AG-WaMED | Advancing non conventional water management for innovative climate-resilient water governance in the Mediterranean Area

Grant Agreement Number No. [Italy: 391 del 20/10/2022, Egypt: 45878, Tunisia: 0005874-004-18-2022-3, Greece: ΓΓΡ21-0474657, Spain: PCI2022-132929]

Deliverable 3.3.1

Results of CE data analysis, MWTP estimates and social CBA

Partnership for Research and Innovation in the Mediterranean Area Programme (PRIMA)
The AG-WaMED project has received funding from the PRIMA Programme, an Art.185 initiative supported and funded under Horizon 2020, the European Union's Framework Programme for Research and Innovation. This project also received funding from the Italian Ministry of University and Research (MUR), Science and Technological Development Fund - STDF (Egypt), Ministry of Higher Education and Scientific Research - MESRS (Tunisia), Hellenic Republic, Ministry of Development and Investments (Greece), Agencia Estatal de Investigación (AEI) (Spain) and General Directorate for scientific research and technological development - DGRSDT (Algeria)

Deliverable Identification

Deliverable No and Title	**D3.2.1 - Multi-objective programming solutions, alternative scenarios and choice of best solution by LLs**		
Grant Agreement No	ΓΓΡ21-0474657 (for AGRERI)	**Acronym**	AG-WaMED
Project Full title	Advancing non conventional water management for innovative climate-resilient water governance in the Mediterranean Area		
Funding Instrument	Partnership for Research and Innovation in the Mediterranean Area Programme (PRIMA)		
Call	PRIMA CALL SECTION 2 2021 – MULTI-TOPIC		
Work-Package No and Title	Work Package 3: DSS for water resources system modelling and socio-economic assessment		
WP- Main Beneficiary	AGRERI		
WP-Leader	Athanasios Ragkos ragkos@elgo.gr		
Task No and Title	Task 3.3 - Social perceptions and valuation of benefits from NCW use		
Task Leader	Athanasios Ragkos		
Main Author	Athanasios Ragkos		
Contributors	Thomas Giotis thomgiotis@gmail.com Georgia Papoutsi gpapoutsi@elgo.gr		
Status	Draft ☐ Final ☒		
Dissemination Level	Internal ☐ Public ☒		
Reviewed by	UNIFI		
Abstract	The present report is produced as deliverable for the Task 3.3 of AG-WaMED project, “Results of CE data analysis, MWTP estimates and social CBA”. The task involved the design of a Choice experiment (CE) to evaluate the preferences of Mediterranean citizens in four out of five countries where AGWAMED LLs are situated (Algeria, Egypt, Italy, Spain). The analysis of the data obtained through an online survey indicate that the public evaluates positively all attributes relating to NCW valorization and support more widespread use and – in some cases – diversification and introduction also of other NCW. However, significant preference heterogeneity was observed, indicating that in-depth analysis is needed to design acceptable governance models based on NCW that will be socially acceptable.		
Key words	Non-market valuation; Choice experiment ; Willingness to Pay		
DOCUMENT HISTORY			
Planned Release Date	30 April 2025	**Actual Release Date**	31 May 2025
Version	V1	**Released Version No**	1

Executive Summary

The present report is produced as deliverable for the Task 3.3 of AG-WaMED project, “Results of CE data analysis, MWTP estimates and social CBA”. The task involved the design of a Choice experiment (CE) to evaluate the preferences of Mediterranean citizens in four out of five countries where AGWAMED Living Labs (LLs) are situated (Algeria, Egypt, Italy, Spain). The analysis of the data obtained through an online survey indicate that the public evaluates positively all attributes relating to (Non-Conventional Waters) NCW valorization and support more widespread use and – in some cases – diversification and introduction also of other NCW. However, significant preference heterogeneity was observed, indicating that in-depth analysis is needed to design acceptable governance models based on NCW that will be socially acceptable. Risks of land abandonment were important for all countries and the only attribute for which preference were homogeneous.

List of Tables

Table of Contents

1.Introduction

This deliverable corresponds to Task 3.3 of AGWAMED project and focuses on the assessment of public preferences regarding NCW use in the Mediterranean. Generally, the objectives of WP3 are **i)** to develop a modelling suite capable of carrying out NCW assessment in the study areas of the project, where LLs are nested, **ii)** to model alternative scenarios of NCW use under different socio-environmental challenges (SO2 - KPI2), **iii)** to deliver socio-economic assessments of NCW use in the Mediterranean basin in relation to sustainable development and **iv)** to capture public perceptions about attributes and acceptability of NCW use (SO4 - KPIs 5, 6)

In particular, this Task involved estimating monetary values for benefits expected to accrue from the use of NCW which are not valued in markets (non-use values) to inform the socio-economic analysis. A Choice Experiment (CE) survey was launched in Algeria, Egypt, Italy and Spain, where the general public will be surveyed with regards to specific environmental and social attributes that will be affected by the use of different levels and types of NCW. Multiple sources were used to identify attributes for the experimental design, including (i) literature review on socio-economic implications and perceptions of NCW use; (ii) the results of the MOP model (Task 3.2) and; (iii) validation from project partners and the LLs. Based on this design, a questionnaire was formulated and presented online to approximately 400 respondents per country (note that one sample was surveyed from each LL and for the transnational LL it was preferred to be addressed only to respondents from one of the two countries i.e. Algeria). The analysis was based on Random Parameters Logit models in order to reveal how societal groups perceive NCW use and their preferences on farm production based on them. Also the Marginal Willingness to Pay for different NCW attributes was estimated. These estimates can be incorporated in a social CBA framework in order to take into account also non-use benefits of NCW that are not adequately accounted for in market prices.

2.Methodology

The analysis is based on an application of the Choice Experiment (CE) method. CE is a non-market valuation method which is very helpful in valuing goods and services which are normally not priced in competitive markets or whose values are distorted. The design of a CE is based on Lancaster's (1966) theory of consumer preference, which states that goods and services can be described and evaluated in terms of their specific characteristics – attributes. A CE experimental design requires, therefore, the choice of attributes that describe the good or service – in this case use of Non Conventional Water (NCW) in different Living Labs (LLs). Each attribute can assume specific levels, which can be either numeric (scale) or qualitative (nominal or ordinal), depending on their nature and on research objectives (Hensher et al, 2015). The researcher adds a monetary attribute that corresponds to an amount that a hypothetical 'consumer' of the good/service would be willing to pay in order to achieve the attribute levels they desire. The possible combinations of attributes and levels yield 'alternatives', which are then organized in pairs formulating the 'choice sets'. Each respondent is presented with a specific number of choice sets (Louviere et al., 2000) and in each one he/she is asked to mark the alternative he/she prefers. This method is particularly useful in market research, especially in cases of novel products with attributes which are unknown to consumers or are of interest for specific market segments.

2.1 Choice of attributes and levels – Experimental design

Table 1 presents the attributes included in the experimental design and the levels they assume. These attributes were chosen based on an extensive review of literature regarding valorization of NCW and social and economic considerations in the Mediterranean (Efthimiou et al., 2025) and policy documents regarding NCW in Mediterranean countries.

The list of possible attributes in Table 1 was evaluated critically by the AGWAMED partnership, where each partner provided feedback about the current situation and priorities in their countries. In addition, results from Deliverable D3.2.1 were also taken into account, especially in terms of possible quantification of attributes and levels. After a first round of feedback, the "long" list of attributes was enriched with possible levels and then was shared with partners, who in turns provided additional information about each one of them. As a result of this activity, the attributes ranked higher in all four countries and for which there were adequate and meaningful data to provide levels were included in the survey design. They are presented in Table 2.

Table 1. Initial "long" list of attributes considered for the experimental design

Attribute	**Description (Possible measurement)**	**Possible levels**	**Comments**
NCW use	Ha irrigated with NCW **Or** % of land irrigated with NCW **Or** % of irrigation needs covered by NCW		Partners provided estimations of the following (if available) 1. How many ha or which percentage of land or which percentage of irrigation needs is actually covered from NCW? 2. Is there an expansion plan to increase the above? If yes, what is the expected future situation (how many ha or which percentage)? If no, are there and projections? 3. Based on existing planning, is there an ideal situation i.e. an ideal acreage of ha or percentage of irrigation needs covered from NCW?
Cropping pattern		Low diversity Medium diversity High diversity	Less water availability is linked to the potential loss of crops and monocultures
Traditional/Certified crops		Egypt 1 (figs) Italy 1 (Vines); 2 (wheat) Spain 1 (Almonds); 2 (vegetables) Algeria 1 (fruit)	
Land in risk of abandonment		Percentage per country	Here we can be based on the results of Task 3.2. However please give us any relevant information that you might have.
NCW methods		Rainwater harvesting Desalinization Wastewater reuse	This attribute can be included for LLs where some of all these methods are applicable and feasible
Irrigation water availability			Please provide information about the percentage of water consumption for irrigation and how NCW contributes to this

Risk of water scarcity		Low Medium High	Please provide relevant information based on previous research
Availability of water for urban uses			Please provide information about the percentage of water consumption for urban uses and how NCW contributes to this
Water quality	Frequency of water quality controls **or** Suitability of NCW	Examples 1 per 2 days 1 per week 1 per 2 weeks Suitable for industry Suitable for irrigation Suitable for household uses	Maybe this attribute is not relevant for all countries. Please check the list of levels and confirm or revise
Payment amount	Increment in monthly food expenses **or** Increment in monthly water bills	% Increase	

Table 2. Attributes included in the experimental design and their levels

Attributes	**Brief description**	**Levels**			
		Algeria	*Egypt*	*Italy*	*Spain*
Use of non-conventional water	NCW use in each one of the four LLs (percentage of total use or possible increase of NCW use)	0% increase (SQ) 3% increase 10% increase	0% increase (SQ) 3% increase 8% increase	75% (SQ) 80% 90%	42% (SQ) 52% 64%
Crop diversity	Possible loss or reduction of one typical/traditional crop under future water scarcity	Olives (SQ) Olives and fruit	Olives (SQ) Olives, Figs	Wheat, Olives, Less vines (SQ) Wheat, Olives, Vines	Citrus, olives, less vegetables Citrus, Olives, Vegetables
Types of non-conventional water	Introduction or expansion of another NCW apart from the only or main one in the LL	Boreholes (SQ) Boreholes and Floodwater	Rainwater harvesting (SQ) Rainwater harvesting and Desalinization	Rainwater Harvesting (SQ) Rainwater Harvesting and Wastewater reuse	Desalinization **Low** wastewater reuse (SQ) Desalinization Wastewater reuse
Land in risk of abandonment	Percentage of land that could potentially be abandoned under future water scarcity	13% (SQ) 2% 0%	13% (SQ) 8% 0%	5% (SQ) 3% 0%	9% (SQ) 5% 0%
Payment amount	Percentage of increase of monthly water bills	0% (SQ) 3% 5% 8%	0% (SQ) 3% 5% 8%	0% (SQ) 3% 5% 8%	0% (SQ) 3% 5% 8%

Use of non-conventional water

This attribute accounts for NCW use in each one of the four LLs. The exact wording and description in each LLs differed slightly according to the current situation and main challenge. In Spain and Italy, there we specific data regarding the percentage of NCW use over total water use (which is denoted as SQ in Table 2). Based on existing information (literature, publications, ongoing and future projects) projections of future NCW availability were provided and thus formed the basis for two additional levels of this attribute. In Egypt and Algeria, partners provided information which involved possible increase in the availability of NCW in the future, therefore the two levels of this attribute accounted for possible increases in NCW availability. It was decided, after considering information provided by partners, that this attribute provided a satisfactory account also for the attributes “Availability of water for urban uses”, “Availability of water for irrigation” and “Risk of water scarcity”.

Crop diversity

This attribute was designed also to account for the initially suggested attribute “Traditional/Certified crops” (Table 1). Based on the results of Deliverable 3.2.1, future water scarcity can have an impact on the diversity of crops. This is especially relevant for crops which are traditional and represent important sources of income. On the other hand, less crop diversity or monocultures could have adverse impacts on landscapes and cultural heritage apart from local economies. For example, fig cultivation in Egypt is important for local populations, including also the sales of dried figs in regional markets, while in Val d’ Orcia local grape varieties are the basis for PGI wines. The baseline (SQ) for each country was, therefore, the future loss or reduction of at least one traditional crop which would lead to less crop diversity, based on the results of D3.2.1. A second level was added corresponding to the continuation of the existing crop diversity. It was preferred to explain these two levels in a qualitative way (as shown in Table 2) to make it easier for respondents to understand the difference.

Types of non-conventional water

In each one of the four participating countries (at the LL scale) there is a main NCW that is under consideration by AGWAMED. This was set as the baseline (Status Quo, SQ) in each LL as indicated in Table 2. In each country the management scenario involved the inclusion of an additional NCW to enrich current NCW availability and to secure the availability of water under future challenges. The second NCW was chosen based on information from each LL and it was avoided to suggest NCW which were not applicable (eg water desalinization would not be applicable in Val d’ Orcia) or for which there were significant barriers (eg it was reported that in Egypt wastewater reuse was not accepted by the public).

Land in risk of abandonment

Based on the results of Deliverable 3.2.1, it was documented that under future scenarios of water scarcity, there is danger that irrigation water availability will be reduced. This is relevant especially for crops with high demands in irrigation. The optimization process of D3.2.1 showed that as water becomes scarcer, it is more economically rational to use it to irrigate crops with high economic profitability as a priority. Under this situation, however, there is the possibility that the water will only be enough to cover the irrigation needs of only a part of farmland. This attribute describes this future possible situation. In each country, the existing situation accounts for a maximum percentage of land actually cultivated that could be abandoned in the future (denoted as SQ in Table 2), following a "worse-case" scenario of D3.2.1. Two additional levels were considered in each LL, the one of which corresponded to a "soft" scenario of D3.2.1 and the other was "0%" indicating that water scarcity would be fully counterbalanced by NCW (Table 2). In areas where previous estimates were available (especially in Algeria and Spain), results of T3.2 were fine-tuned based on these estimates.

Payment amount

Apart from the attributes describing the use and effects of NCE, the attribute "Payment amount" which refers to the amount that respondents will have to pay as an increase in their monthly water bills to support an NCW scenario. It was preferred to use percentage increases as possible payments in all countries rather than actual amounts to enable WTP comparisons across countries. Also the same percentages were considered in each country (0% (SQ), 3%, 5%, 8%).

2.2. Elaboration of choice sets – Experimental design

Based on alternatives and levels in Table 2, the full factorial was designed and included 144 combinations in total (3X2X2X3X4 = 144). The full factorial was reduced to a main effects experimental design using the Orthogonal Design procedure in SPSS v.24. The main effects included 16 combinations (alternatives) in total. The 16 alternatives were combined in pairs and with the addition of an opt-out (status-quo) alternative (Table 2), 8 choice sets were yielded. Each respondent was presented with the eight choice sets one after the other and was asked to choose between Alternatives A and B – which entailed some type of management – (indicated as Choice 1 and Choice 2 in each Choice Set) or the Alternative C ('opt-out', indicated as Choice 3) and thus to continue the existing situation. An example of the choice set is presented in Table 3.

Table 3. Choice set sample

Attributes	Choice 1	Choice 2	Choice 3
Percentage of NCW use	64%	64%	42%
Number of significant crops	Citrus, Olives, Vegetables	Citrus, Olives, Less vegetables	Citrus, olives, less vegetables
NCW types	Desalinization **Low** wastewater reuse	Desalinization Wastewater reuse	Desalinization **Low** wastewater reuse
Land in risk of abandonment	0%	5%	9%
Increase in your monthly water bill	5%	3%	0

2.3. Questionnaire design

In CEs the survey vehicle is a carefully designed questionnaire which follows specific and strict standards. The CE survey questionnaire, for this survey includes two parts, although the common recommendation in literature is two include three parts (Mitchell and Carson,1989; Arrow et al., 1993; Boxall et al., 1996). Indeed, the usual approach is that in the first part respondents are asked general questions to detect their attitudes for the issue of the survey of for relevant issues. In the second part, the payment scenario is presented, followed by the choice sets. In the third part, sociodemographic characteristics are recorded.

For this application, it was decided to merge parts 1 and 3 and to place this merged part after the main valuation exercise (Part 2). This was deemed as the preferred option because more time would be needed to explain to respondents what NCW and the existing situation in each case study area is. This was particularly important for respondents in Northern Africa, as it was expected that people would require more time to understand the nature of the survey, because they are generally less used to participating to such questionnaire surveys.

Therefore, in the final version of the questionnaire, which was used for the survey in all four countries, in the first part respondents were presented with general information about the project and then with information about what is NCW (Box 1).

Box 1

Research and Innovation activities are ongoing globally and in the Mediterranean to counterbalance issues of water scarcity. In the last years, Non-conventional waters (NCW) have been gaining increasing attention.

Non-conventional waters (NCW) are defined as supplementary water resources that need specialized processes to be used as water supply.

These processes can be either new technologies or the continuation or (re)discovery of existing traditional practices in all parts of the Mediterranean. NCW mainly include

- Wastewater reuse (including recycling and purification) through the use of several technologies. This water can be used for several purposes and activities according to legislation standards.
- Runoff water (such as rainwater) harvesting, by means of which rain water is stored in natural or constructed reservoirs, dykes, cisterns and can be used later.
- Desalination of saline water from the sea by means of specialized technologies and use for many economic activities including irrigation of crops.

The use of NCW can

- Reduce the pressure on water reserves and the risk of land abandonment
- Increase the availability of water for households
- Support the livelihoods of farmers under water scarcity
- Ensure agricultural production, including typical products

After the initial information, a description of the current situation in the respective Living Lab was provided. The aim was to explain the agricultural activities in the LL as well as the challenges regarding water scarcity. Then the role of NCW and the respective methods for valorization actually in force were presented. Potential plans for the future were also explained. Box 2 presents an example of the description of the Spanish LL. The Appendix includes all four versions of the questionnaires, where the interested reader can see the exact quotations.

Box 2

In Campo d Cartajena, agricultural production is highly systemized and specialized on key irrigated products including citrus fruit, olives and vegetables. Many of these products are sold throughout the country and support the food security of the country or are exported and contribute to the livelihoods of numerous families working in primary production or agribusiness.

In Campo de Cartajena crop irrigation is ensured mainly through desalinization of saline water. There are extended facilities in the area that desalinize water and then channel it for irrigation and for other uses (e.g. industry, household use). This way, risks are reduced and local production is secured, as the last few years rainfall is scarcer and more irregular, while production is totally subject to the availability of water as freshwater reserves are running down (water transfer from Tajo-Segura Aqueduct). Therefore, farmers are more insecure because they find it difficult to plan their annual cropping activities and could either put pressure on water reserves or reduce water availability for other uses, including household use. Under this situation, local agencies are planning to invest on the expansion of desalinization facilities or to find new sources of water.

After the general description of the LL, the five attributes were presented in a clear and concise way, avoiding to provide too much information which would cause

confusion. Descriptions provided basic information about current state and the future possible levels if a management option was implemented. Box 3 presents the description of the five attributes that was presented to respondents in Egypt.

Box 3

Future possible NCW scenarios could have impact on the following characteristics (attributes)

- **Use of non-conventional water.** Rainwater harvesting in cisterns and dykes is the most important source of irrigation in times of water scarcity. However, if the existing situation continues, lower rainfall will not be able to provide enough water for all crops. If proper investments are made, the availability of NCW will increase by 3% or 8% in the future.
- **Crop diversity.** If the current situation continues, there is danger that fig cultivation, which stand for a significant part of the local agriculture and livelihoods of families, will be reduced or will stop. This will mean losses of income and also an important problem for local economy.
- **Types of non-conventional water.** Actually rainwater harvesting is the main source of NCW. An additional solution that is being considered and developed is desalinization of saline water for several uses and returning it for irrigation, industry or household use. If desalinized water is used, more water will be available for irrigation and other uses.
- **Land in risk of abandonment.** If the existing situation continues, it will not be feasible to irrigate the whole agricultural area in the future in times of drought. This means that up to 13% of total land could be abandoned. If proper investments on NCW are made risk of abandonment will be lower and threatened area could be reduced to 8% or to zero (0%)
- **Payment amount.** You could support financially investments on NCW by paying an additional amount to your monthly water bills. This could be 3%, 5% or 8% higher. If no investments are made you will still pay what you normally pay.

The payment scenario involves a hypothetical increase in the monthly water bills that respondents pay. It was explained that this increase would go directly to a separate fund that would be used exclusively for such investments. By paying more the respondent would contribute to achieve better management of NCW.

An important feature of the design of the questionnaire was the inclusion of a “cheap-talk” part. This approach is increasingly used in CE studies and aims to reduce hypothetical bias. Indeed, it has been documented that respondents tend not to reveal their true preferences and to exaggerate their actual Willingness-to-Pay or their preferences regarding specific attributes because they will not be asked to actually take and action or pay the specific amount. With “cheap talk” respondents are informed that the payment is hypothetical, but they are urged to respond as if

they were to really pay the specific amount of money, as their sincerity os important for the research. The specific quotation used was as follows

"By choosing one of these Choices you accept to pay the indicated amount and thus contribute to the achievement of this scenario. Please keep in mind that when you make a choice you will not be asked to actually pay the amount indicated. However it is important for us that you respond as if you were going to pay this amount".

After the description of the payment scenario, respondents were presented with the choice sets. They were explained how they should read them and where to note their choice. They were specifically explained that Choice 1 and Choice would entail some kind of management – and thus an improvement – while in Choice 3 there was no management, only a continuation of the existing situation, and thus they would not have to pay an amount.

In the second part of the questionnaire, respondents were asked about their attitudes and personal characteristics. In the last question, they declared their level of agreement or disagreement to a set of items concerning their preferences with regards to environmental protection and water uses. Then they were asked about their demographic and personal characteristics. These questions are presented in Table 4.

Table 4. Questions regarding sociodemographic characteristics and perceptions

Variable name	Description	Measurement (scale)
Gender		1. Male 2. Female 3. Rather not say
Age		1. 18-34 2. 35-49 3. 50-65 4. +65
Household size	How many people live in your household (including yourself)?	Number of household members
Formal education	Highest level of formal education achieved	1. Primary school 2. Secondary school 3. Technical school 4. University degree
Area	Urbanization of the area that the person lives in	1. Urban 2. Semi-urban 3. Rural
Environmental Group	Are you a member of an environmental group?	1. Yes 2. No
Income	Which of the following best describes the economic position of your household?	1. My family and I live a comfortable life

		2. My family and I are comfortable but need to reconsider some major expenses 3. My family and I struggle when unexpected expenses come up 4. My family and I struggle to cover our everyday needs
Perceptions	• The government should pay for environmental investments • Water should be more expensive to discourage overuse • I am worried about climate change and extreme weather events • I prefer environmental-friendly products • I like to support financially common causes	Likert scale (3 = Agree; 2 = Neutral; 1 = Disagree)

2.4. Data processing - Quality control and finalization

The econometric analysis of CE data uses Random Utility Models (RUM) where utility (Uij) is distinguished in an observed (Vij) and an unobserved (εij) part. Based on RUM, in the probability distribution function of specific model specifications (2), the probability (Pij) that respondent i chooses alternative j over all other k alternatives in choice set B equals the utility derived from this alternative over the utility derived from all other alternatives. Observed (systematic) preference heterogeneity can be captured in respondents' social and economic characteristics, which enter the model as interaction terms. Random Parameters Logit (RPL) models (Revelt and Train, 1998) are based on these distributional and behavioural grounds, but in these, a separate linear utility function is introduced for each respondent and the estimated standard deviations for random coefficients account for unobserved heterogeneity. Hence, utility from choosing an alternative in a choice set is itself a random variable. The probability distribution function is (b2 and b3), where ηi is the random factor in the utility function.

$$P_{ij} = \frac{e^{\mu V_{ij}}}{\sum_{k=1}^{J} e^{\mu V_{ik}}} \forall j, k \in B \quad \text{(b2)}$$

$$P_{ij} = \frac{e^{Z_{ij}(\beta+\eta_i)}}{\sum_{k=1}^{J} e^{Z_{ik}(\beta+\eta_i)}} \forall j, k \in B \quad \text{(b3)}$$

In their simplest forms, RPL include only attributes as variables explaining the behaviour of respondents. However, it is also possible that other variables can enter the model, in order to explain public preferences in terms of personal attitudes,

sociodemographic or behavioural characteristics. RUM do not permit to include such variables directly, however it is possible to integrate them and assess their impact as interaction terms with attributes.

In CEs the experimental design allows for the estimation of the Marginal Willingness to Pay (MWTP), for marginal changes in the level of each attribute, which is the trade-off between income and a marginal change in the level of the attribute. In particular, for RPL models, MWTP is estimated for each attribute using logit estimates. The monetary value of the good or service under consideration is reflected in the compensating surplus (CS) (Hanemann,1984), using Formula (4) (Hanemann, 1989) where Vi0 and Vi1 are the utilities of individual i before (status-quo situation) and after the implementation of the proposed valuation scenario (i.e. the specific levels of attributes in a choice set) and β_payment is the coefficient of the monetary attribute, which stands for the marginal value of income.

For attributes with fixed coefficients in RPL models trade-offs are estimated by means of Formula (5) where 1. . . n are the coefficients of interaction terms S1. . .Sn which include the specific attribute. It is obvious that Formula (5) takes into account the observed part of preference heterogeneity. Usually, MWTP is estimated through a statistical method (δ technique), because MWTP thus calculated is a random variable itself, as the quotient of the utility function of the attribute and of the payment attribute, as can be seen in Formula 5. The WALD procedure in NLOGIT 6.0 provides a useful platform to derive such estimates in a straightforward way.

For attributes with randomized parameters, the method changes. Still Formulae 4 and 5 hold, however it is necessary that the standard deviation of the randomized coefficient needs to be included in the estimation process (Hensher et al., 2015). The technique of Hensher et al. (2015) uses the population moments to simulate the unknown distribution of MWTP. Then it is possible to estimate means, medians and standard deviations, depending on the distributional assumptions of the random coefficients. For this particular application, since the random coefficients follow a normal distribution, 250 random draws from a normal distribution n~(0,1) were taken and then used to make consequent calculations for each draw using Formula 5.

$$CS = \frac{\ln \sum_{i=1}^{I} e^{V_{i1}} - \ln \sum_{i=1}^{I} e^{V_{i0}}}{\beta_{\text{payment}}} \qquad (4)$$

$$MWTP = -\frac{\beta_{\text{attribute}} + \beta_1 S_1 + \ldots + \beta_n S_n}{\beta_{\text{payment}}} \qquad (5)$$

2.5. CE survey and data collection

The survey was carried out in the four countries online through the Qualtrics platform. The steps taken were as follows

1. Preliminary (pilot) interviews). Pilots were conducted using a common protocol. At first, the final version of the questionnaire was presented to ten persons in each country, who took the survey and were then asked to provide feedback regarding the feasibility of the scenarios and of the levels of the attributes. After small changes were incorporated in the questionnaire, a second pilot was run to 20 respondents. After receiving feedback, the final version of the questionnaire was delivered. It was estimated that the average respondent took about 5 minutes to respond and a restriction was put that did not allow respondents to finish the survey earlier, thus "forcing" them to allocate time to read all texts and thus make informed decisions
2. The target set for each country was to collect 400 finished interviews. Hensher et al. (2005) mention that – as a rule of thumb – the sampling strategy should foresee that each alternative should be chosen by at least 50 persons.
3. The main sampling criterion was gender (almost equal number of men and women in every country). No specific quotas were set regarding age and location.
4. Data were input in an MS Excel spreadsheet. Responses were analysed using Limdep v.11/NLOGIT 6.0.

3. Results

3.1. RPL models – Results of maximum Likelihood estimation

Tables 5a - d present the RPL models which were estimated for the datasets from Algeria, Egypt, Italy and Spain respectively. Various model specifications were tested for each dataset where the coefficients of one or more attributes were allowed to vary. The models presented here provided the best fit. Goodness-of-fit measures and details about the sample are presented under each Table.

Table 5a. RPL model for the sample from Algeria

Variables/Interaction terms	**Coefficient**	**Standard error**
Constant	0.02081	0.11161
Types of NCW	0.09104	0.08231
Percentage of NCW use	.05969**	0.0258
Number of crops	.53060***	0.09467
Land in risk of abandonment	-.06306***	0.01391
Payment amount	-.05250**	0.02426
St. Dev "Percentage"	*.18945****	*0.06059*
St. Dev "Crops"	*1.68510****	*0.45892*
St. Dev "Types"	*2.05459****	*0.49965*

** Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level*

McFadden R-square 0,0365; Log-Likelihood function -3429,47607; Draws 250 Halton; The coefficients of "Types", "Percentage" and "Crops" follow a normal distribution; Chi squared [7](P= .000) 260,05549; Observations 3240

Table 5b. RPL model for the sample from Egypt

Variables/Interaction terms	Coefficient	Standard error
Constant	0.16459*	0.09186
Types of NCW	0.12463**	0.06068
Percentage of NCW use	0.02784**	0.01257
Number of crops	0.15501***	0.05929
Land in risk of abandonment	-0.04534***	0.00812
Payment amount	-0.02731*	0.01504
St. Dev. "Types"	*1.09587****	*0.33996*
St. Dev. "Crops"	*0.69305**	*0.39722*

** Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level*
McFadden R-square 0,02912; Log-Likelihood function -3455,84052; Draws 250 Halton; The coefficients of "Crops" and "Types" follow a normal distribution; Chi squared [8](P= .000) 207,32659; Observations 3240

Table 5c. RPL model for the sample from Italy

Variables/Interaction terms	Coefficient	Standard error
Constant	0.17419*	0.09041
Types of NCW	0.11934*	0.06586
Percentage of NCW use	0.01489**	0.00622
Number of crops	0.04936	0.05088
Land in risk of abandonment	-0.10209***	0.01826
Payment amount	-0.08571***	0.0162
St. Dev. "Types"	*0.79426***	*0.36050*

** Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level*
McFadden R-square 0,1387; Log-Likelihood function -3510,12438; Draws 250 Halton; The coefficient of "Types" follows a normal distribution; Chi squared [7](P= .000) 98,75886; Observations 3240

Table 5d. RPL model for the sample from Spain

Variables/Interaction terms	Coefficient	Standard error
Constant	0.39524***	0.09024
Types of NCW	0.08006	0.06355
Percentage of NCW use	0.00793*	0.00412
Number of crops	0.08994*	0.05399
Land in risk of abandonment	-0.05819***	0.0109
Payment amount	-0.07995***	0.0172
St. Dev. "Types"	*1.12017****	*0.31437*

** Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level*
McFadden R-square 0,02329; Log-Likelihood function -3548,35248; Draws 250 Halton; The coefficient of and "Types" follows a normal distribution; Chi squared [7](P= .000) 164,94984; Observations 3223

The main observations regarding public preferences in all countries are presented below, grouped by attribute

- *Types of NCW*. The coefficients of "Types of NCW" were positive in all four models. However, only in two countries these coefficients were significant (Egypt and Italy), while in Spain and Algeria the coefficients were not significant and therefore no safe conclusions can be derived. In both these countries, however, the second option (floodwater retention and wastewater reuse respectively) are already implemented. Moreover, significant standard deviations were estimated in all four countries for the coefficient of this variable. This indicates the extent of diversity of the preferences of citizens regarding the use of NCW and – more important – to diversification towards more NCW sources.
- *Percentage of NCW use*. In all countries, the coefficient of this attribute is positive and significant (at the 5% or for 10% level). This indicates that the public would welcome an increase in the use and valorization of NCW. Heterogeneous preferences, however, were detected only in Algeria, where a significant standard deviation was estimated for this attribute.
- *Number of crops*. Crop diversity was also evaluated positively in all countries. Especially in the two southern Mediterranean countries the relevant coefficient was significant at the 1% level and in Spain it was significant at the 10% level. A non-significant positive coefficient was estimated for Italy. However, heterogeneous preferences were found in Algeria and Egypt.
- *Land in risk of abandonment.* For this attribute, no preference heterogeneity was reported in any of the four models. Coefficients were all positive and significant. These two findings illustrate the importance that the Mediterranean public places on land abandonment and its support on management and governance options that would reverse relevant risks.
- *Payment amount*. The sign of the coefficient of "Payment amount" is statistically significant and negative in all four models, which is an indication of internal validity of the model. Indeed, it is reasonably expected that respondents will have negative preferences regarding paying higher amounts. Also it should be noted that no unobserved preference heterogeneity was found in any of the four models for "Payment amount"

3.2. MWTP estimates

Based on the results of the RPL model, MWTP estimates are calculated for all attributes. Table 6 presents these results. The most important finding is that MWTP varies significantly across attributes, while specific findings are summarized below.

- MWTP for "Types of NCW" is positive on average in all four countries, ranging from 0,95% to 4,36% in Spain and Algeria respectively. However, in all countries the standard deviations are significantly larger than the average indicating that a part of the population does not endorse the introduction of more NCW.

- For “Percentage of NCW use”, significant positive MWTP estimates were derived for northern Mediterranean countries. MWTP for Italy was 0,17% and for Spain 0,1% for an increase in the percentage of water needs cover by NCW by 1%. Positive MWTP was also estimated for the dataset from Egypt but was not significant. On the other hand, in Algeria MWTP was also positive (1,12% increase in monthly water bill for a 1% increase of NCW use) but the significant standard deviation illustrates that a part of Algerian citizens do not support this increase.
- Regarding crop diversity, preferences are heterogeneous without clear trends. Although MWTP was positive in all countries, the relevant estimate for Italy was not significant, while for Algeria and Egypt standard deviations were quite large indicating a considerable preference heterogeneity. Only in Spain MWTP was positive and significant (1,12% increase in monthly water bills to support maintaining an additional crop).
- There is a significant negative MWTP for “Land in risk of abandonment” in all four countries. This indicates that the public would be willing to pay a monthly increment to their water bills ranging from 0,73% (Spain) to 1,66% (Egypt) to support governance options that would mitigate relevant risks by 1%.

Table 6. Mean Willingness to Pay (MWTP) estimates

	Algeria		**Egypt**		**Italy**		**Spain**	
	MWTP (%€)	Standard Error/ Standard deviation	MWTP (%€)	Standard Error/ Standard deviation	MWTP (%€)	Standard Error/ Standard deviation	MWTP (%€)	Standard Error/ Standard deviation
Types of NCW	1.539639	38.67551	4.364793	39.66374	1.346316	9.158312	0.951218	13.847
Percentage of NCW use	1.118911	3.566199	1.01955	0.721	0.17374**	0.08236	0.09914*	0.05625
Number of crops	9.946912	31.72025	5.550921	25.08414	0.57588	0.59475	1.12497*	0.68526
Land is risk of abandonment	-1.20116***	0.43224	-1.66065*	0.85339	-1.19112***	0.21695	-0.72971***	0.15616

- Highlighted cells denote MWTP estimates derived for variable coefficients which were estimated by means of the population moments. For these estimates standard deviations are reported instead of standard errors

4.Conclusions – Future steps

The results of the Choice Experiment demonstrate that Mediterranean societies have positive views of NCW, despite the fact that preferences are heterogeneous. The CE method has yielded important considerations which need to be taken into account in the design of policies and strategies for the valorization of NCW, particularly in terms of investment plans on specific NCW that will not only have positive environmental contributions but also societal approval. A common consideration is that land abandonment is an issue that the public is aware about and the only attribute for which there was not any unobserved preference heterogenetity. Therefore, this is an important issue to integrate when designing policies for water management. On the other hand, crop diversity, as a result of more NCW water availability, is evaluated positively by the public but preferences are heterogenous especially in the two southern Mediterranean countries. Similarly, preferences are highly heterogeneous in all four countries when it comes to diversifying towards more types of NCW. Although the CE design took into account cultural barriers and external issues relating to introducing multiple NCW, the CE results indicate that more NCW are not always a positive option for the public. However, more NCW use is an option that is welcomed by the public in nothern Mediterranean (Italy and Spain), while preferences in Algeria are heterogeneous.

5.References

Arrow, K., Solow, R., Portney, P., Leamer, E., Radner, R., Schuman, H., 1993.Contingent valuation methodology report, report of the NOAA panel oncontingent valuation. Fed. Regist. 58 (10), 4602–4614.

Boxall, P.C., Adamowicz, W.L., Swait, J., Williams, M., Louviere, J., 1996. Acomparison of stated preference methods for environmental valuation. Ecol.Econ. 18, 243–253.

Hanemann, W.M., 1984. Welfare evaluations in contingent valuation experimentswith discrete responses. Am. J. Agric. Econ. 66, 332–341.Hanemann, W.M., 1989. Welfare evaluations in contingent valuation experimentswith discrete response data: reply. Am. J. Agric. Econ. 71, 1057–1061.

Hensher, D.A., Rose, J.M and Greene, W.H. (2015). Applied choice analysis. Cambridge University Press, Second Edition.

Lancaster, K., 1966. A new approach to consumer theory. J. Political Economy 74(2), 132–157.

Louviere, J.J., Hensher, D., Swait, J., 2000. Stated Choice Methods: Analysis andApplications in Marketing, Transportation and Environmental Valuation.Cambridge University Press.

Mitchell, R.C., Carson, R.T., 1989. Using Surveys to Value Public Goods: TheContingent Valuation Method. John Hopkins University Press, Baltimore, USA.

Revelt, D., Train, K., 1998. Mixed logit with repeated choices: households' choice ofappliance efficiency level. Rev. Econ. Stat. 53, 647–657.

6. Appendix – Questionnaires

All versions of the questionnaire can be found here