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# The role played by environmental concern and institutional trust in changing public preferences for water management

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## Abstract

Efforts to improve the efficiency of irrigation systems in areas which suffer from water scarcity have often failed to reduce water demand owing to the constant expansion of irrigation. Andalusia, in southern Spain, is a clear case in point, as the publicly funded programs aimed at improving irrigation put forward since the 1990s after recurrent episodes of drought have not been able to meet agrarian demand. This situation has generated an active debate among stakeholders and public managers. This study aims to investigate the role of public opinion in this debate, as demanded by new water governance models, embodied in the Water Framework Directive. We use the results of a representative annual survey in Andalusia between 2004 and 2013. First, we analyze the evolution of public support for the two most costly public measures: constructing reservoirs and improving irrigation. Second, we analyze some attitudes that may have affected a change in public opinion, including institutional trust and environmental concern. The results suggest that the public legitimizes the administration's bid for more efficient irrigation systems, essentially for environmental reasons. However, should attempts to control water demand continue to fail, support for this measure may be withdrawn.

## KEYWORDS

drought, environmental concern, institutional trust, irrigation systems, public opinion, reservoirs

cultural sector, which consumes 81.3% of all available water, are met despite recurrent drought. At the same time, these measures

## 1 | INTRODUCTION

Southern European countries suffer recurrent episodes of drought. Until the late twentieth century, the response to drought in Spain consisted chiefly of regulating water basins to compensate for geographic differences in rainfall distribution. However, over the last two decades water management in Spain has undergone important changes, particularly since the adoption of the principles set out in the Water Framework Directive (WFD, 2000), such as environmental sustainability, economic rationality, transparency and social participation. In Andalusia (southern Spain) the regional government has worked hard to improve the efficiency of irrigation systems, without abandoning the construction of major water infrastructures. The government aims to ensure that the water supply needs of the agri-

are also a response to recent environmental legislation, which promotes more efficient use of water. However, the data indicate that even with improved water regulation, demand still outstrips supply because of the constant increase in the irrigated areas in the region (Sampedro & Moral, 2014). The increase in demand for water following a substantial improvement in efficiency is not a problem exclusive to Andalusia (FAO, 2017).

In this context, recent legislation emphasizes the role of public

opinion in water policies, in terms of both legitimacy and efficiency. This present study analyzes public preferences with regard to the two most costly water-management policies during the period 2004-13: the construction of reservoirs and increased efficiency in irrigation. The source used is a survey of environmental attitudes based on more than 19,000 interviews conducted with a representative sample of the Andalusian population. This article also examines the attitudinal factors that may underlie these preferences. In this

regard, we analyze the distribution of responses according to the sociodemographic characteristics of respondents: the level of trust that respondents have in public institutions (as an indication of the perceived legitimacy of the measures adopted) and the environmental attitude of respondents.

This paper is divided into six sections. Section 2 describes recent developments in water management in Spain and Andalusia, including the construction of reservoirs and the evolution of irrigated agriculture (including water-consumption levels). Section 3 examines public governance and the implications of the engagement of the public in decision-making processes. Section 4 describes the empirical source used for this work, the *Ecobarómetro de Andalucía*, and explains the principal component analysis (PCA) based operationalization of environmental concern and institutional trust indices, based on the survey data. Section 5 presents the results, and is divided into three subsections. The first two sections describe the popularity curve of the measures under examination—improving irrigation efficiency and building reservoirs—during the period 2004–13, and compare these curves with the evolution of the environmental concern and institutional trust indices during the same period. Finally, a logistic regression analysis is carried out to analyze the influence of independent variables (sociodemographic factors, environmental concern and institutional trust) on preferences concerning the construction of new reservoirs and the implementation of efficiency-enhancing measures in agriculture. Section 6 discusses the most important results, and Section 7 presents some conclusions.

## 2 | WATER MANAGEMENT IN SPAIN AND ANDALUSIA

Throughout the twentieth century, water-management policies in Spain were dominated by the traditional hydraulic paradigm, as has been abundantly described in the national and international specialized literature (del Moral, van der Werff, Bakker, & Handmer, 2003; Naredo, 1997; Saurí & del Moral, 2001; Swyngedouw, 1999, 2015). According to this paradigm, which remains influential, the goal of national and regional water policies was to guarantee the supply of water earmarked for productive purposes, especially in the context of irrigation agriculture and the generation of electricity. As a result, current hydraulic infrastructures in Spain include over 1,231 reservoirs, with an overall capacity of 56,075 hm<sup>3</sup> (MAPAMA, 2018),<sup>1</sup> compared to 60 reservoirs at the beginning of the century. Irrigated agriculture covered an area of 3.2 million hectares in the 1990s, compared to 1 million at the beginning of the twentieth century (MAGRAMA, 2015). The aim of this policy was to compensate for the irregularity of rainfall across regions and seasons, thus ensuring the availability of resources and reducing the vulnerability of the population to recurrent episodes of drought (the last major droughts took place in 1992–5, 2004–8 and 2015–17). In fact, the dramatic drought suffered by Spain in the 1990s led to changes in its irrigation systems. The Andalusian Irrigation Plan 1996–98 (MAPA, 1996) concerned a region in which the water supply in certain areas

had to be completely cut off. The plan prioritized, and heavily subsidized, the modernization of irrigation infrastructures, with the double goal of making agricultural enterprises more competitive and reducing water consumption (and thus guaranteeing supply).

Furthermore, enactment of the WFD (2000) and its transposition into Spanish legislation (2003) caused a change in water planning and management strategies. The ultimate goal is to guarantee the good status of all water bodies (surface, groundwater and coastal), to promote public participation and to incorporate the risk factor into hydrological planning. To use water resources efficiently and sustainably, pricing policies that allow for the recovery of the costs of water services, and the “polluter pays” principle are established.

Despite these clear goals, the transition to a new water management paradigm based on a more efficient use of water is remarkably slow (FNCA, 2014, FNCA, 2015). In fact, water-regulation capacity in Andalusia has increased 28% over the last 20 years. This increase in regulation capacity has not been sufficient to meet demand, which has grown continuously, and water supply restrictions have been imposed in one out of every 3 years over the last three decades (Corominas, 2011; Sampedro & Moral, 2014).

Despite the wholehearted support lent by public bodies to these contradictory measures (increasing supply through the construction of reservoirs and reducing consumption through the modernization of irrigation), the goal of meeting demand has not been reached. This failure is the result of the increase in gross demand, but also of the lack of controls when implementing irrigation systems that has led to a substantial increase in the surface occupied by irrigation agriculture in the region (Corominas, 2011; Sampedro & Moral, 2014).

## 3 | PUBLIC OPINION AND WATER MANAGEMENT

Woodhouse and Muller (2017) have recently analyzed the increased academic interest in water governance from the early 2000s onwards. According to their analysis, the most cited works focus on improving practices and policies, using the principles established by the Organisation for Economic Co-operation and Development (OECD). The OECD has defined water governance as “the range of political, institutional and administrative rules, practices and processes (formal and informal) through which decisions are taken and implemented, stakeholders can articulate their interests and have their concerns considered, and decision-makers are held accountable for water management” (OECD, 2015, p. 5).

However, the definition of water governance and of its aims, procedures and implications is dependent on the specific socioinstitutional, political and geographic context affected by the water policies. In this regard, European Union (EU) member states have adapted to the requirements of the WFD (2000), which promotes participative mechanisms in decision-making, uses the basin as the basic management unit and establishes economic tools for improving the environmental quality of water. Article 14 of the WFD emphasizes the importance of engaging the public in water-planning processes, and not only the classic stakeholders (major agricultural consumers, hydro-electricity companies, technicians, the scientific

<sup>1</sup><http://sig.mapama.es/snczi/visor.html?herramienta=EstadisticasPresas>

community, domestic consumer associations, environmentalists, etc.), but also the public.

The WFD's emphasis on public engagement in decision-making processes has led to a reassessment of the OECD's focus on "rules, practices and processes." This turn in public management developed over the last two decades has focused on the ideas of public value and networked governance. Some authors have labeled this approach "the public value paradigm" (O'Flynn, 2007; Stoker, 2006). This public governance paradigm promotes public management models based on public engagement and the subsequent improvements in efficiency. In addition, public preferences play a central role in management strategies, and this has significant implications for public managers. In addition to their traditional targets (efficiency and accountability), public managers should aim to take into account public preferences in their decision-making processes, seeking public value and creating and maintaining trust (Kelly, Mulgan, & Muers, 2002; O'Flynn, 2007).

According to the public value governance, no management policy can be regarded as efficient if the needs and preferences of the public have not been taken into account sufficiently. As such, public managers face the challenge of involving the public in a permanent dialogue which permits the pursuance of different options through consultation, communication and deliberation processes (Smith, 2004; Stoker, 2006).

We should not, however, ignore the fact that in a representative democratic system, citizens do not all exhibit the same concern for all policy matters, and we must develop systems to involve the public in designing better policies (Pharr & Putnam, 2000). Concerning water governance, the participation that the WFD explicitly demands has been critically analyzed in European and Spanish contexts (Jager et al., 2016; Newig & Fritsch, 2009; Parés, Brugué, Espluga, Miralles, & Ballester, 2015). These critical appraisals emphasize the shortcomings of existing public-engagement mechanisms as far as the participation of the public in hydrologic planning is concerned.

The public value governance takes into account these shortcomings and insists that "public managers need to be able to manage through networks, to be open to learning in different ways, and to draw in resources from a range of sources" (Stoker, 2006). Thus, the present work bases its proposals concerning water-management policies on a public opinion survey. We argue that it is essential to gain a more comprehensive knowledge of the preferences of the public concerning water management, and thus overcome the so-called "Collingridge dilemma" (when the population finds policy-changing instruments too late, because the relevant decisions have already been adopted; Maestre & Rojo, 2002). However, the small number of studies on the relationship between public opinion and water-management policies is striking (Paneque, Lafuente, & Vargas, 2018; Stoutenborough & Vedlitz, 2014) and, in fact, few surveys include questions on water policies.

The main target of the present work is to gain a better understanding of public preferences with regard to the two management measures described in Section 2. This is a matter of great importance for southern Spain, as both measures have been strongly supported by the regional administration over the last two decades, despite the fact that they can be regarded as antagonistic in terms of use-efficiency criteria.

To better understand the public's perceptions and attitudes regarding water policies, this study analyses two central factors that

can affect public opinion: environmental concern and institutional trust. In Section 3.1 we analyze the concept of environmental concern, and how it has been used in environmental psychology, as an explicative variable of support to given environmental measures. In Section 3.2, we analyze the concept of institutional trust as well as its links to governance theories and its use in empirical studies about the popularity of public policies.

When environmental concern and institutional trust are regarded separately, they leave many unanswered questions, and we argue that they can instead be used complementarily, filling a lacuna in our knowledge and painting a more comprehensive picture of public preferences with regard to water-management policies. Recent studies have incorporated political variables into the analysis, especially with regard to public trust in the government, and the results are encouraging, particularly in relation to public perception of environmental policies (Fairbrother, 2016; Franzen & Vogl, 2013; Harring & Jagers, 2013).

### 3.1 | Environmental concern

Dunlap and Jones's definition of environmental concern has been used frequently in environmental psychology. It refers to "the degree to which people are aware of problems regarding the environment and support efforts to solve them and/or indicate a willingness to contribute personally to their solution" (Dunlap & Jones, 2002, p. 485). This definition of environmental concern revolves around personal attitudes and the solution to environmental problems.

Various studies have analyzed the personal attitudes that affect environmental conduct, such as beliefs, norms, values and worldviews (Dietz, Fitzgerald, & Shwom, 2005; Steg, De Groot, Dreijerink, Abrahamse, & Siero, 2011; Stern, 2000). However, it is still unclear which factor has the greatest predictive value in terms of environmental conduct. That is, people who declare they are concerned about the environment do not always agree with proenvironmental actions.

Several authors have pointed out that other situational factors, personal skills and routines also play a role in environmental conduct (Kormos & Gifford, 2014; Schultz & Zelezny, 1991). Although Stern (2000) suggests that support for environmental policies depends more on the perceived costs and returns than on personal attitudes, such as environmental concern, he also points out that more interdisciplinary research is still needed for us to gain a better understanding of these variables.

Several survey-based studies have focused on analyzing the relationship between environmental concern and individual water-saving behavior (Aprile & Fiorillo, 2017; Corral-Verdugo, Bechtel, & Frajjo-Sing, 2003; Corral-Verdugo, Carrus, Bonnes, Moser, & Sinha, 2008; Russell & Fielding, 2010.) However, very few are targeted at analyzing public preferences regarding water management. Russenberger, Bjornlund, and Xu (2011) examined how individual preferences concerning water allocation are formed. This study considers values, attitudes and beliefs regarding water and the environment. In contrast, Routh, Jones and Feldman (2005) analyze whether beliefs and environmental attitudes can be used to predict preferences concerning the construction of reservoirs.

In our study, we expect individuals who present a higher degree of environmental concern to exhibit a preference for water-

management policies related to more efficient consumption through the modernization of irrigation.

### 3.2 | Institutional trust

Public governance theory regards institutional trust as a key factor for public engagement in governance processes. Trust is presented as a key variable in the creation of public value, and it is argued that “even if formal service and outcome targets are met, a failure of trust will effectively destroy public value” (Kelly, Mulgan, & Muers, 2002, p. 17). As a result, one of the targets of public managers in these new governance models is to promote public trust (O’Flynn, 2007). According to Stoker (2006), the best way to earn the trust of the public is to court their support for public policies, whereas O’Toole (2005) argues that political deliberation, civic attitudes and trust are key variables in improving the quality of governance, along with the ability to engage and show sympathy for the preferences of the public.

In general terms, trust in public institutions refers to the public perception of the trustworthiness of central political institutions. Public trust in an institution increases with the belief that said institution will not act arbitrarily and will not make decisions that harm the interests of the citizens, but rather that it will act justly and correctly (Hardin, 1998; Montero, Zmerli, & Newton, 2008). The degree of political trust therefore depends on the performance of the institutions, and can be used as an indicator of reliability, equity, competence and transparency (Levi & Stoker, 2000). The factors on which the trustworthiness of an institution depends are directly related to democratic principles, and public trust is therefore regarded as an indicator of the degree of support enjoyed by the government and the legitimacy of its decisions (Newton & Norris, 2000). A high degree of institutional trust facilitates public support for the policies put forward by the government (Levi & Stoker, 2000), as demonstrated empirically in proenvironmental policies (Hammar & Jagers, 2006; Jagers, Löfgren, & Stripple, 2010; Konisky, Milyo, & Richardson, 2008; Zannakis, Wallin, & Johansson, 2015).

We argue that a high degree of trust in the political institutions and the social agents involved in environmental management suggest that the public legitimizes the water management-related measures adopted by said institutions.

## 4 | METHODOLOGY

The empirical data used to carry out this study have been extracted from the results of the *Ecobarómetro*, an annual survey on environmental attitudes undertaken in Andalusia between 2001 and 2013 (2012 was not surveyed) among a representative section of the population. The *Ecobarómetro* was an initiative of the Regional Ministry for the Environment and the Institute for Advanced Social Studies-Spanish National Research Council (IESA-CSIC).<sup>2</sup>

The questionnaire is divided into three blocks: the questions in the first two blocks are the same every year, and the questions in the third block vary depending on the regional government’s most significant environmental concerns for the year of the survey (e.g., forest fires, landscape, climate change). This study focuses on the two first blocks. The first block, which includes 20 questions, examines values, beliefs and information about environmental protection. In the second block, which includes five questions, respondents evaluate the environmental policies pursued by the regional government and other social actors and institutions involved in environmental management.

This analysis focuses on the period 2004-13, when the survey incorporated questions concerning water management. To adjust the data to the temporal and geographic dimension of the study, the results for the years under consideration have been conflated into a single dataset, comprising 19,627 responses (see Appendix). The data were then divided into different data categories, according to the sex and the age of respondents in each of the river basin districts, using data from the population census. The error margin of results per year and river basin district is  $\pm 1.9\%$ , with a confidence level of 95%.

### 4.1 | Preferences about water-management measures

The indicator used to measure public support for the different management measures is calculated on the basis of responses to the following question: “Among the following water management-related measures, which do you consider the most adequate for water management in Andalusia?” Each year, respondents are provided with a list of 10 measures, from which they must choose, but only seven of these measures feature throughout the 10-year series.<sup>3</sup>

We focus on the public perception of two measures—the construction of reservoirs and the improvement of irrigation systems—for the following reasons. First, both measures are significantly popular (every year, they are among the top three in popularity). Secondly, their implementation is costly in monetary terms, in contrast to saving water in a domestic context, which also features regularly among the three most popular measures. The degree of institutional trust declared by the respondents who show their support for these measures indicates whether the public approves public measures enacted in support of these policies. Third, a debate exists concerning whether improving irrigation positively contributes to attaining water-saving targets. If support for this measure is greater among respondents who exhibit a greater degree of environmental concern, it can be argued that respondents understand improving irrigation as an environmentally friendly measure. The comparison of these variables with the degree of public support for building reservoirs, a measure which is clearly productivist in nature, will enrich the conclusions.

<sup>2</sup>The complete *Ecobarómetro* survey is available at: <http://www.juntadeandalucia.es/medioambiente/site/portalweb/menuitem.7e1cf46ddf59bb227a9ebe205510e1ca/?vgnextoid=3f6f82e0851d4010VgnVCM100000624e50aRCRD&vgnnextchannel=f83bc17a45b05310VgnVCM1000001325e50aRCRDhttp://www.iesa.csic.es/investigacion/detallarproyecto/id/3/desc/Ecobar%C3%B3metro%20de%20Andaluc%C3%ADa>

<sup>3</sup>Building more reservoirs, improving irrigation, implementing consumption-saving measures at the domestic level, using sea water, transferring water from other regions, decreasing the quantity of water available for irrigation and increasing the price of water (2004-13), decreasing construction activities in areas where water is scarce (2004-8), digging more wells (2004-11), reusing residual water (2009-13), improving distribution networks and controlling the contamination of rivers and underground water bodies (2013).

**TABLE 1** Principal components analysis (PCA) of environmental concern

	Component*
Scale of environmental concern	0.620
It is very difficult for a person like me to do anything about the environment	0.546
Degree to which respondents consider themselves to be informed about issues related to the environment	0.698
Sign against actions that are harmful for the environment	0.591

Eigenvalue 1.519<sup>†</sup>

Variance accounted 37.977%

KMO 0.629. KMO values range from 1.0 (excellent fit) to 0.5 or less (poor fit)

Extraction method: PCS

Rotation method: varimax with Kaiser normalization

\*Amount of variance that each variable explains in the components.

<sup>†</sup>The sum of the contribution of each variable (Eigenvalue) represents the information from the original values summarized by the component.

Source: Authors with data from Junta de Andalucía, 2004-13.

## 4.2 | Environmental concern index

Calculation of the environmental concern index is based on the empirical operationalization carried out by Jiménez and Lafuente (2010) using the results of the *Ecobarómetro*. The notion of environmental concern is multilayered and conduct-oriented, and involves psychological factors such as beliefs, values, attitude and knowledge (Zelezny & Schultz, 2000). Four dimensions were defined: emotional, cognitive, dispositional and active. The emotional dimension is related to the public's feelings of environmental concern, and to the public adoption of worldviews concerning the protection of nature. The cognitive dimension is related to the degree and quality of information available concerning environmental problems. The dispositional dimension is related to citizens' commitment to adapt their personal conduct to sustainability criteria. The active dimension is related to individual (consuming ecological products, saving energy, recycling domestic waste, etc.) and collective attitudes (cooperating with environmentalist groups, contributing financially to environmental campaigns, participating in protest marches, etc.). We have selected four indicators which are included in the *Ecobarómetro*, one for each of the dimensions that make up environmental concern. The emotional dimension is expressed by the respondent's degree of concern for the environment: "On a scale of 0 to 10, on which 0 means that you are not concerned and 10 means that you are very concerned and act accordingly, where would you place yourself?" The cognitive dimension is expressed by the degree of knowledge: "How well informed do you think you are concerning environmental issues?" The dispositional dimension is expressed by the degree of agreement with the expression: "It is very difficult for a person like me to make a difference to the environment." Finally, the active dimension is expressed by the personal disposition toward collective action: "Sign against actions that are harmful for the environment."<sup>4</sup>

We used a principal components analysis (PCA) to develop a measure of environmental concern that encompasses the different dimensions of this phenomenon (Table 1).<sup>5</sup> The PCA has reduced the information of the selected indicators into one component or measure of environmental concern. Henceforth, we shall use the component

result as an index of environmental concern: a high value in this index indicates a high degree of environmental concern, a good degree of environmental knowledge, positive personal values and a positive attitude toward protection of the environment.

## 4.3 | Index of institutional trust

The Word Values Survey addresses the issue of institutional trust by asking the following: "Please, take this card and state, for each institution, how much confidence you have in them." The number of institutions and the scales of the answers vary from survey to survey. The *Ecobarómetro* in Andalusia uses the following statement and question to measure public perceptions of the environmental work of different institutions: "Look at the following list of institutions and organisations. State how much trust you have in their ability to offer solutions to environmental problems: much, a good deal, a bit or none at all?" For our study, we have selected those institutions which are present throughout the temporal series: the EU, the Spanish Government, the Andalusian Government, local councils (*ayuntamientos*), government and administration, political parties, the judicial system, the scientific community and environmental nonprofit organizations.<sup>6</sup>

The PCA reveals three important components (Table 2), which explain the overall covariance value (71%).<sup>7</sup> The first dimension component is constituted by the different administrative and executive divisions (regional government, Spanish Government, councils and the EU), and is referred to in this study as "Trust in the administration." The second dimension component is constituted by the key political institutions (political parties, the judicial system, the government and

<sup>5</sup>The PCA is well-suited to the targets of our study because it is a data-reduction technique which deals with a small number of noncorrelated variables or components that represent most of the information found in the original variables (in our case, indicators for the different dimensions of environmental concern). This technique facilitates the interpretation of the data (by summarizing the information) and allows for subsequent multivariate analyses.

<sup>6</sup>In 2004 the answers did not include the judicial system and the scientific community.

<sup>7</sup>An independent PCA was carried out for 2004 because only seven institutions

were being considered. In this case, the PCA revealed three dimensions, which explain the overall covariance value (81%). Sample adaptation measure Kaiser-Meyer-Olkin (KMO) is 0.878, and loadings and signs are similar to those obtained for the rest of the survey, which allows us to conflate variables generated by each dimension with those obtained in the previous operation.

<sup>4</sup>Jiménez and Lafuente's (2010) original proposal addressed eight indicators, some of which are not found throughout the whole series and have been accordingly discarded. Indicators that referred to water management have also been discarded, in order to avoid overlap with the dependent variable.

**TABLE 2** PCA of institutional trust

	Component*		
	1	2	3
The government and the administration	0.506	0.571	0.297
The judicial system	0.234	0.654	0.318
The political parties	0.182	0.854	0.014
Ecological organizations	0.205	0.122	0.810
The scientific community	0.166	0.166	0.831
The European Union	0.719	0.120	0.301
The Spanish Government	0.834	0.305	0.142
The Andalusian Government	0.853	0.208	0.178
The councils (ayuntamientos)	0.807	0.210	0.095
Eigenvalue <sup>†</sup>	4.482	1.069	0.862
Variance accounted for (%)	33.4	19.1	18.7
KMO 0.884. KMO values range from 1.0 (excellent fit) to 0.5 or less (poor fit)			
Extraction method: PCA			
Rotation method: varimax with Kaiser normalization			

\*Amount of variance that each variable explains in the components. The highest values are shown in bold type.

<sup>†</sup>The sum of the contribution of each variable (Eigenvalue) represents the information from the original values summarized by the component.

Source: Authors with data from Junta de Andalucía, 2004-13.

the administration), and is referred to in this study as “Trust in the political system.” Finally, the third component is constituted by non-profit environmental organizations and the scientific community, and is referred to in this study as “Trust in environmental expertise.”

## 5 | RESULTS

### 5.1 | Evolution of the public perception of water-management measures

The most significant evolution in public preferences concerning water management has been the decrease in support for the construction of reservoirs. In 2004, this was the most widely supported measure, with 44.8% support. In 2005, with the beginning of the latest drought cycle, this fell by 8%, reaching 20.4% in 2006. Except for a brief, albeit significant, upsurge in 2008 (22.9%), this measure gradually lost support after the drought episode came to an end, and at the end of the series in 2013 it was at its lowest (13.6%).

While the construction of reservoirs lost support, the efficient management of water through the improvement of irrigation systems and the implementation of measures to reduce domestic water consumption won increasing public support. Although here we focus on irrigation, for the reasons stated in Section 4.1, we also want to emphasize that the reduction of domestic water consumption enjoys a higher degree of public support. The improvement of irrigation is mentioned by just 11% of respondents in 2004 and 8.3% in 2005, although by 2006 this percentage had doubled to 17.4%. These measures scored the highest values in 2009 (22.9%) and 2010 (24.8%). For their part, domestic consumption-oriented measures also began the series at a low point (6.7%), but from 2006 onwards they were always above 20%, and by the final years of the series (2011-13) the percentage of support enjoyed by these measures is approximately 10% above support for improved irrigation systems.

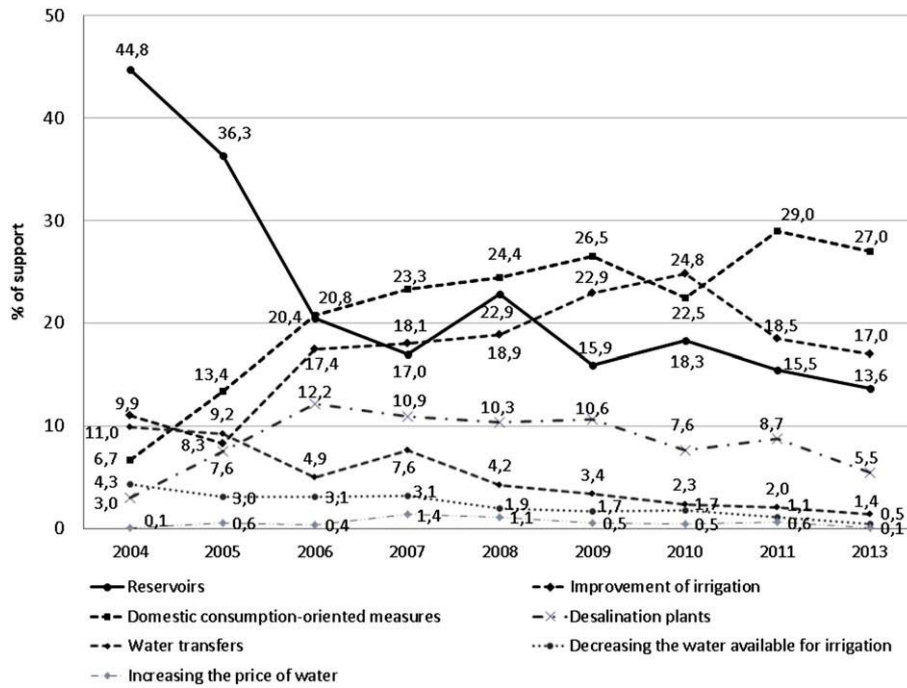
Figure 1 illustrates the support earned by all the measures during the series under consideration. Particularly remarkable are the low levels of public support for measures such as increasing the price of water or decreasing the water available for irrigation, which barely score 1 and 3%, respectively, throughout the series. Water transfers between regions were supported by nearly 10% of the public at the beginning of the series, but these progressively lost the initial support and by 2013 the percentage had fallen to 1.4%. Finally, the construction of desalination plants was relatively popular between 2006 and 2009, when public support for this measure was around 10%.

### 5.2 | Evolution of environmental concern and institutional trust

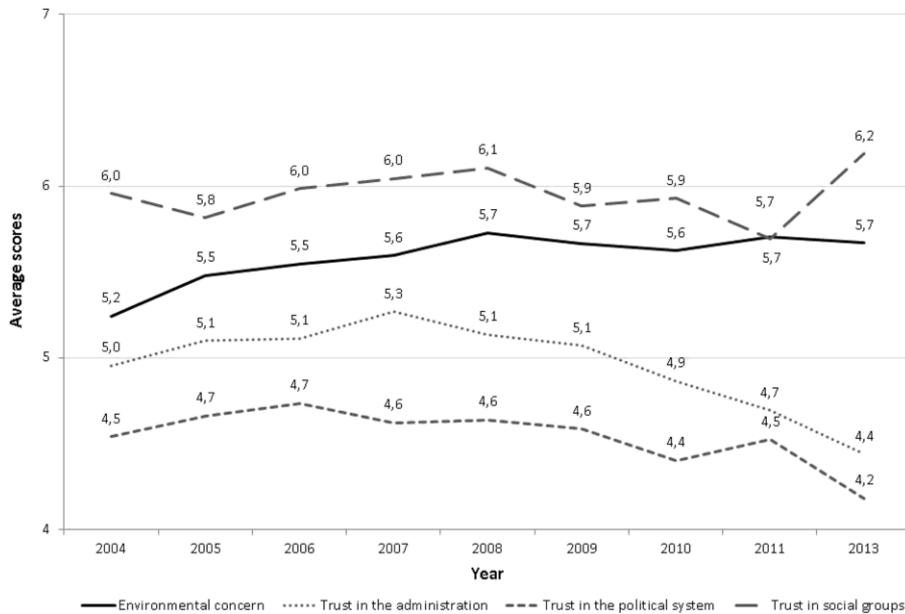
Figure 2 illustrates the average scores, on a scale from 1 to 10, of environmental concern and institutional trust indices in Andalusia.

The level of environmental concern remains remarkably stable throughout, with no significant swings that may have had an effect on public preferences concerning water-management policies. Only in 2004 is the index significantly lower than in the rest of the series. The scores range between 5.24 in 2004 and 5.73 in 2008.

By contrast, it is clear that Andalusians have more trust in environmental expertise (available from nongovernmental and scientific organizations) than in the administration for the solution of environmental problems. In most years, this value scored only marginally under 6. From 2009 onwards, the level of trust in these organizations decreased slightly, scoring its lowest in 2011 (5.69), after which the trend was reversed and (in contrast to the level of trust earned by the political institutions and the administration) the index began increasing again, reaching its highest score in 2013 (6.19). The decrease in the level of trust earned by the administration, which average around 5, began in 2008 and became especially pronounced from 2010 onwards. Concerning the political system, the degree of



**FIGURE 1** Evolution of public support for water-management measures (%). Source: authors with data from Junta de Andalucía, 2004-13 [Colour figure can be viewed at wileyonlinelibrary.com]



**FIGURE 2** Evolution of environmental concern and institutional trust indices (%). Source: authors with data from Junta de Andalucía, 2004-13

trust manifested by the public is in general low, the lowest scores being calculated for 2010 (4.40) and 2013 (4.18).

In conclusion, the data indicate growing levels of political disaffection, which has also affected the institutional agents, especially from 2008 onwards. These results agree with Perez-Nievas (2013), who carried out a nationwide study covering the period 1990-2013, and concluded that in Spain, the institutional crisis preceded the economic crisis, and the disaffection between the institutions and the public became particularly acute from 2011 onwards, coinciding with the second episode of economic recession. Although

“environmental expertise” also suffered in the climate of generalized mistrust that characterized the period 2009-11, they close the series with the highest level of public trust.

### 5.3 | Predictors of support for the construction of reservoirs and the improvement of irrigation systems

To analyze which factors have the greatest impact on the water-management preferences of the public, we have undertaken two logistic regression analyses per year (2004-13), in which the dependent

variables are the option of building more reservoirs and the option of improving the efficiency of irrigation systems, respectively. In the first block, we include three sociodemographic variables that can have an effect on preferences: sex, age and level of education. The second block only considers the environmental concern index. The third block incorporates the three institutional trust indices. The inclusion of variables by block allows for the comparison of data interannually, and for the assessment of different theories concerning the support enjoyed by environmental measures, in which environmental and political attitudes can be determinants.

The diachronic evaluation of the data will consider two elements: the drought episode in the period 2005-8 and the state of citizen disaffection from 2008 onwards.

Table 3 deals with the construction of reservoirs. For Block 1, the data confirm the predictive value of sociodemographic variables; throughout the series, this measure is especially popular among older people and people with a lower level of education. Block 2 incorporates the index of environmental concern, which has a negative value but which does not contribute significantly to the adjustment of the model. Regardless, it is worth mentioning that in the initial years of the series (2004-6), when the level of support enjoyed by reservoir construction was still high, those who supported this measure scored below-average levels of environmental concern. In Block 3 the institutional trust index also presents a negative value in the model. Trust in the administration is only relevant in 2006, while political trust is a significant variable at the beginning (2004-5) and the end of the series (2011-13). Trust in environmental expertise has a significant negative value between 2004 and 2007, as well as 2013.

In the period during which the construction of new reservoirs was most popular (2004-6), the respondents who supported this

measure consisted of elderly men with a low degree of environmental concern. The drought period (2005-8) is characterized chiefly by the mistrust of these respondents for institutions, and especially for environmental expertise discourses which argue against the construction of these infrastructures. The process of political disaffection undergone between 2008 and 2013 largely explains the persistent support enjoyed by reservoir construction among certain demographic groups.

Table 4 illustrates the results concerning improving irrigation systems. In Block 1 the sociodemographic data reveal that men are more likely to support this measure than women, which agrees with Lafuente and Moyano (2011) conclusions, according to which women tend to lean more toward saving water in the domestic sphere. The level of education variable has a positive value in the model almost every year. In Block 2 environmental concern also has significant positive values. In Block 3 the institutional trust indices also have a significant positive value. Of the three institutional trust indices, trust in the administration is the most informative, as it is a significant value during the period 2004-7, whereas political trust is only significant in 2008 and trust in environmental expertise is significant only at the beginning of the series—that is, in 2004.

Although the sociodemographic and environmental profile of those in favor of improving the efficiency of irrigation systems does not change throughout the series (men, with a high level of education and a well-developed degree of environmental concern), the value of the institutional trust variable as a predictor for the degree of public support earned by the measure is less regular. During the drought period (2005-8), trust in the administration is a key variable to understanding the increased support for measures conducive to more efficient irrigation systems. Finally, once political disaffection set in

**TABLE 3** Regression models concerning reservoir construction

	2004	2005	2006	2007	2008	2009	2010	2011	2013
	$\beta$ (SD)	$\beta$ (SD)	$\beta$ (SD)	$\beta$ (SD)	$\beta$ (SD)	$\beta$ (SD)	$\beta$ (SD)	$\beta$ (SD)	$\beta$ (SD)
Block 1									
SEX	.181*	-.263**	-.231*	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
AGE	.177***	.299***	n.s.	.233***	.197***	n.s.	.179***	.127*	.185**
EDUC	-.182***	-.141**	-.123*	n.s.	-.265***	-.336***	-.172**	-.356***	-.279***
R <sup>2</sup>	.037	.053	.007	.015	.042	.029	.022	.037	.032
HL	6.630	16.076	9.912	3.018	13.703	2.083	3.055	9.700	11.892
P-value	.577	.041	.131	.221	.057	.353	.931	.206	.156
Block 2									
SEX	.168	-.246**	-.239*				n.s.		n.s.
AGE	.177***	.291***	n.s.				.174***		.170**
EDUC	-.141**	-.087	-.048				-.136*		-.202**
Environmental concern	-.090*	-.122**	-.158***				-.101*		-.190***
R <sup>2</sup>	.041	.059	.015				.025		.047
HL	21.537	21.157	11.968				16.153		22.533
P-value	.006	.007	.153				.040		.004
Block 3									
SEX	.179*	-.231**	-.241*	n.s.	n.s.				n.s.
AGE	.174***	.296***	n.s.	.209***	.216***			.129*	.161*
EDUC	-.125**	-.058	-.052	n.s.	-.258***			-.357***	-.202**
Environmental concern	-.069	-.099**	-.139**	n.s.	n.s.			n.s.	-.177***
Administration trust	n.s.	-.118*	n.s.	n.s.	n.s.			n.s.	n.s.
Political trust	-.105*	-.190***	n.s.	n.s.	-.176***			.134*	-.330***
Environmental expertise trust	-.097**	-.089**	-.089*	-.129***	n.s.			n.s.	-.104*
R <sup>2</sup>	.050	.078	.023	.023	.053			.041	.064
HL	13.332	13.753	3.984	26.301	7.050			11.139	12.389
P-value	.101	.088	.859	.001	.531			.194	.135

Significance: \*\*\*.001, \*\*.01, \*.05.

HL, Hosmer-Lemeshow test.

Logistic regression. Conditional hierarchical model.

**TABLE 4** Regression models concerning improved irrigation systems

		2004	2005	2006	2007	2008	2009	2010	2011	2013
		$\beta$ (SD)	$\beta$ (SD)	$\beta$ (SD)	$\beta$ (SD)	$\beta$ (SD)	$\beta$ (SD)	$\beta$ (SD)	$\beta$ (SD)	$\beta$ (SD)
Block 1	SEX	n.s.	n.s.	-.314**	-.507***	-.394***	-.386***	-.439***	-.519***	-.508***
	AGE	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	.145**	n.s.	n.s.
	EDUC	.259***	.172*	n.s.	n.s.	.157**	.166***	.248***	.249***	.310***
	R <sup>2</sup>	.015	.006	.006	.015	.017	.020	.032	.032	.039
	HL	0.994	7.337	0.000	0.000	6.550	0.629	6.703	6.557	4.526
	P-value	.608	.026	—	—	.364	.996	.569	.364	.606
Block 2	SEX	n.s.	n.s.		-.502***	-.395***	-.386***	-.448***	-.516***	-.514***
	AGE	n.s.	n.s.		n.s.	n.s.	n.s.	.149**	n.s.	n.s.
	EDUC	.186**	-.025		n.s.	.107	.121*	.186***	.207***	.258***
	Environmental concern	.170**	.421***		.154***	.137**	.111**	.176***	.096*	.141**
	R <sup>2</sup>	.024	.046		.025	.023	.024	.044	.032	.048
	HL	15.899	9.693		13.655	5.824	7.001	10.771	4.430	10.486
	P-value	.044	.287		.091	.667	.537	.215	.816	.233
Block 3	SEX	n.s.	n.s.	-.317**	-.492***	-.402***				
	AGE	n.s.	n.s.	n.s.	n.s.	n.s.				
	EDUC	.150*	.020	n.s.	n.s.	n.s.				
	Environmental concern	.143*	.391***	n.s.	.151***	.137**				
	Administration trust	.125*	.330***	.180***	.188***	n.s.				
	Political trust	n.s.	n.s.	n.s.	n.s.	.112*				
	Environmental expertise trust	.221***	n.s.	n.s.	n.s.	n.s.				
	R <sup>2</sup>	.042	.070	.016	.037	.027				
	HL	12.654	7.064	15.606	13.501	6.021				
	P-value	.124	.530	.048	.096	.645				

Significance: \*\*\*.001, \*\*.01, \*.05.

Logistic regression. Conditional hierarchical model.

HL, Hosmer-Lemeshow test.

(from 2008 onwards), this variable clearly became dissociated from public preferences concerning irrigation.

According to the regression models undertaken, the sociodemographic profile of respondents has a determinant influence in their water management-related preferences. While the profile of those who show the most support for the construction of reservoirs are respondents of an advanced age with a low level of education, that of those who support greater efficiency in irrigation systems are men with a high level of education, and age is not related. Environmental concern is also a relevant variable; those who present a higher degree of environmental concern lean toward improving the efficiency of irrigation, whereas those with a lower degree of environmental concern favor the construction of reservoirs. Institutional trust is a more relevant factor during drought periods (2004-8), especially in 2005. While those in favor of building more reservoirs tend not to trust social agents such as nongovernmental and scientific organizations, those who exhibit high levels of trust in the administration favor increasing the efficiency of irrigation systems.

## 6 | DISCUSSION

The main target of the present article was to examine the degree of public support for the construction of major hydraulic infrastructures and for increased efficiency in irrigation. Both measures have been promoted by the Andalusian Government to ensure that water is available in a context of recurrent drought. In this regard, the results indicate decreasing public support for the traditional hydraulic paradigm (represented here by the construction of reservoirs, which is farthest from the environmental targets set out in the WFD).

According to the survey, those who are most supportive of the construction of new reservoirs are elderly people with a low level of education.

Second, we also aimed to explore the attitudinal factors that may, to some extent, explain public preferences concerning water management. Moving beyond the sociodemographic profile, the empirical approach of this work is based on the assumption that environmental and political attitudes need to be considered for the analysis of environmental-related decision-making processes. This can be undertaken by incorporating indicators such as environmental concern and institutional trust, which go a long way toward explaining preferences in public water-management policies.

The results suggest that the role played by political attitudes in water-management preferences is more vulnerable to political mood swings. The drought suffered by the region in the period 2004-8 added another factor of complexity to the analysis, as extraordinary palliative measures were enacted—in particular, the publication of several national and regional drought decrees that justified the under-taking of works considered in the public interest, especially concerning the construction of infrastructures, the use of under-ground water sources, and the improvement of irrigation systems, among others. In this context, in which the debate went beyond economic users and reached the wider public, institutional trust increased only among those whose preferences (improving irrigation) coincided with the actual measures undertaken, which were to impose tighter controls over irrigation water. During this same period, those most in favor of building more reservoirs were characterized by a lower degree of trust in environmental and scientific organizations, which generally oppose the construction of major hydraulic infrastructures.

The process of political disaffection in Andalusia from 2008 onwards had a different effect among those most in favor of building more reservoirs and those who lean toward improving efficiency in irrigation. Among the latter group, institutional trust ceases to be a determinant factor in their preferences, and thus we may conclude that when trust in institutions deteriorates, the public tends to build their preferences on other factors, such as environmental values. Low levels of political trust, however, seem to be directly related to the decrease in support for the “building reservoirs” option, as both these variables fall to their minimum levels in 2013. The interruption of the data series from the *Ecobarómetro* makes it impossible to ascertain whether this is an exceptional circumstance or whether it heralds a more durable trend. This underlines the importance of keeping up with these exercises and evaluating the role played by political and environmental attitudes in public preferences.

## 7 | CONCLUSIONS

This study provides further information about a field that has received much attention in specialized literature, but the empirical implications of which remain underexplored. Although the EU's WFD incentivizes public engagement, effectively incorporating public preferences within decision-making processes is proving problematic. This should be analyzed within the broader academic debate on public governance. We argue that public managers should be aware of public preferences and take them into consideration. The present article presents a solid empirical basis from which to analyze the evolution of public preferences concerning water-management policies in Andalusia in the period 2004-13.

The results of the opinion surveys carried out in Andalusia incorporate public preferences concerning the debate about water management currently being held by different actors, especially concerning the impact of irrigation-improvement programs on water demand. Although the data presented confirm that irrigation-improvement programs implemented by the administration over the last 20 years have not reduced water demand, the results of the survey indicate that the public supports these measures and believes that they have a positive effect on the environment. Public support for these measures has increased steadily over the last decade, especially among citizens who have a high degree of environmental awareness. In addition, during the central years of the period of drought (2005-7), when irrigation improvement plans intensified, trust in the administration also increased, which goes a long way to explaining public support for this measure. In contrast, respondents who support building reservoirs, a clearly productivist measure, have the opposite profile in terms of environmental concern. This measure is supported by those respondents who express little concern for environmental matters and have little trust in environmental expertise (nonprofit environmental organizations and the scientific community) that argue against productivist approaches.

In conclusion, these results suggest that the population believes in the environmentally friendly nature of the modernization of Andalusian irrigation pursued by the regional government. However, if the area covered by irrigation agriculture continues to grow, the increase

in efficiency will not result in lower consumption and the achievement of the associated environmental targets, and we run the risk of seeing public support for efficiency-enhancing measures decrease.

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## APPENDIX A

Demographic characteristics of the population surveyed (%).

		2004	2005	2006	2007	2008	2009	2010	2011	2013
Sex	Male	49.3	48.4	48.6	49.4	49.4	48.9	48.3	49.0	48.8
	Female	50.7	51.6	51.4	50.6	50.6	51.1	51.7	51.0	51.2
Age	Under 30 years old	24.0	23.5	23.0	22.3	21.7	21.0	20.3	19.6	18.3
	From 30 to 44 years old	30.7	30.9	31.1	31.3	31.5	31.5	31.4	31.2	30.7
	From 45 to 59 years old	21.4	21.7	22.0	22.4	22.8	23.1	23.7	24.4	25.6
	60 years or older	23.9	23.8	23.9	24.0	24.1	24.4	24.6	24.8	25.5
Educational level	No studies or compulsory education incomplete	34.6	31.4	30.0	34.6	33.9	40.3	38.2	26.9	25.7
	Completed compulsory education	33.0	36.6	37.3	35.9	35.2	20.6	30.8	38.9	33.2
	Secondary	16.8	18.1	19.4	16.1	16.7	23.5	16.2	18.2	25.3
	University	15.4	14.0	13.0	13.3	14.0	15.4	14.5	15.3	15.3
	NA	0.2		0.3		0.1	0.2	0.3	0.6	0.5