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Looking into individual choices and local realities to define adaptation options to drought and climate change

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ABSTRACT

Climate change adaptation choices defined by local communities reflect individual risk perception and contextual factors. This study examines how local contextual environmental factors contribute to individual choices for adapting to water scarcity in three locations in central Spain. The study evaluates citizens' choices by audience segmentation and explore the role of geographical location in segments' engagement with adaptation and adaptation measure preference. The results of the analysis of the effect of local experience support the findings of other studies that suggest that local experience is linked to risk perception but does not necessarily drive adaptive behaviour. The results suggest that respondents from most degraded areas show a higher local risk perception, but do not show homogeneous commitment to adaptation. The results also indicate differences over adaptation measure preferences across locations. Respondents of less degraded areas have a lower risk perception and show individualistic responses as compared to respondents in water stressed communities. These results highlight the relevance of local experience-driven risk perception in support to adaptation actions. Spain exemplifies many countries in southern Europe and North Africa, where drought is already a challenge to society and it is affecting an increasing number of people.

1. Introduction

Citizen responses to climate change range from scepticism to profound concern (Cheng et al., 2011; Hine et al., 2013, 2016; Maibach, 1993; Maibach et al., 2011). After the high political visibility of the recent Conference of the Parties in Madrid (COP25) where social action was the center of adaptation, there is a need to understand individual attitudes towards adaptation choices. Choices concerning adaptation are often derived from risk attitudes, public information and psychological traits (Biesbroek et al., 2013; Eisenack et al., 2014; Ekstrom and Moser, 2014; Esteve et al., 2018; Le Dang et al., 2014). Beyond the individual choices, effective policies need to be supported by groups of individuals with a common vision of local solutions (Bain et al., 2012; Hine et al., 2016; Iglesias and Garrote, 2015). These collective choices may also be affected by geographical location, due to the influence in the magnitude of impacts (García de Jalón et al., 2013; Scannell and Gifford, 2013). Therefore, the knowledge of both individual choices and local realities is useful for identifying the measures that may be included in effective policies.

Audience segmentation allows targeting communication and actions to specific audience segments in order to promote a desired outcome or behaviour that benefits society. Audience segmentation allows for: (a) an enhanced understanding of citizens' values, beliefs and attitudes towards climate change that makes it possible to adjust mitigation and adaptation strategies, and the way they are communicated to specific target audiences; and (b) it permits to design strategies to modify those values, beliefs and attitudes, and engage reluctant audiences into pro-environmental behaviours. Audience segmentation is widely applied in policy research (Cheng et al., 2011; Forthofer and Bryant, 2000; Maibach, 1993; Slater, 1996). In the field of climate change, Leiserowitz et al. (2009) identified six audience segments in the United States of America (the '*Six Americas*') to improve the effectiveness of public campaigns for global warming mitigation and adaptation, that inspired subsequent research about audience segmentation for climate change

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policy analysis (Bain et al., 2012; Detenber et al., 2016; Hine et al., 2013, 2016; Maibach et al., 2011; Metag et al., 2017; among others). The role of local contextual factors that may influence a segment's response to adaptation is difficult to understand due to the lack of comparative studies with the same approach (Maibach et al., 2011) and because audience segments are not static and may change in light of new climate related experiences or improved knowledge (Hine et al., 2016; Metag and Schäffer, 2018). Therefore, comparative analysis of perception of adaptation needs to a common climate challenge in different contexts is useful for designing effective adaptation policy.

Local conditions may influence citizens' risk perceptions about climate change, by affecting the psychological distance to the phenomenon. Psychological distance refers to the extent to which an individual perceives events as distant from the self (Trope and Liberman, 2010) across four interrelated dimensions: hypothetical, temporal, spatial, and social (i.e. being uncertain, taking place in the long term, affecting distant locations, and affecting other social groups). It is assumed that perceiving climate change as a psychologically distant phenomenon may reduce individuals' concern and willingness to act against it (McDonald et al., 2015). Factors that reduce psychological distance may lead to increased concern and willingness to involve in climate change mitigation and adaptation actions, and different, sometimes contradictory conclusions have been reported. For example, Evans et al. (2014) or Scannell and Gifford (2013) demonstrated that communication addressing personal relevance and emphasizing local climate change impacts and adaptation measures increased engagement and willingness to adopt climate change prevention actions. Also, Singh et al. (2017) found that individuals considering climate change as hypothetically, spatially and socially distant were less likely to support adaptation. However, there are also contrasting studies, such as the one by Chen (2020) or Schuldt et al. (2018) that conclude that reducing psychological distance does not necessarily translate into increased policy support or pro-environmental behaviour.

Individuals' personal experience is one of the elements that may interact with psychological distance (McDonald et al., 2015). Studies that analyze the role of personal experience (e.g. Akerlof et al., 2013; Spence et al., 2011) support the notion that people exposed to contact with events that may be attributable to climate change may show increased concern and willingness to act against climate change and its impacts (McDonald et al., 2015). Gifford and Nilsson (2014) reviewed previous research on factors driving pro-environmental behaviour focusing on personal and social factors. Among other factors, they explain that proximity to problem sites may increase environmental concern, as people that perceive their wellbeing threatened by environmental problems were more likely to engage in specific water conservation, recycling or environmentally responsible consumption. Haden et al. (2012) showed that farmers experiencing water shortages were willing to adopt mitigation and adaptation actions, and that support to adaptation was particularly linked to local climate risk perception. However, even if personal experience may reduce psychological distance, its effects over people's concern and behavioural change may vary according to values, beliefs and norms (McDonald et al., 2015). In this regard, Myers et al. (2013) found that personal experience may influence people that show a low engagement with climate change more importantly than previous personal beliefs, while more engaged citizens would interpret personal experience in a way that reinforce their previous beliefs. Therefore, the effect of local experience on citizens' support to climate change policy and specific adaptation options may differ across audience segments.

In this research we hypothesize that audience segments' response to policy measures for water-related climate change adaptation interacts with the effect of local context and experience. Different local environmental contexts may determine different risk perceptions and responses, and people affected by varied degrees of environmental degradation and with different experiences in relation to climate change impacts on water may show different willingness to adopt specific adaptation measures. Therefore, this study analyses audience perceptions regarding water scarcity and climate change impacts and adaptation in the water sector, taking into account the effect of local degradation of the environment and water resources on such perceptions, among a range of citizens in the Tagus basin in Spain. The results of the study aim to provide a better understanding of audience preferences in different contexts, to target appropriate communication and measures that support climate change adaptation to minimize the impacts of drought and water scarcity. In achieving this goal, first, we identify audience segments among citizens from three different locations. Then we analyze citizens' support to adaptation policy measures for each segment, looking at how these segment preferences may vary across local contexts.

2. Approach

2.1. Framework

The methodological framework includes three steps (Fig. 1). The first step is the design and implementation of a survey to explore risk perception. The survey was designed in a multi-stakeholder process and implemented in three different locations in the Tagus river district (see Fig. 1). The survey aims to explore people's perceptions about water-related risks associated with climate change, about the need to adapt to water scarcity in the present and in the future, and about people support to a wide range of adaptation measures that can be implemented to minimize potential risks (e.g., from water management changes to prioritise water for ecosystems, to increase in water tariffs to lower water demand). The second step is the analysis of survey results to identify audience segments in terms of risk perceptions and support to adaptation. The third step is the geographical analysis of audience segments, assuming that the geographical distance was the main driver of psychological distance in the case study region; the potential limitation of this assumption is discussed in the limitations section (2.5) below.

2.2. Geographical location and local challenges

The geographical location of the study is the Tagus River district in Spain. The Tagus River is a transboundary river between Spain and Portugal, is the longest river of the Iberian Peninsula, and its basin covers an area of 81,447 km^2 (68% in the continental area of Spain). Agriculture is the main water user in terms of total volume, and irrigation accounts for about 70% of current water demand. Urban and industrial water demand are a priority in the basin, since the capital of the two countries (Madrid and Lisbon) are located in the Tagus river district. Urbanization and industrial use of water are an important threat to water quantity and quality. Since 2000, the European Water Framework directive establishes that the concept of water for ecosystems as the main user of water in European river districts, therefore historical water allocation priorities are evolving to comply with this concept. The location of Madrid was selected to exemplify the urban demand and the location of Guadarrama was selected to exemplify the ecosystem services priority introduced in Europe since 2000.

The Tagus River also provides water to another river (Segura), and this inter-basin transfer of water is being challenged in view of climate change. Due to a significant reduction of water flows in the head of the Tagus River in the last 20 years, the inter-basin water transfer produces social unrest in many areas. The location of Talavera was selected to exemplify this social unrest.

Climate change is intensifying pressures on water resources in the Tagus district, since all climate scenarios project further runoff reduction in the 21st century (15% in the case of RCP4.5 scenario, and 25% in the case of RCP8.5 scenario (CEDEX, 2017).

Within the complex social and environment context of the Tagus River district, there are different local realities. Water scarcity and poor

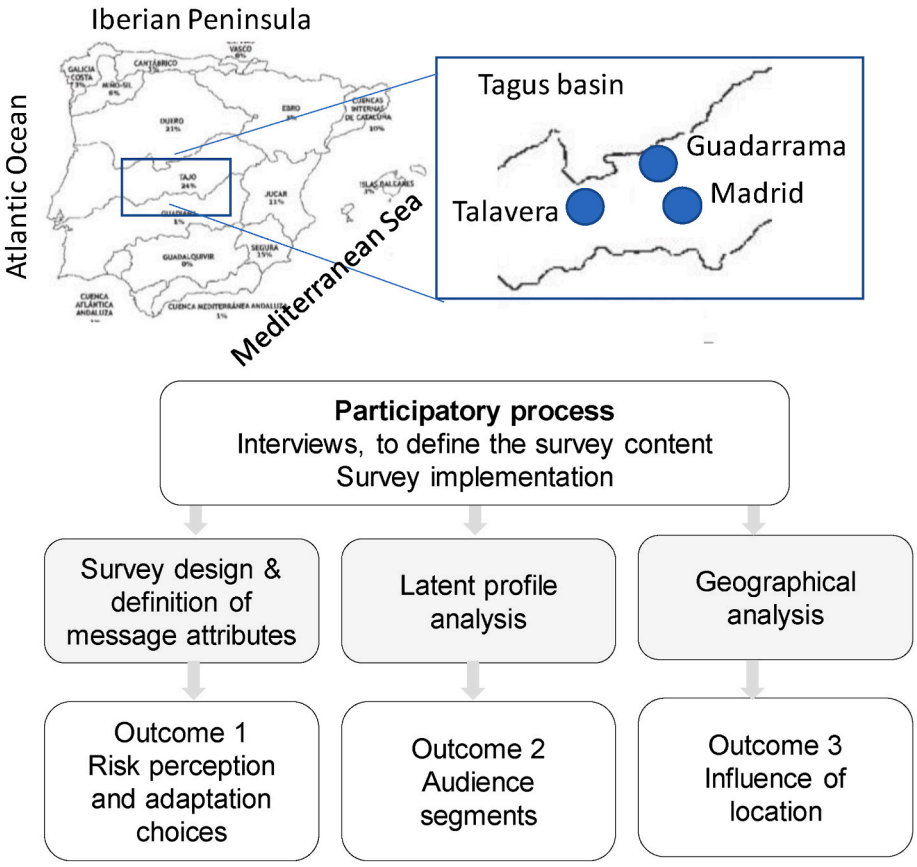

Fig. 1. Research framework.

water quality is perceived differently in different areas of the Tagus River district. In order to assess the hypothesized relevance of local contexts, we selected three locations within the Tagus River district: (1) Talavera de la Reina, an agricultural town in an administrative district of 203,000 ha of agricultural land, agriculture is a key economic sector and water user, and the Tagus River is subject to critical pressures on water quantity and quality; (2) Guadarrama is located in the Protected Peripheral Area of the National Park of Sierra de Guadarrama that comprises 33,000 ha of protected natural systems including different valuable ecosystems under international, EU and national protection schemes such as UNESCO Biosphere Reserves, RAMSAR catalogued wetlands, or Natura 2000 sites; and (3) Madrid, the capital city of Spain and the most important urban population concentration, far from water-dependent agricultural areas and from natural landscapes. Table 1 summarizes the key social and environmental features of the selected sites that contribute to define the psychological distance.

2.3. Survey design and implementation

The survey was designed within the EU 2020 project BASE (https://base-adaptation.eu/) based on discussion in two focus groups (October 2013 and October 2014, including 20 participants). The aims of the focus groups were: (a) to define the water scarcity problem in the case study; (b) to frame the questions that characterize risk perception; (c) to define the adaptation message attributes (feasible adaptation measures typologies) supported by science, identifying a strategic combination of water commitments across sectors; and (d) defining the survey.

The survey included 16 questions and information on 44 variables. From these 16 questions, 5 corresponded to demographic information to characterize respondents, including age, gender, educational level, municipality, labour situation, and 2 referred to participants' relation to land irrigation, and to environmental group membership. The remaining

Table 1
Key features of the selected study sites. Own elaboration. Sources of data: CEDEX (2015); INE (2020); Camarero et al. (2009); Millán-Franco et al. (2019).

Location	Population (2019)	Main agri-environmental features and representability
Talavera de la Reina	87.7 thousand	- Urban area in a region where agriculture is an important source of employment and income - Water quantity and quality deterioration in the past 20 years - Social conflict over water transferred from the Tagus to the Segura river - Low mobility of people - Talavera exemplifies social unrest about water allocation
Guadarrama	15.7 thousand	- Rural area with low population density - Located in the National Park Sierra de Guadarrama - Includes important international habitat protection schemes - Water with good ecological status, in general - Low mobility of people - Guadarrama exemplifies the use of water for ecosystem services
Madrid	3.3 million	- Densely populated urban area - Main uses of water are domestic and industrial - High pressure from intense economic activity - Great source of water pollution and general environmental pollution - High mobility of people - Madrid exemplifies urban demand priority

9 questions referred to psychological and policy related variables covering different aspects about perception, attitude and commitment with respect to adaptation needs and actions. These questions were used to segment the audience, and to explore their willingness to accept different adaptation measures, with the aim to guide adaptation policy communication and implementation.

The survey was carried out by Quota R in October 2015 in the three selected locations. A total of 300 respondents, 100 from each location, participated in the survey; the individuals approached for the survey did not feel obligated to participate in the survey. The personal identifiers such as names were not collected and verbal consent was asked. The survey respondents were informed that their responses were being used for the specified purpose of evaluating adaptation needs to less water and responses would not be used in any way that would allow their identification.

Table 2 shows the demographic characteristics of respondents. More than half of the respondents (55%) were older than 40 years, the population in Guadarrama was the oldest and in Madrid the youngest. The gender is balanced in all locations (52% female). Population in Madrid shows highest educational levels and Talavera the lowest. The occupation in Talavera shows a higher than average share of unemployed or unoccupied population and Guadarrama shows the lowest rate for this variable.

2.3.1. *Variables that define risk perception and attitude towards adaptation*

Individual's risk perception and adaptive behaviour are captured through a set of psychological variables relating to perceptions about current and future water issues locally, and to respondent's personal support to adaptation to water scarcity. These variables (Table 3) are the ones to be potentially used to segment the audience into different profiles.

2.3.2. *Climate change-driven water scarcity adaptation options*

Participants were asked to express their agreement in a 5 points scale (from 1 = strongly disagree, to 5 = strongly agree) with the convenience of a list of different potential adaptation measures in light of predicted decrease in rainfall and water availability as a consequence of climate change. The list of 11 measures was built and discussed with stakeholders in the workshops. The measures included in the survey are: increase price of water (A1: price); improve water management in towns (A2: WM towns); provide more water for towns and less for the environment (A3: red. env. flows); increase area of natural parks (A4: nat. parks); produce food with less water (A5: agr. water efficiency); increase organic food production (A6: organic food); consume food produced in other regions to preserve water from own region (A7: import food); irrigate with water from hydroelectric dams (A8: HE reservoirs); increase research on efficient water resources management (A9: research); increase reservoir capacity (A10: reservoir capacity); do not change current situation (A11: no change).

Table 2
Characteristics of respondents.

Variable	Total sample	Talavera (TAL)	Guadarrama (GUA)	Madrid (MAD)
Age:				
≤ 30 (%)	28	29	11	44
31-39 (%)	17	18	25	8
≥40 (%)	55	53	64	48
Gender:				
Female (%)	52	55	51	50
Male (%)	48	45	49	50
Educational level:				
No studies or primary ed. (%)	22	35	16	16
Secondary ed. (%)	50	45	54	51
Higher education (%)	28	20	30	33
Occupation:				
Employed or studying (%)	73	69	77	73
Unemployed or no occupation (%)	27	31	23	27

Table 3
Risk perception and response variables.

Measure	Variable name	Categories
Need to implement adaptation measures to guarantee water availability for all uses	s_adapt	3 (yes, no, n.a.)
Current implementation of water-saving measures	ss_adapt	3 (yes, no, n.a.)
Type of adaptation measure implemented	m_adop	5 (faucet-related, house appliances-related, reuse-recycle, reduce use, none)
Water saving responsibility from national, regional or local administration	a_resp	3 (yes, no, n.a.)
Responsibility of actors in facing water scarcity (11 variables for 11 different actors: EU, national government, regional governments, local authorities, river basin authorities, the industry sector, hydroelectric companies, farmers, the tourism sector, environmental NGOs, the citizens)	a_EU, a_nat, a_CCAA, a_mun, a_riv, a_pri, a_hyd, a_far, a_tur, a_env, a_cit	3 (yes, no, n.a.)
Adequacy of relevance of water scarcity and drought in the media	ws_med	4 (less/equal/more than actual relevance, n.a.)
Relevance of water scarcity currently	ws_twn	6 (not important, little importance, neither much nor little, quite important, very important, n.a.)
Relevance of irresponsible water use currently	cons	
Relevance of water quality degradation currently	w_qual	
Relevance of water scarcity in 30 years	ws_twn_f	
Relevance of irresponsible water use in 30 years	cons_f	
Relevance of water quality degradation in 30 years	w_qual_f	
Agreement on lack of enough water in the town	nw_town	6 (strongly disagree, disagree, neither agree nor disagree, quite agree, strongly agree, n.a.)
Agreement on lack of enough water in the country	nw_Spa	
Agreement on lack of enough water in the World	nw_wrld	
Agreement on lack of enough water in the future	ws_pr_f	

2.4. *Audience segmentation and analysis*

Survey responses were analysed with the aim of identifying audience segments using multivariate analytical methods. Particularly, in line with previous audience segmentation studies (Detenber et al., 2016; Hine et al., 2016; Maibach et al., 2011; Morgan et al., 2015), we applied Latent Profile Analysis, a statistical analysis technique that allows for identifying subgroups of individuals into different classes according to an unobserved (latent) variable, using observed multivariate data. Audience segments were then studied in terms of (a) characteristics of segment members, (b) preferred future adaptation measures, and (c) segment linkage with geographical location and relevance of location in support of adaptation measures.

2.5. Limitations and sources of uncertainty

Several limitations shed uncertainty over the results of this study. First, we base the hypothesis of the influence of local experience over perception and attitude towards climate change adaptation on the assumption that living in a certain town implies experiencing different context conditions in terms of water scarcity and degradation severity. However, survey respondents may have not consciously experienced such degradation of water resources conditions. Nonetheless, even if they do not personally experience or acknowledge water scarcity in quantity or quality, they live in different environmental and, particularly, different water contexts, and the hypothesis that these differing contexts may affect their perceptions, values, belief and attitudes towards adaptation is still valid.

Second, length of residence of respondents in current towns has not been considered in the analysis. Respondents' risk perception and psychological distance to water scarcity and climate change may be determined by previous residence in different locations. Those previous experiences can have an effect on attitudes towards adaptation and measures preference that this study does not take into account.

The length of residence in a town is an important determinant of physiological distance. The economic reality of the three towns selected is diverse – from a small village (Guadarrama) to a large city (Madrid) – and the economic factors driving length of residence in the three towns also vary. The length of residence of people in Madrid is shorter that in the other two towns (Camarero et al., 2009; Millán-Franco et al., 2019). Further research may explore this variable.

A third constrain in the study is the limited number of measures used to characterize the different dimensions of respondents' risk perceptions and attitudes towards water-related adaptation. However, in this case, the questions included in the survey that determine the number of measures to be used, were defined together with stakeholders in focus groups. Therefore, even if limited to a simplified conceptualization of risk perception and adaptive behaviour, it reflects what stakeholders identified as relevant factors to be considered.

Finally, it should be noted that with the aim of analysing the effects of the local context, the study focuses in a small area and, even if sample size is enough as to be representative of the towns' population, the number of observations is small, which limits the scope of the analysis and demand caution in generalizing the findings of this study. Additional links between psychological variables and audience segments could be found in a more extensive survey.

3. Results

3.1. Descriptive statistics

The study first calculated the descriptive statistics that characterize the perception of risk of water scarcity, the need for adaptation to overcome the risks, and the support for concrete changes in water management and policy, for the total sample surveyed and for each location (Tables 4–6; detailed survey results in Appendix A, Table A1 and Table A2). The initial descriptive statistics show already a pattern of differences across the three locations.

Table 4
Survey results on the need to adapt and adaptation commitment. TOT: total sample; TAL: Talavera, GUA: Guadarrama; MAD: Madrid.

	TOT	TAL	GUA	MAD
There is a need to implement adaptation (%)	91.67	86.00	99.00	90.00
Self-implementation of adaptation measures (%)	51.67	57.00	55.00	43.00
Adopted measure (%)				
faucet-related	21.67	23.00	23.00	19.00
efficient use of appliances	5.33	3.00	7.00	6.00
water reuse/recycling	4.67	4.00	6.00	4.00
reduce use	20.00	27.00	19.00	14.00
None	48.33	43.00	45.00	57.00
National, regional or local authorities should invest money in water saving measures to fight lack of water (%)	88.33	72.00	96.00	97.00

Table 5
Descriptive statistics of survey results on respondents' perceptions about current and future water-related risks, mean values and standard deviations. TOT: total sample; TAL: Talavera, GUA: Guadarrama; MAD: Madrid.

	TOT	TAL	GUA	MAD
Relevance of water scarcity in media (1 = less than actual relevance to 3 = more than actual relevance)	1.19 (0.44)	1.09 (0.29)	1.20 (0.45)	1.28 (0.54)
Current relevance of water scarcity in town (1 = not important to 5 = very important)	2.63 (1.28)	3.56 (1.02)	2.24 (1.29)	2.10 (0.98)
Current relevance of irresponsible water use in town (1 = not important to 5 = very important)	3.08 (1.24)	3.59 (1.01)	2.82 (1.32)	2.84 (1.24)
Current relevance of water quality degradation in town (1 = not important to 5 = very important)	2.95 (1.48)	4.15 (0.88)	2.63 (1.45)	2.03 (1.15)
Future relevance of water scarcity in town (1 = not important to 5 = very important)	4.35 (0.75)	4.76 (0.43)	4.24 (0.73)	4.03 (0.83)
Future relevance of irresponsible water use in town (1 = not important to 5 = very important)	4.48 (0.66)	4.76 (0.43)	4.41 (0.67)	4.26 (0.74)
Future relevance of water quality degradation in town (1 = not important to 5 = very important)	4.29 (0.91)	4.83 (0.38)	4.21 (0.93)	3.80 (0.98)
There is not enough water for citizens' needs currently in town (1 = strongly disagree to 5 = strongly agree)	2.47 (1.39)	3.48 (1.31)	2.21 (1.33)	1.72 (0.83)
There is not enough water for citizens' needs currently in Spain (1 = strongly disagree to 5 = strongly agree)	3.20 (1.21)	3.73 (1.20)	3.06 (1.20)	2.81 (1.06)
There is not enough water for citizens' needs currently in the World (1 = strongly disagree to 5 = strongly agree)	4.53 (0.71)	4.84 (0.37)	4.55 (0.58)	4.21 (0.92)
Water scarcity will be a major issue in the future (1 = strongly disagree to 5 = strongly agree)	4.64 (0.61)	4.83 (0.38)	4.62 (0.55)	4.47 (0.79)

3.2. Audience segments

Latent Profile Analysis conducted using Mplus 7 (Muthén and Muthén, 2015) was used to classify survey participants into different audience segments based on their expressed risk perceptions and attitudes towards water-related challenges. A four class model was selected according to two criteria: (a) the Bayesian Information Criterion (BIC) (Schwarz, 1978) that indicates that the smallest the BIC, the better the model fit: and (b) the Lo-Mendell-Rubin likelihood ratio test (LMR) (Lo et al., 2001), that indicates that a significant p-value indicates that the model fits better than the model with one less class (Table 7). In this study, the Latent Profile Analysis divided the sample into four audience segments according to 6 variables that reflect respondents' risk perception regarding water scarcity and implementation of any adaptation measure to minimize the risk. Particularly, the psychological variables used to define segments included personal support to water related-adaptation through the implementation of specific water-saving measures (*ss_adap* and *m_adop*), and perception of current and future relevance of water scarcity (*ws_twn* and *ws_twn_f*) and irresponsible water consumption (*cons* and *cons_f*) in respondents' home towns. Standardized mean values and errors for the segmentation variables are presented in Fig. 2.

The audience segments are described below.

Segment 1: Alarmed

This segment groups 72 individuals (24.67% of respondents) that show a personal commitment already implementing an adaptation

Table 6
Support to water adaptation measures, mean values and standard deviations. TOT: total sample; TAL: Talavera, GUA: Guadarrama; MAD: Madrid.

	A1: price	A2: towns	A3: environ. flows	A4: parks	A5: agric. water efficiency	A6: organic food	A7: import food	A8: HE reservoirs	A9: research	A10: reservoir capacity	A11: no change
TOTAL	1.77	4.43	2.25	3.90	3.24	3.90	1.95	3.45	4.75	4.25	1.99
	(0.89)	(0.72)	(1.01)	(1.01)	(1.22)	(1.03)	(1.02)	(1.17)	(0.54)	(0.94)	(1.28)
TAL	1.98	4.49	2.07	4.02	3.02	3.85	1.55	3.09	4.71	4.67	2.97
	(0.87)	(0.77)	(0.99)	(0.92)	(1.29)	(1.03)	(0.70)	(1.13)	(0.56)	(0.67)	(1.60)
GUA	1.65	4.28	2.49	3.90	3.42	3.94	2.08	3.24	4.75	4.17	1.86
	(0.85)	(0.78)	(0.97)	(0.94)	(1.13)	(0.93)	(1.03)	(1.14)	(0.61)	(0.88)	(1.04)
MAD	1.68	4.51	2.21	3.77	3.29	3.92	2.22	3.98	4.80	3.89	1.37
	(0.91)	(0.59)	(1.04)	(1.14)	(1.22)	(1.13)	(1.15)	(1.05)	(0.43)	(1.07)	(0.56)

Table 7
Latent Profile Analysis model fit indices for two to six class model solutions.

Classes	BIC	LMR (p-value)	Entropy
2	4088.25	<0.0001	0.941
3	3935.89	<0.0001	0.956
4	**3935.93**	**0.0002**	**0.976**
5	3999.73	0.8321	0.955
6	4040.59	0.7680	0.972

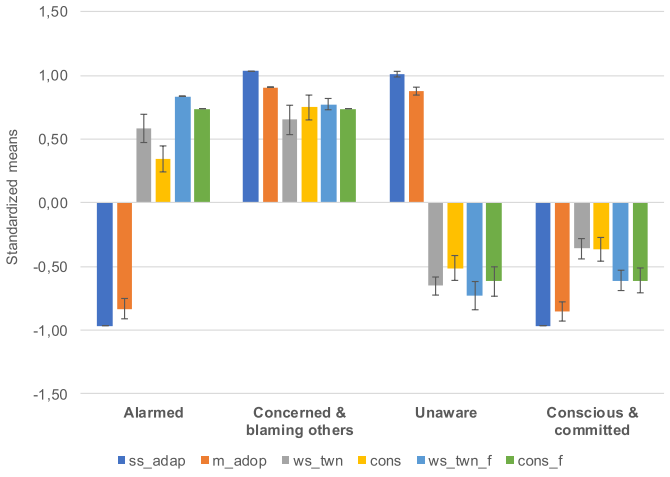

Fig. 2. Characteristics of audience segments according to Latent Profile Analysis; the error bars indicate the standard errors.

measure that minimises the risk of water scarcity. This group of individuals is driven by a higher than average concern about current water stress and alarmed about future water scarcity. The group includes responsible, concerned individuals that are already implementing water-saving measures, such as those aiming at reducing water use through measures related to faucets and toilet facilities (42%) and others aiming at reducing the water bill (42%). Despite disagreement about the relevance of current water scarcity and irresponsible water consumption, 100% of respondents in this group consider water scarcity and irresponsible consumption as very important issues in the future (30-year time horizon).

Segment 2: Concerned and blaming others.

This group is made of 62 individuals (20.67% of respondents) that show no commitment to adaptation despite being concerned about water scarcity. Respondents in this group have not adopted any individual actions to minimize the risk of water scarcity, although a vast majority of them recognize the need to implement adaptation measures that guarantee water for all users. Individuals in this group perceive that water scarcity is an important risk to all and that irresponsible water use is a serious problem. However, this group blames others for the problem and perceive that the responsibility for adaptation lies in other actors rather than themselves. There is more agreement on the responsibility of national authorities as compared to regional or local ones. While recognising the responsibility of citizens, this group of individuals do not implement individually any water saving measure.

Segment 3: Unaware.

This segment includes 84 individuals (28% of the sample) that perceive that water scarcity imposes low risk to themselves and society. A 90% of respondents in this group perceive the need to carry out some water saving measures or changes in water management in order to ensure water availability for all users. However, 99% of the group members do not apply any water saving adaptation measure. In fact, 83% of them consider that water scarcity has no or little relevance currently, and only 24% consider irresponsible water consumption as a problem at the local level. A 77% of respondents consider that water scarcity will be quite or very relevant in the future, and 81% consider irresponsible water consumption similarly important in the future.

Segment 4: Conscious and committed.

This group includes 80 individuals (26.67% of respondents) that show a personal commitment to adaptation, with 100% of group members already implementing water saving measures, despite they do not perceive water scarcity and irresponsible water consumption as a current issue in their towns. Only 10% of respondents consider water scarcity as quite or very relevant currently, 22% in the case of irresponsible water consumption, and 24% in the case of water quality. When considering the situation in a 30-year time horizon, these percentages rise to 87%, 89% and 71% respectively.

Results on the support to adaptation measures show a very similar prioritization of measures across segments (Fig. 3). However, despite

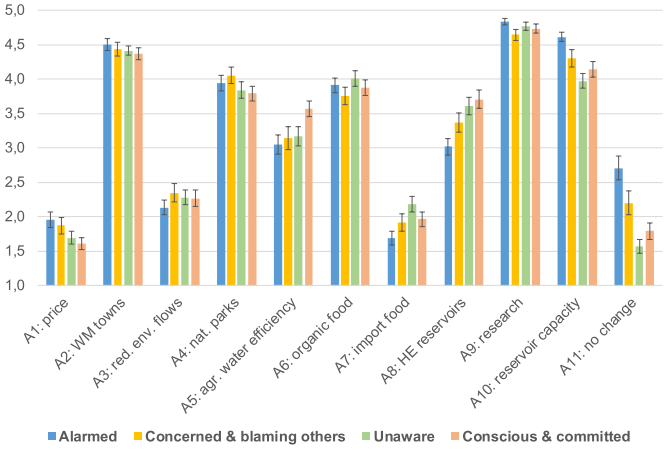

Fig. 3. Audience support to adaptation measures across segments (error bars: standard error).

similar measure ranking, there are differences for certain measures, such as the support to increasing water prices (A1) or reservoir capacity (A10) that receives greater support from 'Alarmed' and 'Concerned and blaming others' audiences, increasing agricultural water efficiency (A5) mostly supported by 'Conscious and committed' individuals, importing food (A7) which shows greater support form 'Unaware' audiences, or using water from hydroelectric reservoirs (A8) which is supported by individuals with a lower risk perception ('Unaware' and 'Conscious and committed' segments). Appendix B presents a full description of each segment and survey results per segment (Table B1).

3.3. The effect of geographical location

The hypothesis that geographical location was a major determinant of audience segments was tested by exploring locations within each cluster. Fig. 4 shows segment composition in each location. 'Alarmed' and 'Concerned and blaming others' audiences are dominated by individuals from Talavera that experience the highest challenges to water quantity and quality. 'Unaware' citizens are predominantly from the city of Madrid, which are the less exposed to environmental concerns, followed by the residents from Guadarrama, that enjoy a privileged protected environment, and with a small representation of individuals from Talavera (11% of segments' members). Finally, the 'Conscious and committed' individuals show a balanced composition between citizens from Guadarrama and Madrid, with a smaller representation from residents in Talavera.

The results show noticeable differences across locations within each segment (Fig. 5). Fig. 5 shows the average support of each segment members to the 10 measures proposed for adaptation to water scarcity (A1-A10) plus the 'no change' option (A11). The scale of support ranges from 1 to 5 (lowest to highest support); 'n.a.' indicates no available response. In Fig. 5, the solid bars represent the average level of support to adaptation measures for all audience member; the level of support for each location is represented by different symbols (dots represent Talavera, triangles represent Guadarrama, and crosses represent Madrid).

The analysis provides the following information. First, the 'Conscious and committed' audience group shows large differences between residents in Madrid and Talavera. The residents in Talavera show a below average support to importing food and using water from hydroelectric dams and above average support to increasing water price, with respondents from Madrid showing the opposite results. Second, the greatest differences across locations are found in the 'Alarmed' group; individuals from Madrid show a significantly higher level of support for increasing water price, increasing agricultural water efficiency, increasing food imports, and increasing irrigating with water from hydroelectric dams. In contrast, citizens in Madrid do not support the reduction of environmental flows as much as citizens in the other locations. In Talavera, support for measures that directly affect agriculture, such as producing food with less water or importing food, is 13.9% and 16% below the average in the total population. Third, the 'Concerned and blaming others' audience segment in Madrid, supports more measures than in the other locations. In contrast with the previous group, this segment supports a reduction of environmental flows, importing food, and using water from hydroelectric dams for irrigation. Support to increasing water price is higher than average in the case of Talavera, while support to importing food is lower than average both for Talavera and Guadarrama citizens. Fourth, the 'Unaware' audience segment shows more homogeneous results across locations. However, for the most controversial measures there are also clear differences, with individuals from Talavera and Guadarrama showing remarkable lower and higher than average support respectively to the reduction of environmental flows and importing food. Finally, the results also show that for all segments, citizens from Talavera show a noticeable higher level of support as compared to average to the 'no change' option, being 28.8% higher within the 'Alarmed' group, 17.6% higher within the 'Concerned and blaming others', 45.8% higher within the 'Unaware', and 74% higher within 'Conscious and committed' audiences.

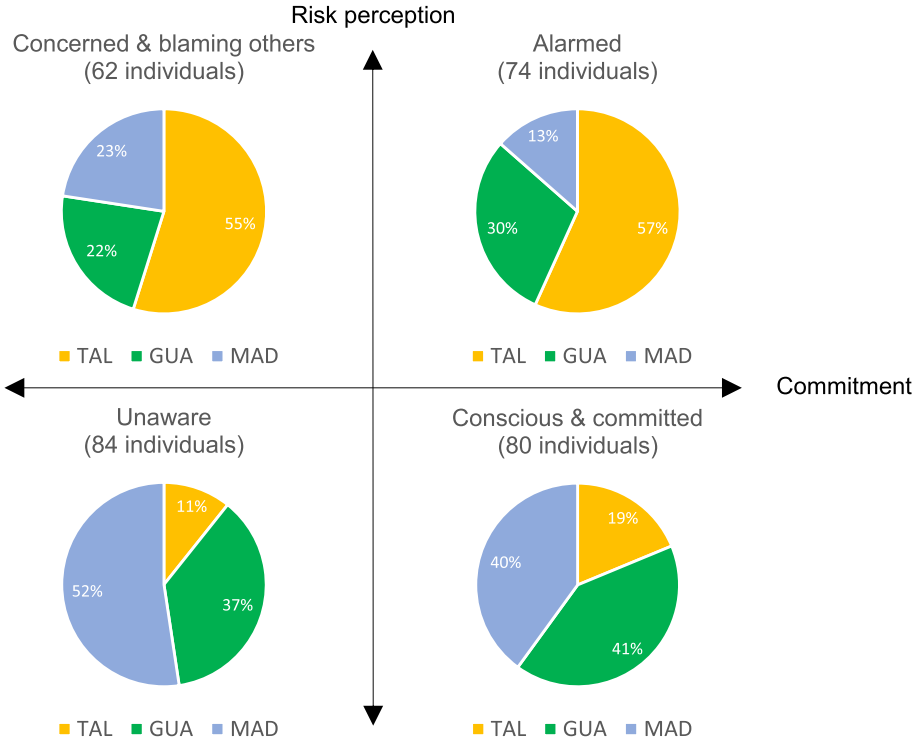

Fig. 4. Audience segment definition in terms of risk perception and commitment to adaptation, and segments' composition per location.

Fig. 5. Average support to water adaptation measures across segments and locations (scale: from 1 = disagree with measure's convenience, to 5 = extremely agree with measure's convenience).

4. Discussion

4.1. Targeting adaptation policy messages and measures to citizens' profiles

A main goals of the research is guide climate change adaptation policy and communication by understanding the role of audience perceptions about climate-driven water scarcity and adaptation needs. Audience segmentation shows that citizens from the Tagus river district perceive differently the risk associated to water scarcity and climate change impacts on water and the need to adapt. Two audience segments show high risk perception ('Alarmed' and 'Concerned and blaming others') with a higher concern about current and future water scarcity, irresponsible use and water quality degradation, perceiving the issue as temporally and spatially closer than the two other segments. These respondents are mostly from the water stressed town of Talavera, the agricultural location that is greatly concerned about the actual water transfer to other river district. Committed audience segments ('Alarmed' and 'Conscious and committed') include people that are already applying water conservation measures. These segments show a higher representation of female respondents, with a higher educational level and lower unemployment rates than the uncommitted audiences, pointing at the relevance of demographic and socio-economic features in engagement with water-conservation measures, in line with previous studies (e.g. Scannell and Gifford, 2013; Gifford and Nilsson, 2014).

The results suggest that a high water-related risk perception is not necessarily linked to engagement with adaptation. Indeed, 'Concerned and blaming others' audiences include citizens with a high risk perception in relation to water scarcity and no involvement with water saving measures. In this segment, despite high awareness and perception of water-related risks in light of climate change, respondents seem to consider other actors as responsible for adaptation. It is the only segment that shows a higher agreement on the role of national government for adaptation than that of local authorities. At the same time, the 'Conscious and committed' segment includes individuals that despite lower risk perception and awareness on the need to adapt they do implement water-saving adaptation measures, potentially guided by other aspects, e.g. economic or general environmental concern, different from a perceived urgency on the need to adapt to climate change.

Even when ranking priorities are the same for the adaptation measures, the level of support to each one is different across segments. The 'Alarmed' segment of audience that include concerned and committed individuals presents the most polarized adaptation support behaviour, showing the largest differences with other segments. Particularly, segments that show a higher risk perception ('Alarmed' and 'Concerned and blaming others') are less reluctant to increasing water price and show greater support to increasing reservoir capacity, than the two other segments. This result suggests that measures that pose a greater economic burden over citizens would get greater acceptance from concerned audiences that perceive a high risk of water scarcity in the present and under future climate change. This fact may be relevant, as water pricing often receives low support from the audience but it has been frequently identified as a key tool to promote a rational and efficient use of water, particularly since the enactment of the EU Water Framework Directive (EC, 2000) twenty years ago. Thus, rising water prices to better reflect the cost of the resource may be facilitated by awareness raising campaigns that contribute to an amplified perception of climate-driven water-related risks. On the other hand, devoting water from hydroelectric dams to irrigation of fields and importing food to reduce local use of water are measures that are less accepted by 'Alarmed' audiences than from other segments. These are measures that could negatively impact specific sectors, hydroelectric industry and farmers, and would get lower support from aware and committed audiences.

The audience segments that show lower risk perception ('Unaware' and 'Conscious and committed') also are less supportive to the increase in water price, the increase of reservoir capacity, and the increase of natural areas. The 'Unaware' segment considers food production as a critical activity in relation to water scarcity and climate adaptation, and shows a greater than average support to organic food production and food imports to reduce local use of water. In contrast, the 'Conscious and committed' individuals show greater support to improved water use efficiency in agricultural production. These kind of individuals would support technical improvements that reduce water use and promote efficiency despite potential increased investment costs for farmers. This result suggests that individuals in this segment are valuing efficiency gains in water use more than in other segments.

4.2. Is location related to citizens' risk perception and acceptability of adaptation measures?

The analysis of survey results highlights the relevance of local experience for risk perception and support to adaptation. Audience segments are linked to geographical location as indicated by the different composition of segments. In Talavera, the location most affected by water quality and quantity deterioration, the audience segment 'Unaware' is the smallest of the three locations. In contrast, 42% of individuals from Talavera are included in the 'Alarmed' segment, and 34% in the 'Concerned and blaming others' segment. In Madrid, a very large urban area not linked to agricultural activities and with other environmental challenges (i.e., air pollution, increase in heat waves), residents are mostly included in segments with a lower risk perception, although show different levels of commitment to adaptation (44% in the 'Unaware' segment and 32% in the 'Conscious and committed' segment). It is important to notice that the study does not consider the fact that individuals' perceptions might be informed by other experiences away from their current home towns, the analysis point to current local experience as a factor that determines audience perceptions, values and attitudes towards adaptation. This shortcoming is discussed in the limitation section (2.5) and calls the need for further research.

The results suggest that locations may have a critical role in the risk perception as result of the psychological distance to the threat. Citizens from Talavera, which experience the most water stressed context, show reduced distance to the phenomenon with respect to its spatial and temporal dimensions, as compared to citizens from Guadarrama and Madrid. The analysis shows that perceived current risk in Talavera (average of three aspects of water resources) is much higher (3.8) than in the town of Guadarrama (2.6) and in the city of Madrid (2.4). This difference is especially remarkable with respect to water quality issues. A similar critical role of the location is observed with respect to risk perception about the future. Comparing current and future risk perception, survey results show that respondents from Talavera perceive the threat as being less distant in time. Additionally, when asked to consider water scarcity locally, at national level and in the World, respondents from Talavera showed reduced spatial distance to the threat by valuing the local problem more similarly to the national and global levels than in the two other locations. Talavera is according to the Tagus river district authority a critical point for water quality and quantity issues, and respondents from this town show greater concern on these problems and further deterioration in light of climate change, than respondents from other locations. Results for Guadarrama and Madrid are more similar although risk perception in Guadarrama is slightly higher. Despite Guadarrama being in a privileged protected natural setting, the public support and environmental protection schemes implemented in the area could have risen awareness among citizens. Therefore, these results underline the relevance of local experience in determining psychological distance to the threat. The analysis shows clearly geographical differences in the perception of risk. However, moving from risk perception into needed action, the audience segments play a more determinant role than the geographical location. For example, in Talavera, where 76% of residents are alarmed or concerned, only 57% of them show at the same time personal commitment with adaptation by implementing water-saving measures.

Regional differences also emerge in relation to the support for concrete adaptation measures that reduce the risk of water scarcity. The need to adopt adaptation measures that reduce water demand and ensure water for all uses is supported by 91.7% in the aggregated population, 86% in Talavera, 99% in Guadarrama, and 90% in Madrid. In relation to the support for public economic investment in water adaptation (i.e., infrastructure, land allocation to protected areas) only 72% of respondents from Talavera agree with such investments as compared to 96 and 97% respectively in Guadarrama and Madrid.

5. Conclusions

There is a growing effort to define adaptation choices that are socially acceptable (Kates et al., 2012; Iglesias and Garrote, 2015). This information is needed to explore policy choices, support local changes and avoid maladaptation (Iglesias and Garrote, 2015). Here, we summarize results from three different locations with a consistent audience segmentation methodology to suggest how local realities define adaptation choices to less water in Spain. The results indicate that personal experience related to geographic location does play a role in determining risk perception and into which segment respondents fit. Interestingly, this did not correspond clearly with commitment to adaptation in general in each location, though it did affect the support for specific adaptation options, as found in other cases (Martinich and Crimmins, 2019).

People differ in their interest in, attitudes on, and behaviour towards scientific and environmental issues (Metag and Schäfer, 2018). Consideration of three locations show that all regions are concerned about adverse impacts and would support adaptation that would result in substantial environmental benefits. The study guides socially supported choices in each location in support of effective investments and management alternatives.

In the aggregated population, citizens risk perception and adaptation needs are categorised in four segments. Alarmed citizens are proactive and already implement water saving measures at the individual level, and support adaptation policies that may be costly, such as water pricing of development of new infrastructure. A group of concerned citizens also blame others, are aware of the risks, but consider that other actors are responsible for adaptation. Conscious citizens perceive future risks but do not view that adaptation is a current urgent policy. Finally, unaware citizens do not perceive the impact of water scarcity, probably because they only rely on their own individual risk. This aggregated is useful for communication of risks and adaptation needs, but not for designing specific policy interventions and changes in water management. Looking into the audience segments and geographical locations, the results show a clear link between local risk perception, local contextual experience, and local specific adaptation choices. Citizens from most affected areas and with higher environmental awareness would support measures that share the economic burden of adaptation among the entire population.

The results of this study are in line with the results reported by Schuldt et al. (2018) or Chen (2020) that conclude that reduced psychological distance does not necessarily translate into support to adaptation or pro-environmental behaviour. The lack of correlation between risk perception and adaptation support may be explained by individuals' perceptions about the effectiveness of measures and role they may play in implementing adaptation. Singh et al. (2017) conclude that although greater the psychological distance results in lower support to adaptation, support to adaptation measures depends on their perceived efficacy.

Our results show that local contextual factors may be linked to different levels of acceptance of adaptation measures even within the same audience segment. Particularly, respondents from Madrid in

segments with a high risk perception ('Alarmed' and 'Concerned and blaming others') show greater support to adaptation measures than other respondents within the same segments, especially to measures of increasing organic food production and food imports, and using water from hydroelectric dams. Also, the analysis shows that individuals experiencing locally a more deteriorated water environment, such as those from Talavera, are more willing to adopt adaptation measures that imply a high economic burden to water users or tax payers than less exposed citizens, but are more reluctant than others to adopt measures that affect one specific sector or activity, especially the agricultural sector. Talavera is located in an area where agriculture is a relevant economic activity, and individuals from this town may be particularly concerned about how water-related adaptation measures could impact this sector.

The study shows that local risk perception does not necessarily result in supporting choices that could benefit other areas. Therefore, emphasises the need for communication to promote a sense of collective responsible for adaptation is crucial for translating awareness into action (Metag and Schäfer, 2018). In this sense, the results of the study may guide communication of climate change policy in each location. Raising awareness and focusing on climate change impacts at the local level, may increase risk perception. Increased risk perception is linked to an increased acceptance of costly adaptation measures (e.g., increasing water prices or developing costly infrastructures) and favours collective approaches rather than individual responses. The results suggest the importance of communicating environmental challenges, not only climate change, as a key element for increasing support to adaptation in areas with lower risk of water scarcity. This is crucial, since the most effective adaptation strategies to decrease the risk of water scarcity are often transboundary and affect locations with different risks.

Author contributions

Ana Iglesias: Conceptualisation, Funding acquisition, Data curation, Writing. **Luis Garrote**: Methodology, Formal analysis, Data curation. **Isabel Bardají**: Conceptualisation, Investigation. **David Santillan**: Methodology, Formal analysis. **Paloma Esteve**: Formal analysis, Investigation, Writing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Survey results

Table A1
Respondents' risk and adaptation need perceptions (% of responses)

	TOT	TAL	GUA	MAD
There is a need to implement adaptation	91,67	86,00	99,00	90,00
Self-implementation of adaptation measures	51,67	57,00	55,00	43,00
Adopted measure				
faucet-related	21,67	23,00	23,00	19,00
efficient use of appliances	5,33	3,00	7,00	6,00
water reuse/recycling	4,67	4,00	6,00	4,00
reduce use	20,00	27,00	19,00	14,00
None	48,33	43,00	45,00	57,00
National, regional or local authorities should invest money in water saving measures to fight lack of water	88,33	72,00	96,00	97,00
Can provide solutions to increasing water scarcity				
EU	82,67	91,00	86,00	71,00
National government	93,67	99,00	94,00	88,00
Regional government	97,67	99,00	98,00	96,00
Local authorities	96,67	98,00	98,00	94,00
River Basin Authority	76,67	84,00	86,00	60,00
Industry	83,00	84,00	89,00	76,00
Hydroelectric companies	80,67	82,00	88,00	72,00
Farmers	87,00	88,00	94,00	79,00
Touristic sector	81,33	85,00	90,00	69,00
Environmental Groups	86,33	90,00	93,00	76,00
Citizens	92,00	97,00	94,00	85,00
	TOT	TAL	GUA	MAD
Relevance of water scarcity in media				
lower than actual relevance	82,33	91,00	82,00	74,00
according to actual relevance	14,67	9,00	16,00	19,00
higher than actual relevance	2,00	0,00	2,00	4,00
Current relevance of water scarcity in town				
not relevant	22,00	0,00	36,00	30,00
minor relevance	31,33	21,00	33,00	40,00
neither much nor little	17,67	20,00	10,00	23,00
quite relevant	19,33	41,00	13,00	4,00
very relevant	9,67	18,00	8,00	3,00
Current relevance of irresponsible water use in town				
not relevant	11,00	0,00	19,00	14,00
minor relevance	26,00	19,00	27,00	32,00
neither much nor little	20,33	22,00	18,00	21,00

(*continued on next page*)

Table A1 (*continued*)

	TOT	TAL	GUA	MAD
quite relevant	28,33	40,00	23,00	22,00
very relevant	14,00	19,00	12,00	11,00
Current relevance of water quality degradation in town				
not relevant	22,33	0,00	28,00	39,00
minor relevance	22,00	7,00	28,00	31,00
neither much nor little	13,33	11,00	13,00	16,00
quite relevant	19,67	42,00	13,00	4,00
very relevant	21,00	40,00	17,00	6,00
Future relevance of water scarcity in town				
not relevant	0,67	0,00	1,00	1,00
minor relevance	2,00	0,00	2,00	4,00
neither much nor little	6,33	0,00	5,00	14,00
quite relevant	43,33	24,00	56,00	50,00
very relevant	46,67	76,00	36,00	28,00
Future relevance of irresponsible water use in town				
not relevant	0,00	0,00	0,00	0,00
minor relevance	1,00	0,00	2,00	1,00
neither much nor little	6,00	0,00	4,00	14,00
quite relevant	36,33	24,00	44,00	41,00
very relevant	55,33	76,00	49,00	41,00
Future relevance of water quality degradation in town				
not relevant	1,33	0,00	2,00	2,00
minor relevance	3,67	0,00	5,00	6,00
neither much nor little	11,33	0,00	7,00	27,00
quite relevant	30,33	17,00	40,00	34,00
very relevant	51,00	83,00	44,00	26,00
	TOT	TAL	GUA	MAD
Insufficient water for citizens' needs currently in town				
Strongly disagree	30,67	5,00	41,00	46,00
Disagree	30,67	27,00	24,00	41,00
Neither agree nor disagree	12,33	13,00	15,00	9,00
Quite agree	12,67	25,00	10,00	3,00
Strongly agree	13,33	30,00	9,00	1,00
Insufficient water for citizens' needs currently in Spain				
Strongly disagree	7,33	1,00	12,00	9,00
Disagree	27,00	24,00	23,00	34,00
Neither agree nor disagree	19,67	10,00	21,00	28,00
Quite agree	29,67	31,00	35,00	23,00
Strongly agree	16,00	34,00	9,00	5,00
Insufficient water for citizens' needs currently in the World				
Strongly disagree	0,67	0,00	0,00	2,00
Disagree	1,33	0,00	0,00	4,00
Neither agree nor disagree	4,67	0,00	4,00	10,00
Quite agree	30,67	16,00	37,00	39,00
Strongly agree	62,33	84,00	58,00	45,00
Water scarcity will be a major issue in the future				
Strongly disagree	0,33	0,00	0,00	1,00
Disagree	1,00	0,00	0,00	3,00
Neither agree nor disagree	2,00	0,00	3,00	3,00
Quite agree	27,00	17,00	32,00	32,00
Strongly agree	68,00	81,00	65,00	58,00

Table A2
Support to water adaptation measures across locations (% of responses) (Q12)

	TOT	TAL	GUA	MAD
A1: price				
Strongly disagree	44,00	25,00	53,00	54,00
Disagree	39,33	58,00	30,00	30,00
Neither agree nor disagree	9,67	8,00	12,00	9,00
Quite agree	3,33	3,00	2,00	5,00
Strongly agree	1,67	3,00	1,00	1,00
A2: WM towns				
Strongly disagree	0,33	0,00	1,00	0,00
Disagree	2,67	4,00	3,00	1,00
Neither agree nor disagree	3,67	5,00	4,00	2,00
Quite agree	39,33	28,00	48,00	42,00
Strongly agree	52,33	62,00	40,00	55,00
A3: red. env. flows				
Strongly disagree	22,00	25,00	13,00	28,00
Disagree	39,33	51,00	35,00	32,00

(*continued on next page*)

Table A2 (*continued*)

	TOT	TAL	GUA	MAD
Neither agree nor disagree	22,67	11,00	30,00	27,00
Quite agree	6,00	3,00	9,00	6,00
Strongly agree	3,67	5,00	3,00	3,00
A4: nat. parks				
Strongly disagree	2,33	1,00	1,00	5,00
Disagree	6,67	6,00	6,00	8,00
Neither agree nor disagree	20,33	16,00	21,00	24,00
Quite agree	36,33	42,00	37,00	30,00
Strongly agree	30,67	33,00	27,00	32,00
A5: agr. water efficiency				
Strongly disagree	8,67	9,00	6,00	11,00
Disagree	19,33	31,00	13,00	14,00
Neither agree nor disagree	20,33	14,00	23,00	24,00
Quite agree	29,33	21,00	33,00	34,00
Strongly agree	15,00	15,00	15,00	15,00
A6: organic food				
Strongly disagree	2,67	2,00	1,00	5,00
Disagree	6,67	7,00	6,00	7,00
Neither agree nor disagree	18,67	24,00	19,00	13,00
Quite agree	35,67	31,00	40,00	36,00
Strongly agree	30,67	30,00	28,00	34,00
	TOT	TAL	GUA	MAD
A7: import food				
Strongly disagree	40,33	55,00	32,00	34,00
Disagree	32,33	36,00	37,00	24,00
Neither agree nor disagree	15,33	6,00	19,00	21,00
Quite agree	7,33	2,00	6,00	14,00
Strongly agree	1,67	0,00	3,00	2,00
A8: HE reservoirs				
Strongly disagree	3,33	3,00	4,00	3,00
Disagree	18,33	28,00	23,00	4,00
Neither agree nor disagree	20,33	17,00	23,00	21,00
Quite agree	24,00	21,00	24,00	27,00
Strongly agree	20,00	10,00	14,00	36,00
A9: research				
Strongly disagree	0,33	0,00	1,00	0,00
Disagree	0,33	1,00	0,00	0,00
Neither agree nor disagree	2,00	2,00	3,00	1,00
Quite agree	18,33	22,00	15,00	18,00
Strongly agree	78,33	75,00	81,00	79,00
A10: reservoir capacity				
Strongly disagree	1,33	0,00	2,00	2,00
Disagree	5,33	3,00	2,00	11,00
Neither agree nor disagree	9,67	2,00	11,00	16,00
Quite agree	32,00	20,00	42,00	34,00
Strongly agree	48,33	75,00	37,00	33,00
A11: no change				
Strongly disagree	41,67	19,00	40,00	66,00
Disagree	22,33	14,00	25,00	28,00
Neither agree nor disagree	10,33	14,00	13,00	4,00
Quite agree	2,33	4,00	3,00	0,00
Strongly agree	8,67	23,00	3,00	0,00

Appendix B. Description of audience segments and survey results by segment

Segment 1: Alarmed.

Segment 1 groups 72 individuals (24.67% of respondents) that show a personal commitment with water-related adaptation, and a higher than average concern about current and future water scarcity. These are concerned individuals that are alarmed about future water scarcity and quality issues. They show a pro-active behaviour towards adaptation by implementing water-saving measures, such as those aiming at reducing water disposal through measures related to use of faucets and toilet facilities (42%) and others aiming at reducing the water bill (42%). A 51% of the group respondents consider current water scarcity as a quite relevant or very relevant concern, while 55% consider irresponsible water consumption within the same importance level, against 30% and 22% respectively that assign no or little relevance to those concerns. However, when asked about the future (30 year time horizon) 100% of respondents in this group consider water scarcity and irresponsible consumption as very important issues.

The group is composed by a 55% of female respondents, average age is 46 years, slightly over the total sample average, and 76% of individuals are working or studying. The most frequent educational level is secondary education (45%) followed by higher education (32%). A 23% of respondents in this segment are related to some form of irrigation, and 4.1% are included in environmental NGOs.

In this group, 93% of members consider that there is a need to implement adaptation, measures, being the regional and local authorities responsible for this (100% of responses), together with the national authorities (97%) and citizens (96%). Most supported adaptation measures in this group are research (A9), increased reservoir capacity (A10) and improved water management in towns (A2), for which 99%, 93% and 91% of

respondents quite or strongly agree with their convenience respectively. Importing food (A7) and increasing water prices (A1) are the least supported measures with 88% and 77% of respondents against their convenience respectively. Finally, measures directly related to agricultural irrigation, such as increasing water use efficiency in agriculture (A5) o irrigating with water from hydroelectric dams (A8) are the most controversial measures, with a high variability of responses. Also, there is not a clear consensus on the convenience of making no changes with respect to water management and use (A11).

Segment 2: Concerned and blaming others.

Segment 2 is made of 62 individuals (20.67% of respondents) that show no commitment to adaptation despite high concern towards water scarcity issues. In this group 100% of respondents have not adopted any adaptation measure for water scarcity, despite 92% of them recognize the need to implement adaptation measures that guarantee water for all users. In this group individuals recognize the need to adapt, but perceived responsibility for adaptation lies in other actors rather than themselves. There is more agreement on the responsibility of national authorities as compared to regional or local, and although they recognize the responsibility of citizens they are not implementing themselves any water saving adaptation measure.

Individuals in this segment show the highest concern towards current water scarcity and irresponsible water consumption in their towns, with 58% and 77% of respondents respectively considering those issues as quite or very relevant. When asked about the future, these percentages rise to 98% and 100% respectively. Within this audience segment, 56% of respondents quite or strongly agree that there is a lack of sufficient water available for satisfying inhabitants' needs in the town. This share turns to 71% when asked about the whole country, and to 97% when asked about the World.

The group shows a balanced composition in terms of gender (50% female), with an average age of 45.7 years. A 66% of respondents are working or studying, and educational level is below other segments' level, with 35% of respondents reporting no education or primary education, and 42% secondary education. 55% of individuals in this group are related to irrigation of land (gardens or agricultural fields), and only 3% are involved in environmental NGOs.

In this group, 84% consider that national, regional or local authorities should invest money to implement measures that support water saving. Particularly, 97% of respondents consider that national authorities could provide solutions to water scarcity, followed by the regional and local authorities (95%), and farmers and citizens (94%). Most supported adaptation measures in this group are research (A9), improved water management in towns (A2) and increased reservoir capacity, for which 94%, 87% and 81% of respondents quite or strongly agree with their convenience respectively. These measures are similar to those supported by segment 1 but the level of support is slightly lower. Also in line with segment 1, increasing water prices (A1) and importing food (A7) are the least supported measures with 82% and 74% of respondents against their convenience respectively. Finally, similarly to segment 1, increasing water use efficiency in agriculture (A5), irrigation with water from hydroelectric dams (A8), and making no change to the current conditions (A11) show a high variability of responses.

Segment 3: Unaware.

This segment is the most numerous and includes 84 individuals (28% of the sample) with a low risk perception about water scarcity. A 90% of respondents in this group perceive the need to implement adaptation measures to deal with water scarcity and ensure water availability for all uses. However, 99% of the group members do not apply any water saving adaptation measure. In fact, 83% of them consider that water scarcity current has no or little relevance in their towns, and only 24% consider irresponsible water consumption as a current issue. A 77% of respondents consider that water scarcity will be quite or very relevant in the future, and 81% consider irresponsible water consumption similarly important in the future.

Group composition is predominantly male (55%), and average age of respondents is lower than the total sample average. With respect to education, 52% of respondents in this group report secondary education as their educational level, with 25% of respondents achieving higher education, and 72% of the group members are currently employed or studying. A 39% of the segments' members are related to irrigation activities and only 2% of them are engaged in environmental groups.

In this group, 94% of respondents (higher than in other segments) consider that the national, regional or local authorities should invest resources in water saving measures to fight the lack of water. However, there is not such a clear agreement on which actor could provide solutions to face increasing water scarcity in the country. Respondents consider that regional (97%), local (94%) and national (92%) authorities may be relevant actors. In contrast, only 71% of respondents consider that the River Basin Authority (in charge of water planning and management in the basin) is an actor that can provide solutions to face water scarcity. In terms of support to specific adaptation measures, results in this segment are different from those shown by segments 1 and 2 with a generally highly support to all measures considered. In this case, besides measures A2, A9 and A10, organic crop production A6 is highly supported with 73% of respondents reporting quite or strong agreement with its convenience. Also, irrigation with water from hydroelectric dams (A8) is not perceived as inconvenient (in fact 51% of respondents consider it a reasonable option), and the no change option is clearly rejected (86%) by individuals from this audience segment.

Segment 4: Conscious and committed.

Segment 4 includes 80 individuals (26.67% of respondents) that show a personal commitment with adaptation to water scarcity, with 100% of group members already implementing water saving measures, despite not clearly perceiving the threat of water scarcity and irresponsible water consumption currently in their town. Only 10% of respondents consider current water scarcity as quite or very relevant, 22% in the case of irresponsible water consumption, and 24% in the case of water quality. When considering the future situation in a 30 year time horizon, these percentages rise to 87%, 89% and 71% respectively.

Female respondents are predominant in the group (57.5%), and average age is 44.6 years, quite similar to the total sample average (44.9). Occupation in this segment is similar to that of segment 1, and the educational level is higher than in other segments, with only 11% of members with a primary educational level and 30% with higher education studies. A 44% of group members is related to irrigation, and only 1 member is involved in environmental groups.

In segment 4, 90% of members consider that the authorities should invest money in water saving measures, being regional and local authorities capable to provide solutions to face water scarcity according to 97.5% of the group respondents. As in segments 1 and 2, the measures considered as reasonable for a largest share of respondents are research (96%), improving water management in towns (91%) and with less support increased

reservoir capacity (79%). As in all other segments, increasing water price is considered a not reasonable measure (for 86% of respondents), and similarly to segment 3 but with a lower level of agreement (74%), making 'no change' is also considered as unreasonable. In this group, there is less variability on the support to adaptation measures. In this case, increasing agricultural water efficiency is not such a controversial measure, with 56% of respondents quite or strongly convinced about its reasonability and only 16% in disagreement with its convenience.

Table B1
Summary results for each audience segment

	Alarmed n = 74	Concerned and blaming others n = 62	Unaware n = 84	Conscious and committed n = 80
Demographic aspects				
Average Age	46.2	45.8	43.18	44.6
Female (% of respondents)	55	50	45	57.5
Educational level (% of respondents)				
Secondary	44.6	41.9	52,4	58,8
Higher education	32.4	22.6	25,0	30,0
Occupied (% of respondents)	75.7	66.1	73.8	75.0
Irrigation (% of respondents)	23	45.2	39.3	43.8
Environmental NGO membership (% of respondents)	4.1	3.2	2.4	1.3
Views on adaptation needs				
Perceived need to implement adaptation measures for water (% of respondents)	93.2	91.9	90.48	91.3
Self-implementation of adaptation measures (% of respondents)	100	0	1.2	100
Nat., reg., or local Government should invest money in water saving measures (% of respondents)	83.8	83.9	94.0	90.0
Can provide solutions to increasing water scarcity? (% of respondents)				
EU	91.9	90.3	72.62	78.8
National Government	97.3	96.8	91.67	90.0
Regional governments	100.0	95.2	97.62	97.5
Municipalities	100.0	95.2	94.05	97.5
River Basin Authority	82.4	87.1	71.43	68.8
Industry and private companies	86.5	88.7	78.57	80.0
Hydroelectric industry	82.4	90.3	78.57	73.8
Farmers	86.5	93.6	84.52	85.0
Touristic sector	83.8	87.1	75.00	81.3
Environmental NGOs	90.5	90.3	83.33	82.5
Citizens	95.9	93.6	90.48	88.8
	Alarmed n = 74	Concerned and blaming others n = 62	Unaware n = 84	Conscious and committed n = 80
Relevance of water scarcity and drought in the media is lower than actual relevance (% of respondents)	90.5	95.2	72.6	75.0
Relevance of water scarcity currently in town	3.38 (1.26)	3.47 (1.16)	1.80 (0.90)	2.18 (0.92)
Relevance of irresponsible water consumption currently in town	3.53 (1.15)	4.03 (0.96)	2.45 (1.13)	2.64 (1.07)
Relevance of degradation of water quality currently in town	3.85 (1.20)	3.76 (1.25)	2.04 (1.28)	2.64 (1.49)
Relevance of water scarcity in the future in town	5.00 (0.00)	4.95 (0.28)	3.81 (0.77)	3.90 (0.56)
Relevance of irresponsible water consumption in the future in town	5.00 (0.00)	5.00 (0.00)	4.08 (0.75)	4.09 (0.60)
Relevance of degradation of water quality in the future in town	4.96 (0.26)	4.89 (0.48)	3.73 (1.01)	3.95 (0.93)
Lack of water for population needs in town	2.91 (1.33)	3.34 (1.54)	1.89 (1.14)	2.05 (1.15)
Lack of water for population needs in Spain	3.51 (1.10)	3.94 (1.07)	2.88 (1.12)	2.71 (1.20)
Lack of water for population needs in the World	4.73 (0.60)	4.79 (0.55)	4.29 (0.78)	4.43 (0.74)
Water scarcity will be a severe problem in the future	4.84 (0.41)	4.92 (0.33)	4.46 (0.81)	4.51 (0.66)
Support to specific water adaptation measures				
A1: price	1.96 (0.97)	1.87 (0.92)	1.69 (0.86)	1.61 (0.77)
A2: towns	4.51 (0.73)	4.44 (0.79)	4.42 (0.61)	4.37 (0.79)
A3: environmental flows	2.13 (0.92)	2.34 (1.09)	2.28 (0.99)	2.27 (1.07)
A4: parks	3.94 (0.95)	4.05 (0.96)	3.84 (1.09)	3.79 (1.00)
A5: agricultural water efficiency	3.04 (1.21)	3.14 (1.30)	3.17 (1.27)	3.57 (1.07)
A6: organic food	3.91 (0.96)	3.76 (1.05)	4.01 (1.03)	3.88 (1.07)
A7: import food	1.68 (0.91)	1.91 (0.98)	2.18 (1.09)	1.96 (1.01)
A8: HE reservoirs		3.37 (1.15)		3.71 (1.19)

(*continued on next page*)

Table B1 (*continued*)

	Alarmed n = 74	Concerned and blaming others n = 62	Unaware n = 84	Conscious and committed n = 80
	3.02 (1.07)		3.61 (1.17)	
A9: research	4.84 (0.41)	4.65 (0.6)	4.77 (0.50)	4.73 (0.61)
A10: reservoir capacity	4.62 (0.59)	4.31 (1.02)	3.98 (0.98)	4.14 (1.00)
A11: no change	2.70 (1.53)	2.20 (1.37)	1.57 (0.95)	1.79 (1.09)

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