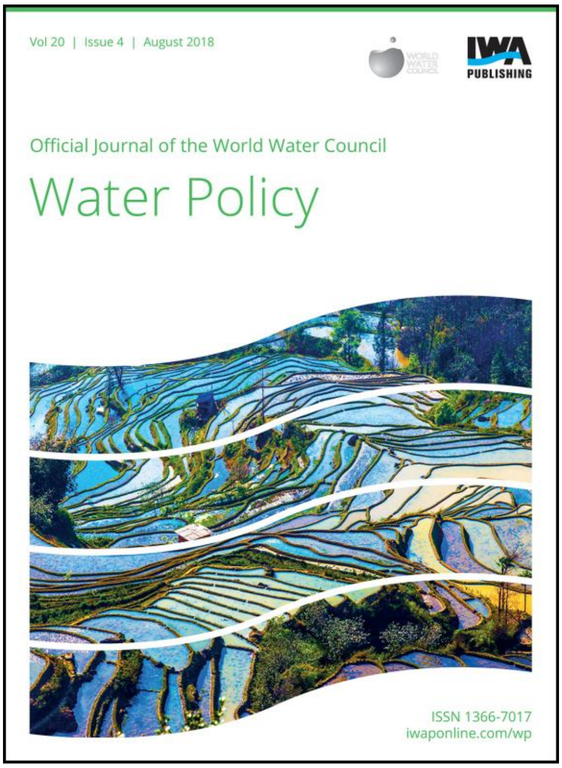
ELECTRONIC OFFPRINT

Use of this pdf is subject to the terms described below



This paper was originally published by IWA Publishing. The author's right to reuse and post their work published by IWA Publishing is defined by IWA Publishing's copyright policy.

If the copyright has been transferred to IWA Publishing, the publisher recognizes the retention of the right by the author(s) to photocopy or make single electronic copies of the paper for their own personal use, including for their own classroom use, or the personal use of colleagues, provided the copies are not offered for sale and are not distributed in a systematic way outside of their employing institution. **Please note that you are not permitted to post the IWA Publishing PDF version of your paper on your own website or your institution's website or repository.**

If the paper has been published "Open Access", the terms of its use and distribution are defined by the Creative Commons licence selected by the author.

Full details can be found here: http://iwaponline.com/content/rights-permissions

Please direct any queries regarding use or permissions to waterpolicy@iwap.co.uk

Water Policy 20 (2018) 794–810

Interest group perceptions on water policy reforms: insight from a water-stressed basin

Encarna Esteban[a], Ariel Dinar[b], José Albiac[c], Alfonso Calera[d], Marta García-Mollá[e] and Lorenzo Avellá[e]

[a]*Corresponding author. Department of Economic Analysis – School of Humanities and Social Sciences, University of Zaragoza & IA2 (Instituto Universitario Mixto Agroalimentario de Aragón), Calle Atarazanas 4, 44003, Teruel, Spain*
E-mail: encarnae@unizar.es
[b]*School of Public Policy, University of California, 920 University Avenue, 92521 Riverside, USA*
[c]*Department of Agricultural Economics, Agrifood Research and Technology Center (CITA-DGA) & IA2, Avenida Montañana 930, 50059 Zaragoza, Spain*
[d]*Hydrogeology, Remote Sensing and GIS Group, Institute for Regional Development, University of Castilla – La Mancha, Avda. España s\n Campus, 02071 Albacete, Spain*
[e]*Universitat Politécnica de València & Valencian Centre for Irrigation Studies, Camino de Vera s/n, 46022 Valencia, Spain*

Abstract

Water policies have been implemented worldwide to face water stress. However, the existence of water users' groups with opposite interests and different political power results in the plain failure or low effectiveness of water policy reforms. A better understanding of users' perceptions regarding policy outcomes is important to avoid the failure of water policies and the intensification of water conflicts. This paper empirically examines the divergent perception of interest groups on the implementation of different policies dealing with water scarcity and their proactive involvement with water agencies. We have conducted a survey in the Jucar River Basin (a water-stressed basin in southeastern Spain) to analyze interest group opinions regarding water policy effectiveness and water institutions' performance in water management. Questionnaires were sent to the main irrigation districts and urban water utilities within the basin. The collected information gives a general picture of the behavior of opposite water interest groups in this basin. The analysis of the perceptions on water policy reform between the groups highlights the existence of significant differences between preferred measures to address water scarcity and lobbying capacity. These differences depend on the size of the group, the specific basin location, and other group characteristics.

Keywords: Interest groups; Irrigators; Stakeholders' behavior; Survey; Urban water utilities; Water policy reforms; Water scarcity

doi: 10.2166/wp.2018.114

© IWA Publishing 2018

1. Introduction

Many water policies and regulation interventions have been implemented globally in order to cope with water scarcity and deteriorating water quality, which is affecting around half of the world's population (Mekonnen & Hoekstra, 2016). However, one of the main problems with water policies is the uneven outcome of their effectiveness and fairness across regions and groups of users. Opposed interests appear in intersectoral conflicts (e.g., irrigation vs. residential users) as well as in spatial conflicts among users located in different places along a river basin (e.g., upstream vs. downstream users). These opposed interests may lead to derailment of the policy reform at stake. The fact that water is a shared resource, either directly as a common pool resource (Ostrom, 1990; van Oel *et al.*, 2009) or indirectly via stream and return flows from upstream to downstream, complicates the relations between groups using the same resource. Illustrations of these opposed interests include local, regional, and international examples resulting in recurring water disputes (Dinar & Letey, 1991; Giordano & Wolf, 2003; Ward & Pulido-Velazquez, 2008).

There are several studies that address local and regional water conflicts (Hendrix & Glaser, 2007; Raleigh & Urdal, 2007; Gizelis & Wooden, 2010; Böhmelt *et al.*, 2014; Devlin & Hendrix, 2014), nevertheless a better understanding of the factors and characteristics that drive water conflicts is still needed. Gaining a better knowledge of the main drivers of basin disputes, and the behavior of interest groups, is essential to understand the root causes of many water conflicts. Part of the explanation of a basin dispute can be attributed to the local physical, institutional-legal, and socio-economic conditions that prevail in the basin – what institutional economists call 'path dependency'. Therefore, the case study approach is quite useful for analyzing specific basins.

In the case of Spain, which is the focus of this paper, water conflicts have been common in many regions. Especially relevant are the conflicts over the use of water for irrigation in the southern and south-eastern basins of Spain, where acute water scarcity prevails. The Jucar River Basin in Spain is a major example of a water-stressed basin where conflicts between stakeholders and regions have prevailed since the 1970s. While the basin water authority (Jucar River Basin Authority) has implemented different policies to address the recurring water shortages, water allocation disputes still prevail.

Water policy combines political, economic, social, and environmental elements, which make regulation a very difficult task (Carvalho *et al.*, 2017). To achieve efficient water management, the cooperation between water institutions, governments, and users is a requisite. This paper seeks to provide empirical evidence to demonstrate how different interest groups share divergent opinions on the reform, namely water institutions' performance and water policies implemented. Several papers have already analyzed water users' perceptions on the suitable policies to manage water shortages and deal with drought situations (Greiner *et al.*, 2009; Mertz *et al.*, 2009; Greiner & Gregg, 2011; Gandure *et al.*, 2013; Ortega-Reig *et al.*, 2014). In our study area, Urquijo & De Stefano (2016) have analyzed irrigators' perceptions on strategies to face drought. We contribute to this literature by implementing a broad survey covering opposite water interest groups and diverse water users. This study analyzes their perceptions on the efficiency of already implemented water policies and the water institutions' performance. Furthermore, we also analyze how cooperation between agents and their intrinsic characteristics alter their opinions and perceptions on water management in a given basin. The essential need for cooperation between stakeholders in water management requires better knowledge of the preferred and more effective instruments to better deal with water scarcity.

The purpose of this paper is the following: (1) analyze interest groups' perceptions about the different policy interventions used in the past to address water scarcity; (2) study interest groups' interactions with water authorities to influence the direction of the policies; and (3) identify common threads and differences between water interest groups. The overall objective is to better comprehend the perception of water policies by the water interest groups. We aim to understand how different water users, belonging to opposite interest groups, perceive the effectiveness of water policies. The results of this research can be important to policymakers seeking to address water scarcity and reduce water conflicts between opposite water users and uses, especially in a context of increasing water shortages worldwide.

The water users' perceptions of water policy reforms are based on the analysis of primary data that was collected using a comprehensive survey administered among stakeholders in the Jucar Basin. While the outcomes are specific for this basin, the results of this study call for the ex-ante evaluation of policies and for a better comprehension of the roots of water disputes between interest groups. The results clearly highlight how elements such as the size of the group, the level of concentration, or the cropping pattern are very relevant factors in conditioning interest group opinions. While there have been recent efforts to analyze irrigators' perceptions and opinions on policies to face water shortages and droughts (Urquijo & De Stefano, 2016), a better knowledge on the specific opinions of these stakeholders is still needed.

The outline of the paper is as follows. The next section describes the physical characteristics of the study area and presents the main interest groups analyzed in this paper and the existing conflicts between them. The data collection and survey implementation are briefly explained in the third section. The analysis of the irrigators' perceptions on the implemented water policies in the basin are summarized and analyzed in the fourth section, and the water utilities outcomes are explained in section five. Section six provides the policy implications gained from the results. Finally, conclusions are presented in section seven.

2. The Jucar River Basin: water conflicts and main interest groups

2.1. The Jucar River Basin

The Jucar Basin is located in southeastern Spain, lying within the regions of Valencia and Castilla-La Mancha, and represents the most important basin within the jurisdiction of the Jucar River Basin Authority (Figure 1). This basin covers 22,000 km^2 with a population density of 120 inhabitants per km^2. The per capita gross domestic product in the main regions of the Jucar Basin (18,000 € and 21,300 €, for Albacete and Valencia, respectively) is below the national average (24,000 €).

The Jucar Basin extends over a semi-arid region with irregular Mediterranean hydrology, which is characterized by dry summers and recurrent drought spells. Surface water is provided by dams in the Jucar River and its tributaries, although groundwater sources are also very important. The Jucar system also includes two major water distribution canals, the Acequia Real and the Canal Jucar-Turia. Most of these water resources are used by irrigated agriculture and urban and industrial centers, with the larger share going to irrigated agriculture (85%). While long-term mean available water resources in the Jucar Basin are 1,700 Mm^3 (with 930 surface and 770 groundwater), extractions are 1,680 Mm^3 leaving the system very unreliable during drought years (Kahil *et al.*, 2016).

Agricultural irrigation activities date back centuries, especially in the region of Valencia, but nearly 40 years ago new irrigation projects were developed. Currently, the basin includes three major irrigation areas (Figure 1): (1) the Eastern La Mancha aquifer irrigation area, located in the upper Jucar (from hereafter – upstream); (2) the more modern Canal Jucar-Turia irrigation district located between the lower Turia and the Jucar river watersheds; and (3) the traditional irrigation districts in the lower Jucar. Regions (2) and (3) are referred from hereafter as downstream.

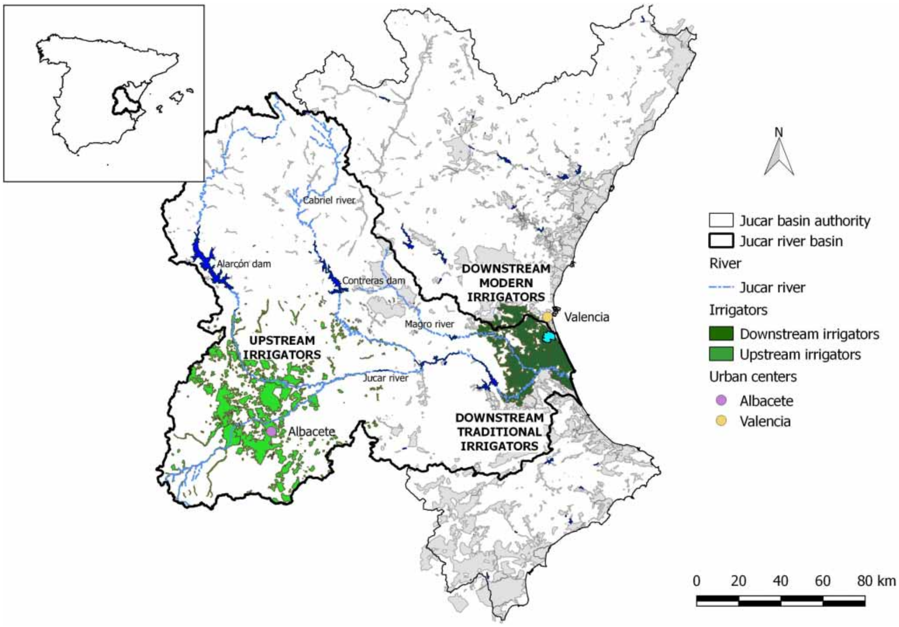


Fig. 1. The Jucar River Basin.

The institution in charge of water management and regulation of surface and groundwater is the Jucar River Basin Authority (JRBA). This institution, created in 1935, is part of the Spanish Government but has an autonomous functionality. The JRBA main activities are related to water governance, management, planning, cooperation, and construction and operation of water infrastructures (Estrela, 2004). A special feature of the basin authority is the key role played by stakeholders in the decision-making and enforcement processes at both basin and local watershed levels. Stakeholders have representation in the JRBA and they can have a real influence in the water management of the basin. In order to deal with the growing water scarcity in the basin, three main policies have been implemented by the JRBA to address water scarcity: water quotas, water rights, and investments in irrigation technology improvements, or irrigation modernization.

1. Water quotas are limits or constraints placed on the amount of water that each irrigator can apply per hectare of irrigated land. The purpose of the quota is to limit diversions and extractions in order to maintain a sustainable flow of water resources, especially during droughts. In periods of water scarcity, the JRBA imposes maximum levels of extractions per hectare that cannot be exceeded. Both surface and groundwater extraction limits are controlled by the JRBA in coordination with the watershed boards.
2. Water rights are legal entitlements that allow the use of a given amount of water from a particular water body. The Jucar Basin has several ‘senior rights’ (or ‘historical water rights’) that belong to downstream irrigators and are associated with privileges for traditional irrigators dating back centuries. New legal entitlements of water rights have been granted since the 1970s to new irrigation districts such as the Eastern La Mancha or the Canal Jucar-Turia districts. While upstream irrigators, who started using groundwater in recent decades, were assigned legal rights, some of them are still provisional and pending official agreements. This difference in the recognition of water rights is currently one of the main problems between upstream and downstream users.

3. Irrigation modernization, which is supported by public subsidies, is another important water policy oriented towards water efficiency gains. This policy involves investments to switch to on-farm water saving irrigation technologies (e.g., shifts from flood to sprinkler or drip irrigation technologies). Additionally, this policy also includes investments to reduce the losses from water supply networks. This policy, which is promoted by the national and state governments, is in fact implemented because of the collaboration between farmers and the JRBA.

2.2. Water stakeholders

In this paper we assume that the main water stakeholders in this basin are irrigators, both from upstream and downstream. This assumption is based on the fact that the largest share of water consumption in the Jucar Basin (85%) is used for agricultural issues. Our analysis also includes the urban water utilities that represent urban and industrial water users. These two groups allow us to compare differences in water management perceptions between opposite interest groups (e.g., upstream vs. downstream irrigators), and also between different water uses (e.g., irrigation and urban water uses). While other important stakeholders can be identified (e.g., non-governmental organizations (NGOs), environmentalists) we based our analysis on the perceptions of the irrigation and urban groups.

2.2.1. Upstream water users: the Eastern la Mancha Aquifer. The Eastern la Mancha aquifer is the largest aquifer in Spain, covering 33% of the total Jucar River Basin (7,260 km^2) and extending over three provinces (Albacete, Cuenca, and Valencia). This groundwater body sustains about 100,000 ha of irrigated agriculture with nearly 1,000 landowners. It also supplies water to 275,000 inhabitants in the region of Albacete. The aquifer is located in the central high plain with an elevation of about 700 metres above sea level and with a current water table depth of around 30–40 metres below surface level (Sanz *et al.*, 2009). The river and the aquifer have important hydrological connections with an interchange of water between them (Perez-Martin *et al.*, 2014).

Upstream farmers in the Jucar River Basin are part of the Eastern la Mancha irrigation district that was developed over the La Mancha aquifer from the 1970s onwards in the Albacete region. Further expansion of the intensive agriculture raised water extractions from 50 Mm^3/year in the 1970s to more than 400 Mm^3/year in the 1990s. The large and maintained pressure over this aquifer led to a significant decline in its water table, which almost caused the official declaration of aquifer overexploitation in the 1980s.

2.2.2. Downstream water users: traditional and modern irrigation districts. Downstream irrigators are located in the lower Jucar River Basin in the Valencia region. Although this interest group is divided into two sub-groups, traditional and modern irrigators, both sub-groups pursue the limitation of upstream irrigation affecting downstream water availability.

The traditional irrigators sub-group, located in the lower Jucar River, has its origin in the Middle Ages. Traditional farmers found agriculture to be profitable during the 1960s based on a longstanding irrigation tradition. Already in the thirteenth century, these irrigation districts obtained their ‘historical water rights’ from King Jaime I that declared the Valencia farmers the sole users of the Jucar River. One of the main characteristics of these farmers is their ability to exert political pressure, not just at basin but also at national level. Traditional irrigation comprises around 35,000 hectares of irrigation with nearly 7,000 users.

The modern irrigators sub-group is also located in the lower Jucar and between the Jucar and Turia rivers, which is partially located out of the Jucar River Basin. Traditionally, this group used groundwater resources from the numerous small aquifers spread out along this area. However, the construction of the Jucar-Turia canal in the 1990s allowed them to use surface water and to significantly expand their irrigation. Currently, this irrigation area comprises 25,000 hectares with nearly 13,000 irrigators.

2.2.3. Urban users: water utilities. The Jucar Basin supplies water to about 2.4 million people of whom about 90% live in the Valencia region (Mediterranean coast). Additionally, there is an important seasonal variability in the population because of the massive tourism along the Mediterranean coast during summer. The increased urban pressure during the driest months aggravates water scarcity, especially, for downstream irrigators. Law guarantees urban water consumption with priority over any other consumption including irrigation. However, some water disputes between urban and irrigation users exist, especially in downstream Jucar, because of water contamination from irrigation returns flows with significant pollution loads.

Urban water demand in the Jucar Basin consumes around 210 Mm^3/year to supply water to 300 municipalities. Nearly 50% of the urban water supplies come from surface sources (Jucar River and dams), while the rest originates from aquifers, reservoirs, and a small portion from seawater desalination plants. This basin has currently five major water companies in charge of the urban water management and distribution. These big water utilities supply the water to municipalities and utilities in charge of water distribution networks to households and connected industries.

2.3. Water conflicts in the Jucar River Basin

The growing extractions of water resources in the basin together with frequent droughts, have led to serious conflicts between the various water interest groups. Since the 1990s, irrigators located upstream and downstream have been engaged in disputes over the basin's water resources and water rights. Conflicts between irrigators and urban users for water allocations are not as relevant since Spanish law guarantees the priority of water provision to human consumption over all other uses.

The disputes in the basin erupted because the depletion of the Eastern la Mancha aquifer involved serious impacts on the hydrology of the Jucar River downstream. Depletion has largely reduced aquifer discharges to the river from around 300 to less than 50 Mm^3 over the past 30 years (Perez-Martin *et al.*, 2014). The progressive decline in the Jucar flows has triggered severe negative impacts on downstream farmers, with less water available for their irrigation activities. The conflicts between upstream Albacete and downstream Valencia irrigators intensified in the 1990s because of an intense drought period. The partial desiccation of the Jucar river during the 1995–1996 drought involved several negative impacts on the downstream economic activities. In response, downstream farmers requested the JRBA and other national authorities to limit upstream irrigation water. Realizing the political pressure initiated by downstream irrigators, upstream users assumed the role of controlling their extractions. In 1994, the Water User Association (WUA) of Eastern la Mancha (JCRMO)[1] was established in order to regulate and control groundwater extractions[2].

---

[1] The WUA (JCRMO – Junta Central de Regantes de la Mancha Oriental) is an autonomous organization of users managing the aquifer, being an important stakeholder within the Jucar River Basin Authority. One of its main tasks is the control of water withdrawals from the aquifer (upstream). Furthermore, the JCRMO is the sole WUA in the upstream (Albacete region).

[2] Farmlands in Albacete are controlled and monitored through the use of remote sensing techniques, coupled with crop planting information provided by farmers. This system allows the JCRMO to calculate the amount of water extracted by each irrigator, and then it is possible to implement an effective control over the Eastern la Mancha aquifer resources. In fact, groundwater extractions have been reduced by 25% during the 2000s in that aquifer.

All these facts are evidence of the significant differences between the main two irrigators' interest groups in terms of both attitudes and political influence. However, there are also important differences in the specific characteristics of each group. One important difference is the large number of irrigators with smaller landholding sizes in downstream compared with upstream. In addition, downstream irrigators (20,000) are organized in several (50) heterogeneous[3] WUAs, while irrigators upstream belong to a single WUA.

3. Survey design

In order to elicit the opinion of the stakeholders' groups (upstream irrigators, downstream irrigators, and urban water utilities), questionnaires were designed and administered in the basin. The objective of the questionnaires was to collect information regarding the opinion of individual stakeholders about the policies implemented by the JRBA and also about the individual's (or its representatives) involvement in influencing these policies. The development of the questionnaires was discussed in detail with representatives and experts from different government levels (basin and WUAs), and questionnaires were field-tested for feedback. Three questionnaires were designed, responding to the special characteristics of the interest groups: upstream, downstream, and urban. The questionnaires are made up of 8 to 11 queries with different items, depending on each group characteristics. The queries collect general information on: (1) users' opinions on the three water policies; (2) users' involvement and participation with water institutions at different government levels; (3) users' perceptions on the specific effort and effectiveness of approaching water institutions to influence their decisions. The full questionnaires are included in the Supplementary Material (available with the online version of this paper).

The upstream and downstream irrigators' questionnaires were anonymous and randomly distributed to individuals in both locations during February to May 2016. Because of the disparity within the structure of the two groups the data collection process was different for each location, as explained below. In all, we sent a total of 435 questionnaires, and we received 369 completed ones, which yields an overall response rate of nearly 85%[4]. After dropping questionnaires due to missing relevant information, we were left with 336 observations: 133 in upstream, 201 in downstream, and 3 from urban water utilities. The sampling error is 8% and 6.8% for the surveys of upstream and downstream irrigators, respectively, and 43.5% for the water utilities survey[5].

In the case of upstream irrigators, where a single WUA (JCRMO) exists, the questionnaire was emailed by the JCRMO. The JCRMO randomly delivered the questionnaire to 200 farmers (66% response rate)[6].

For downstream irrigators, where the number of WUAs is large and users are quite heterogeneous, a stratified random interview procedure was applied acquiring 230 observations (87% response rate). The questionnaires were handed to irrigators by a consultant visiting the irrigation areas within the Valencia region. Both modern and traditional irrigators were approached and they were selected without any particular order, so that it can be considered a random sampling independent of any factor that could

[3] WUAs downstream are very heterogeneous in terms of member size (ranging from 50 to 10,000 members), irrigation acreage (ranging from 2 to 21,000 hectares), and also several technical characteristics including differences in the source of water (e.g., groundwater, river, canal, etc.). The largest, and one of the most powerful WUA in downstream is the Users Union of Jucar (USUJ).

[4] WUAs for both upstream and downstream locations assisted in emailing and handling the irrigators' questionnaires. This produced a very large response rate compared with what could be expected from this type of survey.

[5] Significance level at 95%.

[6] The application 'Google Drive' was used to create surveys that irrigators completed and submitted online.

influence the results. The characteristics of this interest group and the lower involvement with WUAs affected the number of questionnaires we could obtain for this group (number of surveys compared with the number of irrigators downstream).

Urban and industrial users are represented by water utilities that distribute water resources to households and industries. We emailed the questionnaire to the main five big companies, using the 'Google Drive' application. We received three completed questionnaires (response rate of 60%)[7].

The responses were processed with Stata 13 for obtaining descriptive statistical analyses. Results by interest groups were combined to obtain a comparison between groups, especially for downstream and upstream irrigators. Complete sets of statistical results are presented in the Appendix (Tables A1–A3, available with the online version of this paper).

4. Results of irrigators' responses: statistical analysis

This section analyzes the main results from the irrigators' questionnaires. In this section we summarize the main statistics and compare some of the most important results between the two interest groups, upstream and downstream.

4.1. Comparison of farmland characteristics between the interest groups

The first part of the questionnaire is based on irrigators' landholding characteristics. The main attribute that can be observed from the results is the large difference in the landholding size and land utilization between the two regions. Upstream irrigators have, on average, a considerably larger landholding size (107 ha) with a lower share of fruit trees (20.5%) compared with downstream irrigators (2.5 ha plots and 80% fruit trees). While the largest landholding size in upstream is nearly 1,030 hectares and the smallest is close to 10 hectares, in downstream the largest landholding is 25 hectares and the lowest is close to 0.06 hectares (see Tables A1 and A2, items 1 and 2A–2B).

An independent sample t-test has been conducted to compare the existence of significant differences in the number of hectares and the share of fruit trees between the two interest groups. The results for the landholding size show statistically significant differences between the two groups, $t(330) = 9.2023$, ($p = 0.0000$). This suggests that the mean landholding size upstream is significantly higher than downstream (positive t-test). Similar results have been found for the variable share of fruit trees, where the negative and significant t-test indicates that the share of fruit trees is higher in the case of irrigators downstream compared with irrigators upstream ($t(330) = -15.8972$, ($p = 0.0000$))[8].

4.2. Comparison between the irrigators' opinions on water policies

In the second part of the questionnaire, irrigators were asked about their general opinion regarding the three policies implemented in the basin to address water scarcity: (1) water quotas or limits on

---

[7] We assume that our results are robust base on some premises: (1) in the whole basin there are just five main big water utilities; (2) our sample includes water utilities from the two main locations, upstream and downstream; and (3) these three water utilities supply water to 42% of the basin population.

[8] t-statistic significance level at 99%.

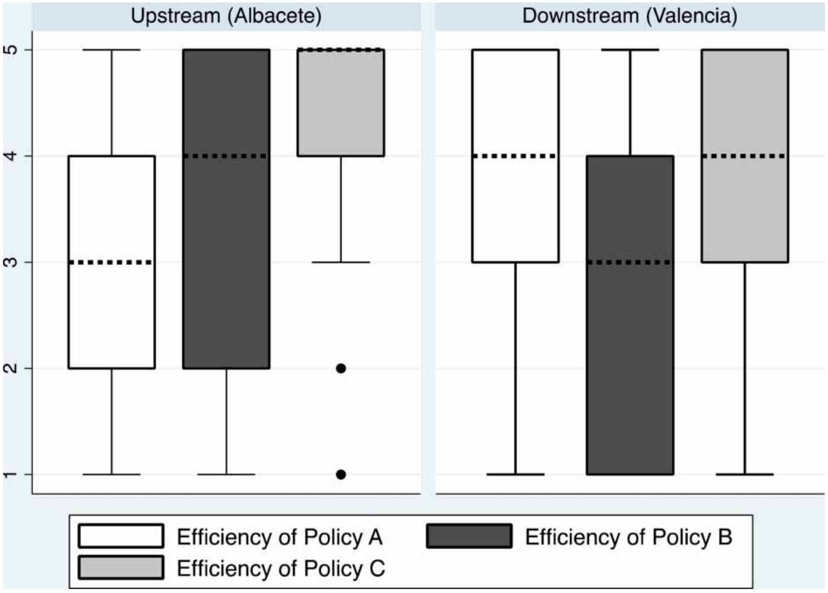


Fig. 2. Irrigators' opinions on the efficiency of the implemented policies. *Note:* Ranked from 1 ('very bad policy') to 5 ('excellent policy'). Policy A is water quotas, Policy B is water rights, and Policy C is irrigation modernization.

extractions (Policy A); (2) legal assignment and distribution of water rights (Policy B); and (3) irrigation modernization to increase water efficiency (Policy C). We asked irrigators about their general opinion regarding the effectiveness, management, and fairness of these policies. The main results are presented in boxplots since this representation allows the combination of different statistical measures (Cleff, 2014, pp. 42). The dotted line through the box corresponds with the median with the upper and lower sides being the upper and lower quartiles, respectively. The lines extending from the box are the whiskers that determine the lowest and highest observed values. The values out of the whiskers correspond to outliers.

A first set of questions reveals the irrigators' opinions regarding the efficiency of each of the three policies implemented (1 = 'very bad' and 5 = 'excellent'). The results for both locations (upstream and downstream) are presented in Figure 2. This boxplot shows the existence of meaningful differences between the two interest groups. In the case of water quotas (Policy A), downstream irrigators have a better opinion compared with irrigators upstream. While most of the irrigators downstream score this policy between 3 and 5 (median = 4); irrigators upstream grade this policy between 2 and 4 (median = 3). Opposite results are observed for water rights (policy B), which is better scored by irrigators upstream (median = 4) than by irrigators downstream (median = 3). Furthermore, the results for this policy show a higher heterogeneity in the opinion in both locations[9]. Finally, irrigators from both locations have a positive opinion regarding irrigation modernization (Policy C). But again, some differences arise between the groups, while 50% of irrigators upstream perceive this policy as excellent (median = 5) in downstream the opinion is not as positive (median = 4). Furthermore, the results in downstream

[9] The irrigators' opinions on the water rights policy are very disperse for both interest groups: from 2 ('bad') to 5 ('excellent') in upstream, and from 1 ('very bad') to 4 ('good') in downstream.

present a higher dispersion, with larger distance between the upper and lower quartiles and with minimum values of 1 (‘very bad policy’).

A second set of questions captures the irrigators’ opinions on the performance of water authorities in implementing the three policies analyzed. The results for this variable (Figure 3) show more similarities between the groups compared with the previous analysis. While some differences can also be observed, the results suggest that both interest groups have a similar opinion of the authorities’ performance in the management of the policies. The unique relevant difference remains for the opinion regarding the management of water rights (Policy B). Downstream irrigators score this policy with a low value (‘badly managed’, median = 2) compared with a more positive outcome in upstream (‘not badly managed’, median = 3).

Finally, the last set of questions deals with the fairness of the policies. Irrigators were asked about their opinion regarding the fairness of each of the three policies implemented. The results presented in Figure 4 show important differences between the opinions of the upstream and downstream interest groups. In general, irrigators downstream have given lower ranks to the fairness of the policies compared with irrigators upstream. For example, while upstream irrigators have ranked water quotas as medium fairness (median = 3), fairness is considered very poor by downstream irrigators (median = 1). Similarly, the results for water rights show significantly better opinion from upstream than from downstream irrigators. Finally, although the two groups present the same median score in the case of irrigation modernization (median = 3), the opinions for upstream are very homogeneous while for downstream the opinions are distributed along all scores.

Similarly to the previous analysis, an independent sample t-test has been conducted to analyze the existence of significant differences between the two interest groups (see Appendix, Table A4, available with the online version of this paper). The outcomes show how the irrigators’ opinion regarding the efficiency of the policies is quite different depending on the location. Irrigators downstream have a significantly better opinion of the efficiency of water quotas compared with upstream irrigators; and

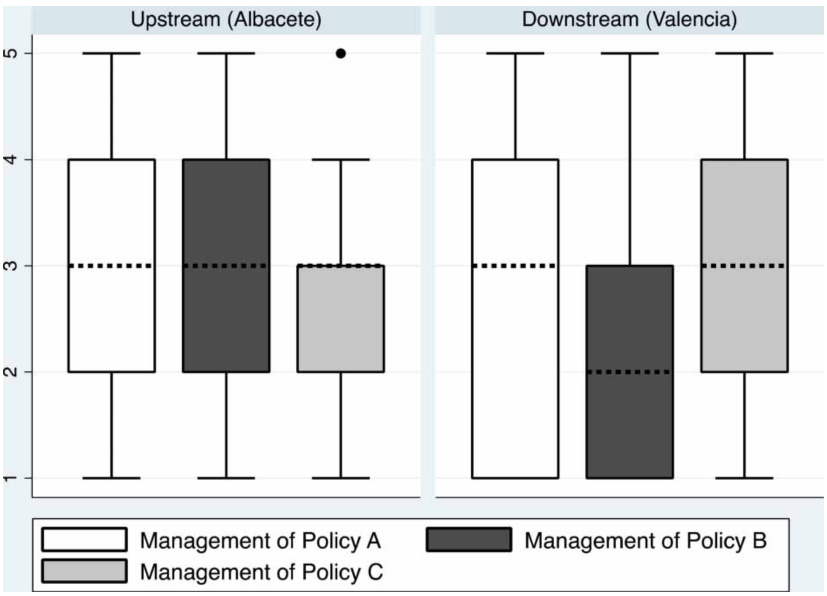


Fig. 3. Irrigators’ opinions on the management of the implemented policies. *Note:* Ranked from 1 (‘very bad management’) to 5 (‘excellent management’). Policy A is water quotas, Policy B is water rights, and Policy C is irrigation modernization.

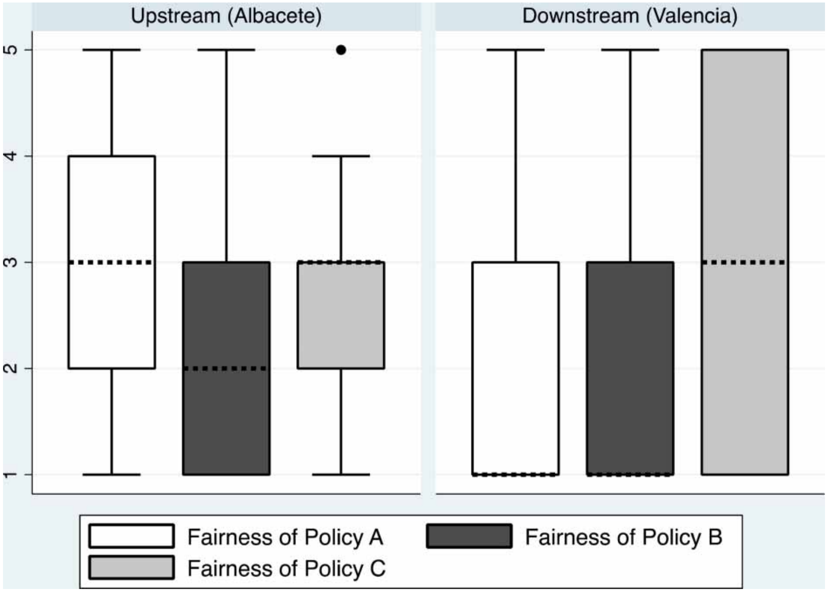


Fig. 4. Irrigators' opinions on the fairness of the implemented policies. *Note:* Ranked from 1 ('very poor') to 5 ('very fair'). Policy A is water quotas, Policy B is water rights, and Policy C is irrigation modernization.

contrary to this, water rights and irrigation modernization are significantly better scored by upstream irrigators. Similarly, the opinions regarding the fairness of the policies present significant differences between the groups. Both water quotas and water rights are considered significantly fairer by upstream irrigators than by downstream irrigators. The results for irrigation modernization do not show a significant difference between groups. Finally, the outcomes on the opinions regarding the management of the policies show, in general, no significant differences between the two interest groups. Just for the water rights policy, the results show that upstream irrigators have a significantly better opinion of the management of this policy compared with downstream irrigators.

To complete the analysis of the users' opinions regarding the three policies implemented in the basin, they were asked to rank these policies from the best (1) to the worst (3) in dealing with water shortages. Table 1 presents the frequency distribution of the outcomes for both interest groups.

Results present a general consensus on the best policy (44.7% and 45.5%, for upstream and downstream, respectively), which corresponds with irrigation modernization (Policy C). However, while in upstream just 18.2% of irrigators think that this policy is the worst; in downstream this percentage is 30.9. Significant differences appear in the ranking of the worst policy. While for upstream irrigators the worst is water quotas (50.8%), for downstream irrigators the worst is the allocation of water rights (45.5%). The frequency distribution results also show that, in general, the opinions in upstream are more homogeneous than the opinions in downstream for the three policies implemented.

4.3. Comparison of the users' involvement with water authorities

The final variable analyzed is the degree of involvement with water authorities. Figure 5 presents a boxplot of irrigators' involvement with institutions at all government levels. The results highlight

Table 1. Frequencies in the policy rankings between the irrigation locations.

	Upstream (Albacete)								
	Policy A			*Policy B*			*Policy C*		
Rank	*Freq.*	*Percent*	*Cum.*	*Freq.*	*Percent*	*Cum.*	*Freq.*	*Percent*	*Cum.*
1	28	21.21	21.21	45	34.09	34.09	59	44.70	44.70
2	37	28.03	49.24	46	34.85	68.94	49	37.12	81.82
3	67	50.76	100.00	41	31.06	100.00	24	18.18	100.00
Total	132	100.00		132	100.00		132	100.00	
	Downstream (Valencia)								
1	69	36.13	36.13	28	14.66	14.66	87	45.55	45.55
2	81	42.41	78.53	76	39.79	54.45	45	23.56	69.11
3	41	21.47	100.00	87	45.55	100.00	59	30.89	100.00
Total	191	100.00		191	100.00		191	100.00	

Note: Policy A is water quotas, Policy B is water rights, and Policy C is irrigation modernization. 1 represents the best policy and 3 the worst policy.

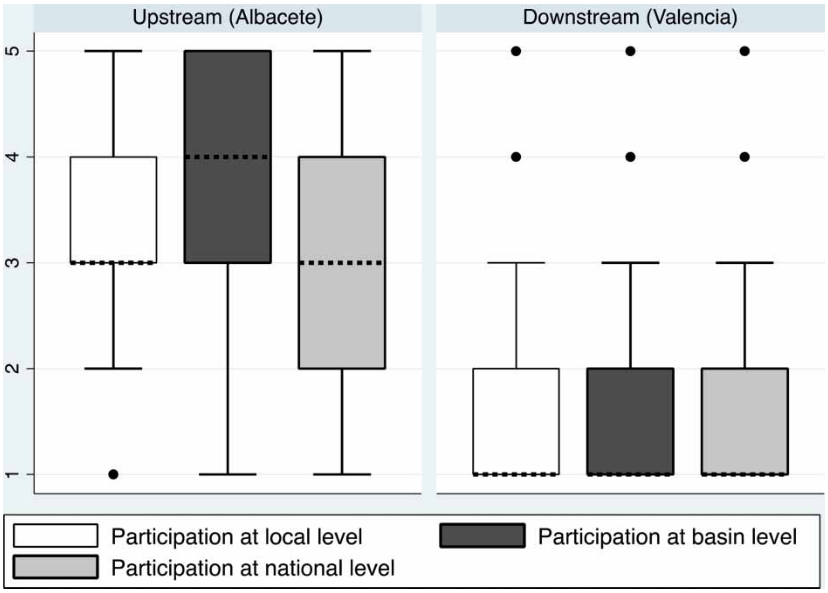


Fig. 5. Irrigators' participation with water authorities. *Note:* Ranked from 1 ('no involvement') to 5 ('very high involvement').

notable differences in the involvement between the two groups. While in the case of upstream irrigators, most of the irrigators declared a medium–large involvement with water institutions at all government levels, downstream the median shows no involvement at all. Additionally, large involvement values in downstream (high or very high) are considered as outliers.

An independent sample t-test analysis supports the result highlighted in Figure 5. The outcomes show significant differences between the two groups: $t(318) = 14.6965$, $p = 0.0000$; $t(317) = 18.1716$,

$p = 0.0000$; $t(306) = 10.6856$, $p = 0.0000$, for local, basin, and national participation, respectively[10]. For all these variables, the results show that there is a significantly higher involvement, at any government level, of upstream irrigators than of downstream irrigators. The smaller size of the upstream group and the existence of a unique WUA, which includes almost all users in this area, is, in our opinion, the main explanation of the larger involvement of this group.

5. Results of water utility responses: statistical analysis

The descriptive statistics of water utilities show the results for three utilities, which are big companies supplying nearly half of the basin's urban water consumption. The first main difference between these utilities is the water source (Table 2). In the case of 'water utility 1' (U1) more than half of the water supplied originates from surface water (55%), and the rest comes from groundwater (20%) and desalinated water (25%). More than half of the water supplied by 'water utility 2' (U2) originates from desalinated water (54%). Finally, the water supplied by 'water utility 3' (U3) originates from groundwater resources (80%). Although the three utilities are large, there are differences in size with U1 supplying three times the water supplied by U2 or U3. Before analyzing the results of the urban responses, it is worth remembering that Spanish law guarantees urban water consumption with priority over all other water uses.

The results show notable differences between the upstream water utility and the downstream water utilities. Both water utilities located in downstream (U1 and U2) perceive the three policies as excellent or good in dealing with water scarcity problems. However, the results for the upstream water utility present significant differences. Water quotas and irrigation modernization are considered as 'medium-efficient' in dealing with water scarcity, while water rights is considered a bad policy ('low-efficient'). The results on the effective management and fairness of the three policies, present a very heterogeneous opinion between the utilities. However, in general, the opinions for all utilities are negative on both the management and the fairness of the policies[11].

Finally, both downstream utilities ranked the policies similarly with irrigation modernization being the best, and water quotas being the worst. Again, the outcomes of the upstream water utility present notable

Table 2. Summary statistics of water utilities.

Urban water company	Water utility 1 (U1)	Water utility 2 (U2)	Water utility 3 (U3)
Type of company	Mixed (private/public)	Mixed (private/public)	Mixed (private/public)
Location	Downstream	Downstream	Upstream
Number of employees	444	300	n.r.d
Number of clients – households	661,500	200,000	177,000
Volume of water supplied (Mm^3/yr)	102	22	31
Percentage of groundwater (%)	20	0	80
Percentage of desalinized water (%)	25	54	n.r.d.

Note: n.r.d. – no reported data.

[10] t-statistic significance level at 99%.

[11] Two exceptions are the positive opinion score of 'very good' for management of water quotas by water utility 1 (U1) and 'fair' for water rights by water utility 3 (U3).

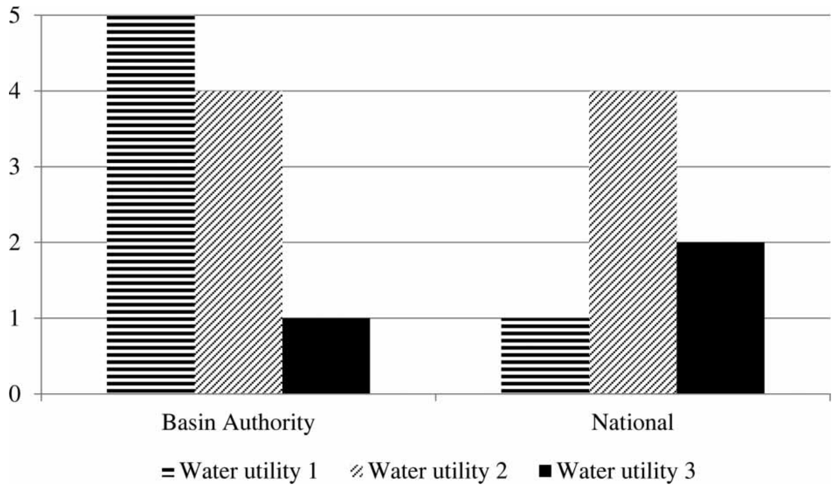


Fig. 6. Water utilities' participation with water authorities. *Note:* Ranked from 1 ('no involvement') to 5 ('very high involvement').

divergences concerning the ranking of policies compared with downstream utilities. In the case of this utility, the best policy is the implementation of water quotas while the worst one is the allocation of water rights.

Similarly to the analysis of the irrigators, we were interested in knowing the level of participation and involvement of the utilities with water authorities. The results in Figure 6 reveal a high participation at basin level for both downstream utilities. However, differences are seen for national level involvement: while U2 is highly involved with national authorities, U1 is not involved at all. In the case of the upstream water utility (U3), the results show a low involvement with water authorities at any government level.

6. Policy implications

The analysis in the previous sections is used to gain several political insights across the different interest groups. This contributes to better understanding of the differences between groups' behavior and to shed light on the nature of the conflicts in the basin. We provide below six policy intuitions that are derived from the analysis.

Policy intuition 1: In general, groups with small membership and with sizable landholdings are more organized than groups with large and heterogeneous membership and smaller landholdings.

The results show that upstream irrigators, around 1,000 users, are organized in a single WUA, while more than 50 WUAs coexist downstream with 20,000 users. Small groups with clear common interests display more homogeneous opinions, and become easier to organize in a single organization. This finding suggests that upstream farmers have better conditions to be a more effective interest group given the similar interests, better coordination, and lower transaction costs of small group size.

Policy intuition 2: The specific location of the group is a key factor affecting the opinions and preferences about water policies.

The results on political opinions (efficiency, management, and fairness) on the water policies implemented in the basin reveal large differences between the interest groups. Furthermore, the survey outcomes reveal sizable differences in the opinions on preferred instruments for dealing with water scarcity, depending on the spatial location. Although upstream and downstream irrigators agree on the best policy to address water shortages, there are important differences in opinions. Especially relevant are the differences in opinions regarding the worst policy. Similar results are found for the water utilities, where utilities downstream share opinions which are different from the utility upstream.

Policy intuition 3: More organized interest groups seem to be more proactive and involved with authorities and policymakers.

The results suggest that irrigators upstream that are more organized and coordinated within a single WUA have a higher level of involvement and participation in influencing policymakers and authorities. In general, the opinions of upstream irrigators are more homogenous than opinions of downstream irrigators. People belonging to a group share similar perceptions, and this is an important result associated with the fact of being a more organized and effective interest group. The disparity in opinions is boosted by the presence of numerous WUAs, undermining their lobbying capacity.

The level of involvement and participation with water authorities is a very important issue in water policy. In order to elaborate effective policy reforms, the participation of stakeholders is a necessary element, and especially in the case of public goods and common pool resources (Ostrom, 1990)[12].

Policy intuition 4: The degree of involvement depends on the level of government (local, regional, or national) that the interest group lobbies and the stakeholders' location.

The results indicate that the level of government determines the degree of interest group involvement. The largest level of involvement is at basin level while the lowest level is associated with national-level water authorities. Most of the upstream irrigators declare that they are highly involved with basin authorities while asserting medium-level involvement with national authorities. For water supplying companies, the results also suggest that involvement with water agencies at any government level is also conditioned by the location of the water utility.

This can be an important result for policymakers in order to promote the implementation of water policies at different government levels. Depending on the degree of cooperation required, regional and basin water institutions should be the institutions in charge of the policy management instead of national agencies.

Policy intuition 5: There are notable differences in the perception of efficiency and fairness of water policies between interest groups. However, more homogeneous opinions have been found on the management of water policies.

Results show that the general opinion on policies (efficiency and fairness) is quite different depending on the interest group. However, the opinion regarding the authorities' performance in managing the policies seems to be quite similar for all interest groups. In addition, more organized and involved interest groups reveal the most homogeneous opinions.

Policy intuition 6: Besides the location of the interest group, the sector is also a factor conditioning their perception about water policies and institutions.

---

[12] An additional insight for the large difference in the effective organization and participation between the two irrigation interest groups could be explained by economic factors. While most of the income of upstream users relies on irrigation, in downstream many users have other main economic activities besides irrigation, and thus agriculture is not their major source of income. This is an important element that could also explain differences in participation and lobbying. We have not analyzed these issues in the paper due to lack of information.

The results highlight how urban water utilities and irrigator groups located in the same area, share different opinions regarding the best water policies to face water shortages. Furthermore, there are also notable differences in the involvement with water authorities depending on the sector they operate.

The interest group location (upstream vs. downstream) largely conditions their behavior in terms of involvement with water organizations and opinion of water policies. But also the sector of the interest group (irrigators vs. urban utilities) is an element that determines the behavior and participation level of groups.

7. Conclusions

This paper analyzes the perceptions of different interest groups regarding policies and institutions addressing water scarcity. Stakeholders' perceptions have been elicited with a survey administered in a highly water-stressed river basin, the Jucar River Basin in southeastern Spain. The development of irrigated agriculture with growing water withdrawals, together with differences in the interest groups' political clout, have triggered harsh water disputes between sectors and regions.

The results of the interest groups' survey show the perceptions that agricultural and urban users have on the policies implemented in the Jucar Basin to address water scarcity. The results show considerable differences among interest groups, driven by landholding size and number of farms, basin location, interest group sector, and the strength of local organizations. These differences are the main factors explaining the users' opinions regarding water policies and the involvement and lobbying with water authorities. These outcomes are similar to other research results that also highlight how groups of water stakeholders with diverse local conditions share different opinions of water policies (Urquijo & De Stefano, 2016).

The paper contributes to the literature on water policy reform by highlighting the existence of substantial differences between preferred instruments to manage water resources between water users and uses. First of all, a very relevant outcome is the fact that most of the surveyed users agreed that irrigation modernization is the best policy in dealing with water scarcity. However, large differences can be observed in the users' perceptions of the effectiveness of water quotas and water rights as suitable instruments to deal with water shortages. The existence of large differences in users' perceptions on the fairness and efficiency of water policy instruments is also a very relevant element to be taken into account by policymakers. Finally, results show that well organized users are more homogeneous in their preferences and opinions, and they have a better appreciation of water policies and institutions.

Good knowledge of the perceptions displayed by the groups of stakeholders can be useful for inducing enhanced cooperation between users and authorities, and for using more efficient instruments to address water stress in river basins. Efficient water policies require collaboration and cooperation among all stakeholders in order to find a worthy solution satisfying every group. These findings provide useful policy insights that could be relevant for water policy making and the design of sound and viable policy regulations.

References

Böhmelt, T., Bernauer, T., Buhaug, H., Gleditsch, N. P., Tribaldos, T. & Wischnath, G. (2014). Demand, supply, and restraint: determinants of domestic water conflict and cooperation. *Global Environmental Change 29*, 337–348.

Carvalho, B. E., Marques, R. C. & Neto, C. O. (2017). Regulatory impact assessment (RIA): an ex-post analysis of water services by the legal review in Portugal. *Water Resources Management 32*, 675–699.
Cleff, T. (2014). *Exploratory Data Analysis in Business and Economics. An Introduction Using SPSS, Stata, and Excel*. Springer, Switzerland.
Devlin, C. & Hendrix, C. S. (2014). Trends and triggers redux: climate change, rainfall, and interstate conflict. *Political Geography 43*, 27–39.
Dinar, A. & Letey, J. (1991). Agricultural water marketing, allocative efficiency and drainage reduction. *Journal of Environmental Economics and Management 20*(2), 210–223.
Estrela, T. (2004). *Jucar Pilot River Basin: Provisional Article 5 Report. Oficina de Planificación Hidrográfica*. Confederación Hidrográfica del Júcar. Ministerio de Medio Ambiente, Valencia, Spain.
Gandure, S., Walker, S. & Botha, J. J. (2013). Farmers' perception of adaptation to climate change and water stress in a South African rural community. *Environmental Development 5*, 39–53.
Giordano, M. A. & Wolf, A. T. (2003). Sharing waters: Post-Rio international water management. *Natural Resources Forum 27*, 167–171.
Gizelis, T. I. & Wooden, A. E. (2010). Water resources, institutions & intrastate conflict. *Political Geography 29*, 444–453.
Greiner, R. & Gregg, D. (2011). Farmers' intrinsic motivations, barriers to the adoption of conservation practices and effectiveness of policy instruments: empirical evidence from northern Australia. *Land Use Policy 28*, 257–265.
Greiner, R., Patterson, L. & Miller, O. (2009). Motivations, risk perceptions and adoption of conservation practices by farmers. *Agricultural Systems 99*, 86–104.
Hendrix, C. S. & Glaser, S. M. (2007). Trends and triggers: climate, climate change, and civil conflicts in Sub-Saharan Africa. *Political Geography 26*, 695–715.
Kahil, M. T., Ward, F. A., Albiac, A. & Sanz, D. (2016). Hydro-economic modeling with aquifer-river interactions to guide sustainable basin management. *Journal of Hydrology 539*, 510–524.
Mekonnen, M. M. & Hoekstra, A. Y. (2016). Four billion people facing severe water scarcity. *Science Advances 2*(2), e1500323.
Mertz, O., Mbow, C., Reenberg, A. & Diouf, A. (2009). Farmers' perceptions of climate change and agricultural adaptation strategies in rural Sahel. *Environmental Management 43*, 804–816.
Ortega-Reig, M., Palau-Salvador, G., Cascant i Sempere, M. J., Benitez-Buelga, J., Badiella, D. & Trawick, P. (2014). The integrated use of surface, ground and recycled waste water in adapting to drought in the traditional irrigation system of Valencia. *Agricultural Water Management 133*, 55–64.
Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press, Cambridge, MA.
Perez-Martin, M., Estrela, T., Andreu, J. & Ferrer, J. (2014). Modeling water resources and river-aquifer interaction in the Júcar River Basin, Spain. *Water Resources Management 28*, 4337–4358.
Raleigh, C. & Urdal, H. (2007). Climate change, environmental degradation and armed conflict. *Political Geography 26*(6), 674–694.
Sanz, D., Gómez-Alday, J. J., Castaño, S., Morata, A., de las Heras, J. & Martínez Alfaro, P. M. (2009). Hydrostratigraphic framework and hydrogeological behavior of the Mancha Oriental System (SE Spain). *Hydrogeology Journal 17*, 1375–1391.
Urquijo, J. & De Stefano, L. (2016). Perception of drought and local responses by farmers: a perspective from the Jucar River Basin, Spain. *Water Resources Management 30*, 577–591.
van Oel, P. R., Krol, M. S. & Hoekstra, A. Y. (2009). A river basin as a common-pool resource: a case study for the Jaguaribe basin in the semi-arid Northeast of Brazil. *International Journal of River Basin Management 7*(4), 345–353.
Ward, F. A. & Pulido-Velazquez, M. (2008). Water conservation in irrigation can increase water use. *Proceedings of the American National Academy of Science 105*(47), 18215–18220.

Received 2 August 2017; accepted in revised form 18 April 2018. Available online 8 May 2018