Integration of preference heterogeneity into sustainable nature conservation: From practice to policy

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ABSTRACT

The aim of this work is to assess and understand the social drivers that determine the willingness to pay for sustainable management measures to preserve a Natura 2000 area. These social drivers of the support for nature conservation were then included in the design of economic instrument to support nature conservation. In a contingent valuation exercise, the local population in the Cabezo de la Jara and Rambla de Nogalte protected areas (SE Spain) stated their willingness to pay for sustainable management measures aimed at their conservation. Among the socio-demographics, environmental attitudes and experiential drivers, income and environmental commitment were found to be the only significant drivers in support of nature conservation, revealing preference heterogeneity. Economic instruments, specifically green taxes and user fees, are proposed, taking into account the sources of heterogeneity in order to ensure financial support for the measures and greater social acceptability. Hence, our research adds to the existing literature through the design of an economic instrument to support nature conservation, considering preference heterogeneity.

Keywords: Acceptability; Contingent valuation; Environmental management; Non-market valuation; Social drivers; Willingness to pay.

1. INTRODUCTION

Ecosystems, in general, and protected natural areas (PNAs), in particular, provide several different types of benefits to society. Ecosystem services, which encompass the contribution of ecosystems to well-being, represent the major benefits they provide. PNAs provide natural resources (raw materials, food or medicinal and genetic resources) and contribute to climate regulation, moderation of extreme events and pollination, as well as stimulating recreation, culture and art (Costanza et al., 2017). Hence, these contributions translate into economic (such as the opportunity to develop business activities), environmental (such as the contribution to biodiversity and soil maintenance) and social (the enjoyment of the aesthetic landscape and the inspiration for cultural development) benefits (Kettunen, 2013). However, all the benefits that PNAs provide are currently threatened by unsustainable uses and rapid degradation, mainly due to the effects of anthropic pressures, leading to biodiversity and habitat losses.

The sustainable management of environmental resources is, therefore, vital to mitigate negative pressures upon PNAs and ensure nature conservation. Sustainability is a multifunctional concept that links humans and ecosystems around the integration of economic, environmental and social dimensions. Thus, the formulation and implementation of sustainable management measures for nature conservation must meet present and future, local and global and human and environmental needs in order to consolidate socio-ecological integrity and intra- and inter-generational equity (Gibson, 2006). Hence, natural resource management needs to deal with the capacity for ecological regeneration of ecosystems, the protection and conservation of biodiversity and the inclusion of the socio-economic values it provides. Governance is, in this framework, key to the incorporation of all stakeholders in the process of policy design, which guarantees that the integrity and equity criteria are achieved in the long-term while satisfying the present preferences and needs of the local population (McCauley, 2008).

Recognition of the economic value of the ecosystem services that PNAs provide to society is central to the support of nature conservation. Valuation of the benefits that nature provides and its integration into the policy-making mechanism could be an effective mechanism to evidence the importance of sustainable nature conservation (Ives & Kendal, 2014). Marginal values can thereby act as indicators of the relative importance of the social demand for the benefits of nature conservation, providing also information about their actual (or perceived) scarcity (Balmford et al., 2002). In fact, most of the ecosystem services that PNAs provide take the form of public goods or externalities, and it is a challenge to assign economic values to them. Economic tools are required to translate the non-market attributes that define PNAs into values of their impacts on society in terms of well-being (De Groot et al., 2012). However, knowing the value that society places on environmental management plans is not enough to ensure this sustainability. We need to go a step forward and assess and understand the drivers which determine this social support. Only this will allow policy makers to define and implement new policies, and even modify current ones, to ensure their acceptability.

Among the non-market valuation techniques, stated preference methods, which are based on the establishment of hypothetical markets to simulate demand for non-marketed goods and services, have been widely employed to infer the preferences for sustainable management alternatives (Hanley & Czajkowski, 2019). These methods allow estimation of the willingness to pay (WTP) and so the value that society confers on nature conservation. Heterogeneity preference assessment is also an application used for the stated preference analysis. The economic value of nature conservation is commonly assumed to depend on the observed attributes of the environmental good or service to be valued, as well as the observed and unobserved characteristics of the individual that states the valuation (Villanueva et al., 2017). Hence, the value people attach to nature conservation can be determined by socio-demographics, the present or past relationship with the environmental good or service and, more deeply, social and psychological factors, such as motivations, attitudes or perceptions (Hassan, 2017; Faccioli et al., 2020). This assessment allows us to understand why people get different utility levels from similar environmental goods and services, and therefore to reveal the drivers that determine stronger preferences for them. Similarly, preferences for environmental management measures can also be disentangled, given the impact that they have on the provision levels of such goods and services, ultimately changing utility levels that people get from them.

Heterogeneity preference assessment has been widely studied in the literature from a practical perspective. Some studies have focused on how socio-demographics, such as age, gender, income or education level, determine the social demand and WTP for nature conservation and landscape improvements (Campbell, 2007; García-Llorente et al., 2012), while others added the relationships between individuals and the good or service to be valued as explanatory variables (Perni et al., 2011; Hoyos et al., 2012). The role of environmental attitudes in the explanation of differences in the WTP for ecosystem services provision and wildlife protection has also been assessed (Choi & Fielding, 2013; Grilli & Notaro, 2019; Faccioli et al., 2020). In addition, there are also works that have merged these three main sources of heterogeneity, such as Rodríguez-Entrena et al. (2014), Perni and Martínez-Paz (2017) and Alcon et al. (2019), showing the multidimensionality of non-market valuations.

Social support for nature conservation and restoration is needed before applying any public funded measure in order to ensure the long-term acceptability (Alcon et al., 2019). Knowledge and understanding of the drivers of social support for sustainable nature conservation allow better design of socially accepted policies. They allow to tackle the factors that really determine the social support for this kind of policy, and provide information on how to improve policy design and implementation in order to ensure acceptance by the local population (Fernandes et al., 2019). Policy making can then focus mainly on these drivers, providing more accurate and reliable values and, in the end, improving the acceptability of nature conservation measures. Therefore, this information can be used as a basis to develop economic instruments and incentives that accurately fit the social demand for nature conservation (Hassan, 2017).

Social acceptability of management measures to support nature conservation needs to be achieved in order to ensure their long-term success. The design of economic instruments, based on the *ex-ante* assessment of preference heterogeneity, serves to guide policy-makers in their commitment to implement those incentives that ensure their acceptability (Jones et al., 2012). In this way, public participation becomes the cornerstone on which environmental policy should be based, considering the preferences and needs of the local population (McCauley, 2008).

In this context, this work aims to assess the drivers that determine the social demand and WTP for sustainable management measures for nature conservation and proposes economic instruments for their financial support, to ensure their social acceptability. To do so, the Cabezo de la Jara and Rambla de Nogalte protected areas (SE Spain) were employed as a case study, in which different sustainable management measures were socially valued prior to their implementation. A contingent valuation method was applied to this assessment and the results were analysed by using Tobit models and a latent class approach.

The implementation of nature conservation measures requires the employment of financial resources to support not only their implementation, but also their operational and maintenance costs. In most countries, public budget is in charge for most of the funding (Emerton et al., 2006). However, there are other alternative funding resources, even complementary, that contribute to obtain financial resources for nature conservation, such as indirect taxes, user fees, entrance fees, licenses and permits, voluntary fees, etc. (Laarman & Gregersen, 1996; Spergel, 2001). In sum, these are fiscal- and market-based economic instruments, that seek to provide additional revenues for supporting PNAs. There is a wide range of work in the literature that seeks to establish different types of economic instruments to support the cost of nature conservation in different cases studies worldwide. Pigouvian indirect taxes represent the main fiscal policy applied to the nature conservation, where not only additional economic resources are obtained but also negative environmental externalities are persuaded to be cut (Rode et al., 2016). Carbon taxes are thereby the most representative example of such economic instrument (Pirard, 2012). Indirect taxes could be also merged with other economic instruments, as Bernard et al. (2009) suggested in the case study of Tapantí National Park (Costa Rica). These authors proposed a financing conservation scheme based on the ecosystem services provided by the national park. Therefore, water taxes paid by drinking water consumers should be used for maintaining water supply services. The conservation of recreation and tourism services was financed by tourism business through voluntary donations with contractual arrangements and by tourists through user fees, whilst the maintenance of biodiversity was suggested to be financed by industrial companies through voluntary donations. Similarly, Schirpke et al. (2020) suggested a payment for ecosystem services scheme based on revenues from businesses and regional government contributions, visitor fees and tourist taxes, to be implemented in 10 different Natura 2000 sites in Italy. On the other hand, Voltaire (2017) proposed and discussed different price systems for determining entrance fees in the Gulf of Morbihan (France), namely, the proposal was a unitary and a third degree price discrimination between students and non-students as entrance fees following the results of a contingent valuation exercise. And Shoji et al. (2021) assessed public preferences for pricing policy alternatives for supporting the management of protected areas in Japan using the best-worst scaling methodology. They revealed that compulsory collecting fees, such as entrance and user fees, licenses and permits, were the most desirable, despite the heterogeneity shown regarding voluntary fees for a social latent class. In addition, Miller et al. (2018) even assessed the consequences of fee increases in the national parks of the United States and found that their demand was quite inelastic, therefore, the fee increases were not expected to significantly affect the number of visitors. However, despite the wide development of market-based instruments in the literature, their design and definition are hardly-ever based on the heterogeneity of preferences. Besides, despite most of the referenced works deal with the contingent valuation method, the work presented here differs from previous ones by going a step forward and using the data from the contingent valuation as a primary source.

Hence, this work attempts to use the results from the contingent valuation to understand the factors that better explain the WTP for supporting the conservation management measures, and thereby using such information for defining economic instruments that better suit social preferences. The innovation resides therefore in the way how the results from contingent valuation are converted into policy recommendations for funding conservation management actions. This is expected to improve the acceptability of not only the management measures to be implemented in the PNA, but also the economic instruments applied to their supporting and funding. In this regard, social acceptability of environmental management depends on the socio-demographic characteristics, as well as on the attitudinal and the relationships between citizens and the PNA (Thomassin et al., 2010).

By using the information on the drivers that determine the economic value of supporting nature conservation, the contribution of this paper to the on-going literature is expected to be two-fold. First, from a practical point of view, the paper is expected to contribute to a better understanding of the social demand for sustainable nature conservation and to an explanation of the value people attach to multifunctional landscapes, like PNAs. Second, focusing on policy, the paper is expected to guide policy makers in their design and implementation of socially acceptable economic instruments for the financial support of nature conservation measures. An understanding of the drivers of the WTP for nature conservation, thereby enabling preference heterogeneity to be accounted for in policy design, is expected to guide policy decisions and to help to increase the acceptability of such kinds of measures.

2. MATERIAL AND METHODS

2.1. Case study description

The case study took place in the Cabezo de la Jara and Rambla de Nogalte protected areas (the PNA, hereafter), both located in the Region of Murcia (SE Spain), which occupy 1,377 ha and belong integrally to the Natura 2000 Network (Special Area of Conservation). The Cabezo de la Jara is a calcareous mountain with a maximum altitude of 1,247 m and is characterised by a landscape dominated by thickets and open plant communities of holm oak and Aleppo pine. The Rambla del Nogalte is a typical Mediterranean watercourse, with a temporary and torrential regime, characterised by a gentle slope and sections that can reach up to 70 m in width. Figure 1 shows the location of the case study. Grasslands cover 59% of the area, 22% is covered by forest, 9% by non-citrus fruit trees and 10% belongs to other uses. Twelve types of natural and semi-natural habitats included in Annex I of the Habitats Directive have been identified within the PNA, which represents 80% of the total area. Two of these are considered to be priority habitats, and two endemic plant species are present in this area. Within the fauna, 31 species have been classified, among which two -Eagle-owl and European Roller- belong to Annex I of the 79/409/CEE Directive and one -Greek tortoise- is included as vulnerable in Annex II of the 92/43/CEE Directive.

Figure 1. About here

The socio-economic activity in the area comprises mainly rain-fed almond cultivation and hunting, which also represent the major human pressures. Regarding public-use infrastructures, the PNA integrates a nature interpretation centre, a youth hostel and an astronomical observatory. The cultural heritage of this area includes the presence of ochre mines, not currently in use, and abundant chasms, with high potential for hiking and ecotourism.

The sustainable management measures to be applied in the PNA were selected through a review of the existing literature regarding similar experiences in other PNAs (Perni et al., 2012; Alcon et al., 2019; Martínez-Paz et al., 2019), as well as by direct interviews with agents involved in the management of the PNA. In total, 12 agents were interviewed, grouped accordingly in forestry agents (3), public managers (3), environmental researches (3) and members of the public and local population (3). The interviews were carried out following the in-depth interview method (Boyce & Neale, 2006) in June 2015. This qualitative method, which does not require a great sample size (Burchardt, 2013), is based on conducting intensive individual interviews with experts and stakeholders to explore their thoughts, experiences and expectations about a specific program. First, the respondents were asked about their views of the current and future situation of the PNA. Then, a discussion about the needs, issues and opportunities in the management of the PNA was followed, where the main areas of management actions for the PNA were determined. Finally, they were converted into specific recommendations and measures to be implemented in the PNA to strengthen its management. In sum, these sources of information revealed the current conservation status of the PNA, the main issues and challenges to address and, consequently, the potential management measures to be implemented.

Environmental matters required the greatest assessment. The periodic floods and illegal hunting were considered the main issues to deal with, followed by the high erosion rates due to agricultural activity and the excessive motor vehicle traffic that have led to deterioration of the flora and fauna. Therefore, the environmental management measures focused on the improvement in watercourse maintenance, the protection of biodiversity, reforestation and the promotion of agricultural practices that enhance soil conservation. Regarding the social status of the area, the agents pointed out the lack of paths to promote social activities, such as hiking and riding, as well as the need to create new recreation areas and to enhance the cultural heritage of the area. Finally, the economic activity of the PNA is currently low. To promote the development of the area, it was decided to boost the creation of new accommodation facilities, such as rural hostels or cottages, and the production and selling of typical local foodstuffs. Table 1 summarises the management measures to be implemented in the PNA, classified according to the area of sustainability they involve: environmental, social or economic.

Table 1. About here

2.2. Methodological framework

An understanding of the drivers that motivate the demand for nature conservation requires the application of multiple methodologies. The demand was primarily estimated using the contingent valuation (CV) method, which served to measure how much people are willing to pay for sustainable management measures for nature conservation. Preference heterogeneity was therefore disentangled by using Tobit models, which looked for the factors that best explain this WTP. The sources of preference heterogeneity could be many. Figure 2 summarises these sources, categorised in three groups. The first source of heterogeneity covers socio-demographic factors, such as gender, age, income and education level; the second group of factors includes attitudinal variables, mainly environmental commitments and attitudes; and the third category comprehends those factors that measure the degree of relationship between individuals and the environmental goods or services to be valued, mainly whether the respondents are actually users of these environmental goods. Finally, a latent class approach was followed, using the drivers of the demand for sustainable nature conservation. This allowed us to characterise in depth the individuals according to the significant drivers selected previously and the stated economic values for nature conservation.

Figure 2. About here

2.2.1. Contingent valuation method

The CV method is a stated preference method where the respondents declare their WTP for non-marketed goods or services in order to maximise their utility (Bateman et al., 2002). This method involves the use of surveys, in which the construction of hypothetical markets serves to estimate the social demand for goods, services or even benefits that are not currently traded. The stated monetary WTP indicates how changes in the provision level of environmental benefits impact on individual wellbeing and represents therefore the socio-economic value which supports their provision (Cook et al., 2018).

The reliability and credibility of the hypothetical markets are crucial to ensure the individuals declare their real preferences (Bishop & Boyle, 2019). The valuation scenario should therefore represent such a situation with a high degree of realism so that the respondents feel at ease, and it needs to be easily replicable in order to mitigate hypothetical bias. The respondents were asked if they would be willing to pay to support sustainable management measures for nature conservation in the Cabezo de la Jara and Rambla de Nogalte. The hypothesis tested here is, therefore, that the sustainable conservation of the case study area avoids its degradation and enhances its restoration, which is expected to be socially valued given the avoided costs from its degradation and the environmental and socio-economic benefits from its restoration.

The maximum amount that the respondents were willing to pay was elicited through a mixed-format CV. This approach combines the dichotomous elicitation format with an open-ended question (Perni et al., 2020). Therefore, the respondents were first asked whether or not they would be willing to pay to support sustainable measures for nature conservation; if they were, then they were asked to state their total WTP. Follow-up questions were used to disentangle the reasons why some respondents were not willing to pay, thereby allowing us to identify protesters. Protesters are those respondents who reject the hypothetical market and consequently do not state their WTP (Grammatikopoulou & Olsen, 2013; Barreiro-Hurle et al., 2018). In the main, they refuse to participate in the valuation scenario, considering that "public administration must be in charge of the conservation and management costs". Conversely, legitimate zeros are individuals who do not value the benefits under assessment (Brouwer et al., 2010). In our case study, these individuals stated that they "prefer to spend their taxes on other purposes", "do not think the PNA should be managed or conserved" or "are not interested in the environmental management and conservation".

The payment vehicle was a tax reallocation. This consisted of the reallocation of an amount from the annual household tax budget of every respondent to support the specific measures for nature conservation that were significant to them, meaning that money would be taken away from other areas of public expenditure, representing an opportunity cost (Rogers et al., 2020).

2.2.2. Tobit model

The identification, quantification and understanding of the drivers that motivate the WTP for sustainable nature conservation provide policy makers with meaningful knowledge to formulate socially acceptable policies. Given the quantitative characteristics of the WTP values from mixed-format CV, the traditional ordinary least squares methods may lead to inefficient estimators (Yoo et al., 2000). The Tobit model is therefore a more convenient tool to assess such censored data, providing a consistent and unbiased method when the dependent variable is non-negative (Tobin, 1958), which is the case of the WTP. Hence, a Tobit model was employed to assess the drivers that determine the maximum WTP for sustainable nature conservation. It was specified as follows:

$$WTP_i = \begin{cases} WTP_i^* & if\ WTP_i^* > 0 \\ 0 & if\ WTP_i^* \leq 0 \end{cases} \quad i = 1, 2, \ldots, n \tag{1}$$

$$WTP_i^* = \beta_0 + \beta_1 x_{1i} + \cdots + \beta_k x_{ki} + \varepsilon_i = \beta_0 + \beta X_i + \varepsilon_i, \quad \varepsilon_i \sim N(0, \sigma^2) \tag{2}$$

where WTP_i is the maximum WTP stated by individual i, WTP_i^* is the underlying latent dependent variable, β_0 is a constant, β are the estimated coefficients for the X_i drivers of the WTP, ε_i is the error term that is assumed to be normally distributed and n is the number of observations.

In the Tobit model, the estimation of the marginal effects is not as straightforward as expected. The estimated coefficients do not reflect the expected changes in the WTP due to increases in the drivers. So, the marginal effect of each driver x_k on the WTP was calculated as follows (McDonald & Moffitt, 1980):

$$\frac{\partial \mathrm{E}(WTP|X)}{\partial x_k} = \beta_k \Phi\left(\frac{\overline{X\prime}\beta}{\sigma}\right) \tag{3}$$

where $\Phi\left(\frac{\overline{X\prime}\beta}{\sigma}\right)$ is the underlying normal distribution evaluated at the mean value of the X_i drivers. It shows the overall effect of an x_k change on the WTP for sustainable nature conservation.

2.2.3. Latent class cluster analysis

Once the drivers of the social demand for nature conservation had been determined by using the Tobit model, these results were employed to develop a latent class cluster (LCC) analysis. This method was used to identify the existence of distinct groups of respondents based on the drivers, so providing an understanding of how the WTP is distributed across the sample (Alemu et al., 2021). The drivers were then used as different clusters to disentangle the classes that formed each one.

Following Vermunt & Magidson (2002), the LCC model for continuous indicator variables, which assumes non-correlated indicators within classes and no covariates, was estimated as follows:

$$f(y_i|\theta) = \sum_{r=1}^{R} \pi_r f_r(y_i|\theta_r) \qquad (4)$$

$$\pi_r = \frac{\exp(\delta_r)}{\sum_{r=1}^{R} \exp(\delta_r)}, \quad \delta_1 = 0 \; for \; normalization \qquad (5)$$

where y_i is a vector of observed indicator variables (*drivers*), θ is a vector of estimated parameters, R is the number of latent classes and π_r is the prior probability of belonging to latent class r, which is determined according the δ_r parameters. The distribution of y_i, given the model parameters θ, $f(y_i|\theta)$, is assumed to be a mixture of class-specific normal densities, $f_r(y_i|\theta_r)$.

The LCC model parameters were estimated through the maximum likelihood method. The optimal number of classes within each cluster was determined using the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). The LCC analysis was complemented by a post-hoc assessment of each latent class to explore the differences among classes in terms of preferences for the sustainable management measures for nature conservation.

2.3. Survey design and environmental commitment

The CV was administered through a survey, which required the implementation of a questionnaire. The questionnaire was structured in five blocks. The first covered the relationship between the respondents and the PNA, including the number of visits to the PNA and the type of activity carried out in it. The second block included five-point Likert scale statements to rate the current situation of the PNA, the perceived main problems for the area and, above all, the different management measures to be implemented. The CV was specifically included in the third block. Before the respondents stated their preferences, they were informed about the current status of the PNA, including the main pressures and environmental and socio-economic features that characterise the area. The proposed measures to be implemented were also described. Cheap talk and a budget reminder were employed to mitigate potential hypothetical bias (Loomis, 2014). The respondents were informed about the opportunity costs that their choices implied regarding social welfare. If public money is reallocated to the support for nature conservation, public funds for other sectors, such as education or health, will be reduced. Finally, a follow-up question was added to identify protesters among those respondents who were not willing to pay (Grammatikopoulou & Olsen, 2013; Barreiro-Hurle et al., 2018).

The fourth block comprehended the environmental commitment. This is a multifactorial concept comprised by three different environmental commitment indexes (ECIs): affective commitment (feelings towards environmental issues), verbal commitment (willingness to act in relation to these issues) and real commitment (actual actions taken to deal with these issues). The environmental indexes were constructed using the environmental attitude and knowledge scale proposed by Maloney et al. (1975). These ECIs were employed to measure individual attitudes to the environment. Hence, these attitudes were assumed to reflect the “intensity of positive or negative affect” about environmental topics (Cruz & Manata, 2020). According to the theory of reasoned action (Ajzen & Fishbein, 1980), attitudes form the basis on which to predict behavioural intentions, and so to predict behaviour. It is assumed, therefore, that higher values of the ECIs are related to better environmental attitudes, which predict pro-environmental behaviour in individuals who are willing to pay more for nature conservation (Faccioli et al., 2020). Each of the commitment indexes was composed of two statements, using a five-point Likert scale from 1 (totally disagree) to 5 (totally agree); this yielded indexes with values between 1 and 5, representing minimum and maximum commitment, respectively. Table 2 summarises the statements employed for each commitment index. The fifth block collected together the socio-demographic features of the respondents (age, gender, education, income…).

Table 2. About here

2.4. Sampling and data collection

The target population comprised the 85,270 households located in Valley of Guadalentín county (Region of Murcia, SE Spain), where the PNA is located. Data were collected in November 2015 through personal interviews, performed by trained numerators in public spaces, such as markets, health centres or parks, and following a random sampling. The final sample comprised 150 households, implying a sampling error, for a confidence level of 95%, of 4.8% for extreme proportions and 8% for intermediate proportions.

3. RESULTS

3.1. Sample characteristics

The respondents' characteristics are shown in Table 3. To ascertain the representativeness of the sample, these characteristics were compared with the population of the Region of Murcia by using T-tests and Pearson χ^2 tests. These showed that the sample was representative in terms of the gender, household income and education of the target population. The respondents had an average age of 44 years, and 44% of them were women. Annual household income was around 22,000 €, and almost half of the respondents had secondary studies. Workers were, however, over-represented.

Regarding the attitudinal characteristics, the respondents stated their environmental commitment by using a five-point Likert scale. The ECIs covered affective, verbal and real elements of the individuals' environmental attitudes. As expected, the ECIs decreased from the affective (4.67) to the verbal (3.63) and real (2.26) commitments, which shows the consistency of the responses. Finally, most of the respondents were recognised as users of the PNA (65%), since they had visited the area, at least once, in the last year.

Table 3. About here

3.2. The economic value of sustainable nature conservation

The CV results served to estimate the value that the respondents attached to sustainable nature management in the PNA. Before the estimation of the economic value, an analysis of the responses to the mixed format of the CV was developed in order to distinguish legitimate zero bidders from protest bidders. Among the 150 respondents, 113 showed a positive WTP, while 37 refused to pay, giving a positivity rate of 75%. In addition, among those who were not willing to pay, there were 26 protest bidders (17% of the sample), whilst 11 respondents (7%) were identified as legitimate zero bidders. On average, people were willing to reallocate 19.35 €/household/year from the taxes they pay to support the sustainable management of the PNA. Aggregation of this value over all households in the Valley of Guadalentín indicates that the benefits of conserving the PNA have a total economic value of 1.65 M€, annually. In addition, these WTP values can be disaggregated into use and non-use values, considering that non-users are willing to pay only for non-use and users are willing to pay for both use and non-use values (Martínez-Paz et al., 2019). Hence, the use value, obtained as the difference between users' and non-users' WTP, amounts 3.53 €/household/year, which provides a total economic value of 199.05 K€ when aggregated for all the users. This represents just 20% of the non-use value, which is 17.02 €/household/year and amounts 1.45 M€ for both users and non-users of the case study area. These values illustrate the significance of non-use values for the overall conservation of the PNA, in line with the importance of environmental management measures to enhance such kind of benefits.

Table 4. About here

The total WTP to support the sustainable management of the PNA was decomposed into the WTP for the different measures that integrate the management action plan. This allowed us to determine not only which measures are demanded more by society and should be the first to be implemented, but also the amount of public money that should be allocated to each of them. The valuation of the environmental, social and economic measures was carried out in the survey by using a ten-point Likert scale. The results from this valuation allowed us to establish the relative importance of each measure and, therefore, the associated economic value. Table 5 shows the importance and WTP for each measure. The greatest WTP values are associated with those measures related to the prevention of floods and the reduction of their negative effects - such as the design and implementation of a hydrological plan for watercourses, improvement of their maintenance and cleaning and reforestation. The second group of most-demanded measures are related to environmental concerns about flora and fauna conservation, followed by the development of social programmes to enhance mines and chasms and economic incentives to create new accommodation facilities.

Table 5. About here

3.3. Key drivers of economic value

The heterogeneity of the social demand for sustainable nature conservation allowed us to identify the drivers that determine the economic value that the respondents attached to the support of sustainable management. Socio-demographic characteristics, environmental attitudes and the relationship with the PNA were the drivers tested. A pooled model (Model 1) including all variables was estimated, in addition to a restricted model containing those variables that were significant at the 90% level (Model 2). Both models are shown in Table 6. Although a likelihood ratio (LR) test concluded that the two models were the same (LR = 2.78; $\chi^2_{12;0.05}$ = 21.06), the AIC and BIC criteria showed that Model 2 performed better than Model 1. Therefore, Model 2 was used for further assessment.

Table 6. About here

Regarding the socio-demographic variables, only annual household income was found to be significant with regard to determining the economic value that people attach to sustainable nature management. The positive sign of the income coefficient shows that the higher the income, the greater the likelihood of being willing to pay higher economic contributions. The WTP was found to rise, on average, by $2.52 \cdot 10^{-4}$ for each one-euro increase in income. However, other socio-demographic variables, such as gender, age, education level or occupation, cannot be used to explain differences in the WTP among individuals. To some extent, this makes sense since the WTP depended closely on the household income. These results also reveal that local population value the PNA irrespectively of most of their socio-demographic, thereby showing that these variables are not significant to implement differentiated policy actions.

Concerning the attitudinal variables, two of the three ECIs considered in the survey were significant with regard to explaining the WTP. In particular, the affective and real elements of the environmental commitment were relevant. The greater the environmental concern of the respondents, the greater their willingness to pay, as both coefficients show positive signs. ECI-Affective and ECI-Real refer to feelings and actual actions regarding environmental issues, respectively. Environmental attitudes are the basis to predict pro-environmental behaviour, and therefore, the results confirm that this behaviour is responsible for higher WTP values for nature conservation. Besides, the ECI-Affective was found to be far more sensitive to increments in the WTP than the ECI-Real, as their marginal effects show, revealing that feelings are stronger than actual actions to predict higher WTP values. Finally, the condition of being a user of the PNA did not contribute to the explanation of the economic value attached to its conservation. This is because no significant differences are expected between users' and non-users' values.

3.4. Latent class cluster results

The significant variables from the Tobit models results were employed to establish classes of individuals with similar preferences for nature conservation. Protesters were removed from the LCC analysis. Income and environmental commitment were employed as clusters to establish classes within them. The number of classes in each cluster was determined using the AIC and BIC criteria, which showed that 2 classes for income and 4 classes for environmental commitment existed among the respondents.

The results from the LCC models are presented in Table 7. Regarding the income cluster, class 1 comprehends 72% of the respondents (those of low and middle income, with an average annual income of 16,900 €), while class 2 includes 28% of the respondents, those with the highest annual income, averaging around 36,000 €. In the environmental commitment cluster, the respondents were grouped in 4 classes, in ascending order according to their affective and real environmental commitment. Hence, class 1 encompasses 17% of the respondents; those with the lowest value for ECI-Affective and also a relatively low value for ECI-Real. This first class includes the respondents least concerned about nature conservation. Class 2, the largest class, comprises 41% of the respondents, those with high affective environmental commitment, but the lowest real commitment. This is quite representative of many ordinary citizens, who state that they are really concerned about nature conservation but actually do not do anything about it. Class 3 includes those respondents (29%) with high affective commitment but moderate real commitment. Finally, class 4 is the group with the highest environmental commitment, showing the highest values for ECI-Affective and ECI-Real. However, this class represents only 13% of the respondents.

Table 7. About here

As expected from the Tobit and LCC models, the WTP for sustainable nature conservation depends closely on the class within the cluster of income or environmental commitment. Table 8 shows the WTP in every class of each cluster, and the significance of the differences among the classes. The higher the annual income, the higher the WTP. Hence, regarding the cluster of income, the WTP in class 2 is much higher than in class 1, with a difference of around 8 €/year. Similarly, the WTP values in the classes of the cluster of environmental commitment are related to this commitment. The differences in WTP reach almost 18 €/year in this case. For the protest bidder rate, no significant differences were found among the classes of either cluster.

Table 8. About here

The importance and value associated with each management measure were also estimated according to the classes and clusters, as shown in Table 9. This allowed us to confirm the heterogeneity in preferences, not only for the WTP, as has been revealed before, but also for the preferred measures to be implemented. Regarding the cluster of income, no significant differences were found between the classes in terms of the individual valuations of each measure by the respondents. However, within the cluster of environmental commitment, significant differences were found in the valuation the respondents attached to each measure, and their relative importance. Differences were found to exist among classes in terms of the measure valued most highly within each group, this being reforestation (class 3), implementation of a hydrological restoration plan for watercourses (classes 1 and 2) or improvement of watercourse maintenance and cleaning (class 4). It is also of note that class 3 barely values the creation of protection programmes for flora and fauna and supports, relatively more, the promotion of agricultural practices that prevent soil erosion, whilst the opposite is true for the rest of the classes. It is also noteworthy that the least important measure for class 1 is the development of programmes to enhance the chasms, an action that is well-valued by the rest of the classes. The heterogeneity in preferences is also notable regarding the measure to improve the conservation status of the public use infrastructures; this is the most valued social measure for class 1, whilst it is the least valued for class 2. Finally, it is also worth pointing out that class 4, which encompasses those individuals most committed to the environment, shows equal values among the measures.

Table 9. About here

3.5. Design of economic instruments

Determination of the extent to which people value and support nature conservation is key to the success of public and political actions in relation to the management of natural resources. In addition, understanding how this value is distributed across the population and how preferences depend on socio-demographic, attitudinal and relational individual variables (sources of heterogeneity) provides a vital insight into the social demand for nature conservation. However, the discovery of the drivers of the valuation of nature conservation is not enough if the policy implications are not discussed. In other words, how can the results shown here help public managers and decision-makers to improve sustainable nature conservation?

The broad range of economic instruments to support nature conservation covers user fees and charges, payments for ecosystem services, taxes, subsides, environmental schemes, certifications, etc. In a broad sense, the economic instruments used in environmental management can be classified into those that relate to the supply side of environmental benefits and costs, and those that focus on the demand side, which besides provide financial resources for supporting nature management actions. The former usually encompass with the *steward principle* (benefits) and the *polluter pays principle* (costs), rewarding those who provide environmental benefits or penalizing them in line with the costs provided, respectively. They include payment for ecosystem services, insurance schemes, subsides, tradeable quotas and rights, auctions and tenders, certification and eco-labelling, among others. Whilst, the economic instruments for the demand side are based on the *beneficiary pays principle* (benefits/costs), assuming that beneficiaries are willing to contribute in line with the benefits they receive and the costs they avoid (Rode et al., 2016). User fees, taxes, and usage rights, are example of economic instruments based on the *beneficiary pays principle*. Hence, the results from the contingent valuation exercise, which asks individuals (*beneficiaries*) how much they are willing to pay for the environmental benefits, and avoided costs, from the implementation of management measures, are directly related to those kind of economic instruments. In this context, two different instruments are proposed, assuming, in addition, that there are no significant differences between the aggregate WTP values estimated from tax reallocation and other payment vehicles, as Morrison and MacDonald (2011) and Rogers et al. (2020) showed. The first is a green tax, directly related to household income. Secondly, a user fee is also proposed, which covers, to some extent, the environmental commitment driver.

The green tax can be defined as a direct income tax, and this revenue will be used to support sustainable nature conservation. As defined in the valuation scenario, it does not involve an increase in the total amount of taxes paid, but a reallocation from the current direct income taxes. The rate at which this could be applied to income was calculated from the marginal effects estimated with the Tobit model (Model 2). In addition, similar to general income tax, different bands of tax rates could be applied to different income levels. The distribution of household income in the classes within the cluster of income was taken as a basis to construct the income bands. Specifically, the median and the 99^{th} percentile of the income distribution within each class were used. Table 10 shows the proposed tax rates and the maximum amount of green tax that the households in each income band would pay.

Table 10. About here

The second economic instrument we propose to support nature conservation is a user fee applicable to those who enter the PNA to visit the ochre mines or the chasms, or to go hiking along the paths located within it. It is assumed that the greater the pro-environmental behaviour of individuals, the greater their environmental commitment and, therefore, they are willing to pay more. Similar to the green tax proposal, a possible user fee was estimated from the Tobit model (Model 2) results, combining the marginal effects of environmental commitment with the results of the LCC analysis. Hence, the latent classes estimated from the cluster of environmental commitment were used to establish the range of user fees to propose. Table 11 shows the proposed user fees, estimated per household and person, which could range from about 2 €/person/visit to 3.5 €/person/visit. Assuming that most of the respondents tend to visit the PNA between 1 and 4 times a year, the expected annual contribution would range from 2 €/person/year to 14 €/person/year.

Table 11. About here

Since there is a range of possible user fees to be applied, the LCC results regarding the perceived importance and value of the different measures for each class could also be applied to policy design. Hence, the lowest user fee could be applied to the social activities demanded most by class 1 of the cluster of environmental commitment (i.e., just visiting the PNA and using the public use infrastructures), while visiting the ochre mines could be the social activity with the highest fee, since it is the one demanded most by class 4, which also shows the highest WTP.

In addition, third degree price discrimination is not recommended to be applied in the design of both green taxes and user fees using as discriminatory variables age, household size and occupation. Therefore, widely implemented price discrimination at user fees based on age (young and elderly people pay less), household size (large families pay less), or occupation (students and retirees pay less) are not recommended here based on the results. Notwithstanding, given that income was the only socio-demographic characteristic found significant to explain WTP, taxes or fees discrimination could be implemented using as discriminatory variable household income, which means that, for instance, low-income households pay less. Indeed, this is what is proposed by the green tax, with increasing tax rates once income increases.

The implementation of such economic instruments is expected to provide, on average, financial income of approximately 446 K€/year in the case of green tax and around 796 K€/year as user fees. It can be seen that the sum of these two sources of financial support for nature conservation is less than the total economic value of the PNA, which raises 1.65 M€/year. This is due to the fact that the two economic instruments do not provide a perfect discrimination that ensures the capture of all the consumer surplus of each individual. Notwithstanding, the financial income obtained in this way is enough to support the budgeted conservation costs of the PNA, around 400 K€/year (CARM, 2021). Indeed, the green tax income alone would be enough to support the expected annual conservation costs. Table 12 summarises the results from the financial assessment expected from implementing both instruments and the economic assessment, namely cost-benefit analysis, distinguishing between use and non-use values as sources of socio-economic and environmental benefits. The annual equivalent cost (AEC) and annual equivalent benefit (AEB) were employed to account for the economic and financial costs and benefits of the measures to be implemented. AEC applies similarly to both economic and financial assessments given that only financial costs were considered for its estimation. AEB for the economic assessment includes the non-market benefits from the contingent valuation exercise, whilst AEB for the financial assessment includes the expected income from green tax and user fees, estimated using the information about the distribution of local population regarding their household income and classes of cluster of environmental commitment. A period of six years and a discount rate of 3.5% were employed (Almansa & Martínez-Paz, 2011). The values were aggregated for the case study area, considering 85,720 households. Finally, regarding the results of the economic assessment, it is revealed that benefits from use values are not enough to compensate the conservation costs of the PNA. This highlights the importance of including use and non-use values of environmental benefits in the policy design agenda to fully overcome the conservation costs.

Table 12. About here

4. DISCUSSION

The support of nature conservation by the local population is key to the long-term sustainability of PNAs. The outcomes of a CV exercise in the PNA of the Cabezo de la Jara and Rambla de Nogalte (SE Spain) show that the vast majority of respondents are willing to pay to support the implementation of sustainable management measures. Environmental measures (52%) are the most demanded actions, followed by economic (33%) and social (15%) ones. Hence, the local population recognises the importance of the resulting environmental benefits for their own well-being and, thus, the need to improve the management and conservation of the PNA. Reinforcement of the maintenance and ecological status of watercourses should be the main priority for the managers of the natural space. The local population, directly affected by floods in recent years, recognises the importance of implementing such measures for their well-being. Second, but not least, biodiversity conservation is also a cornerstone of the sustainable management of the Cabezo de la Jara. The provision of ecosystem services by natural areas is closely related to the biodiversity, and this was well-recognised by the respondents (Harrison et al., 2014). In addition, biodiversity can contribute to human well-being not only through ecosystem services, but also by improving human health, by providing psychological and cognitive benefits, reducing chronic allergies and inflammatory diseases or even mitigating the transmission of infectious diseases (Sandifer et al., 2015). The importance that the local population attaches to biodiversity conservation has been widely evidenced in the literature. For instance, Alcon et al. (2019) showed that biodiversity conservation was the main measure to be implemented for the sustainable management of El Valle and Carrascoy Natural Park, a PNA close to our case study, and Zabala et al. (2021) revealed that biodiversity promotion was the main ecosystem service valued in semi-arid western Mediterranean agroecosystems.

Our results will contribute to better sustainable management of the PNA in the long term. To ensure the long-term sustainability of the PNA, environmental measures alone are not enough; economic and social actions also need to be implemented. The social demand for economic measures, to support the creation of new accommodation facilities and the promotion of local foodstuffs, and for social actions, such as enhancement of the tourism potential of the ochre mines and chasms, has been highlighted. The local population, therefore, considers that sustainable ecotourism is a way to better combine the maintenance of the environmental and cultural heritage with the economic development of the region (Blangy & Mehta, 2006).

The assessment of the social preferences for the support of sustainable nature conservation revealed the heterogeneity in the local demand and, therefore, in the drivers that determine the WTP for this support. Income and environmental commitment were found to be the only drivers that explain the WTP, which means that only one socio-demographic factor plus the environmental attitudes are relevant in the explanation of the social support for nature conservation. The rest of the factors are not significant. This statement has several implications for the value people attach to the environment, in a broad sense, but mainly when it refers to a specific PNA. When the focus is just on the local population, place identity may play a leading role in determining the support for protection of the local environment. If people self-identify themselves as comfortable with a specific environment, they are expected to be more willing to support its conservation - in most cases, independently of their socio-demographics (Rollero & De Piccoli, 2010; Facciolli et al., 2020). Consequently, divergence of WTP values would be a result of differences in only people´s income, which evidently determines their capacity to be willing to pay, and environmental attitudes, which condition their support for environmental actions.

A straightforward relationship between income and value has been shown. By definition, the WTP is income that an individual is willing to reallocate from their private use to the support of environmental goods or services (Tyllianakis & Skuras, 2016). Hence, it is easy to think that the higher their income, the higher the WTP that individuals will state. However, in the literature, there are examples that argue for and against this statement. In fact, Jacobsen & Hanley (2009) showed that only 40% of the 145 works they reviewed really revealed income effects in the assessment of the WTP for biodiversity conservation. In addition, and in areas close to our case study, Perni et al. (2011) revealed that income influenced significantly the WTP to reach a good ecological status of a coastal lagoon in SE Spain; and Alcon et al. (2012) showed that only those individuals with higher income levels were willing to pay more to reclaim wastewater for environmental purposes, while there were no differences among the lowest income levels. However, Alcon et al. (2019) stated that income was not significant with regard to explaining the WTP for the sustainable management of another PNA in SE Spain.

Environmental commitment has been shown to be the main driver determining whether the local population is willing to pay. Pro-environmental behaviour may provide positive impacts on health and well-being (Netuveli & Watts, 2020), and the motivation of pro-environmental behaviour could lead to support for nature conservation actions (Hassan, 2017). Our outcomes support the results of Choi & Fielding (2013) and Bartczak (2015), among others, who showed that pro-environmental attitudes have positive effects on the WTP; thereby, higher environmental commitment will provide a higher WTP. Similarly, Alcon et al. (2019) revealed that positive environmental commitment was also related to a higher marginal utility of money to support nature conservation. However, there are mixed feelings about this topic in the literature. Cooper et al. (2004) showed that the relationship between environmental behaviour and the WTP depends on the nature of the goods, it being stronger when it involves public goods with non-use values. In addition, Hassan (2017) found that this relationship may not always be linear, since it depends on how people perceive human-nature connections.

Economic incentives and financial mechanisms should be developed to ensure the public financial support of nature conservation (Rode et al., 2016). The outcomes of the CV and preference heterogeneity analyses have provided insights into how people would act in a real situation. They have revealed that people are willing to pay to support nature conservation and that this willingness depends on their income and their pro-environmental behaviour. Hence, this information is very useful for the design of economic instruments that have enough incentives to be socially acceptable. Social preferences become, in this way, the focus in the design of economic instruments to support nature conservation, which is expected to enhance the *crowding in effects*[1] to engage the public (Rode et al., 2015). If the design of economic instruments is based on social preferences, then it would become easier to engage people to support nature conservation, even in the long-term.

This strategy ultimately exploits preference heterogeneity to ask different social groups for different levels of financial support for nature conservation. Price discrimination emerges, therefore, as an inevitable consequence that will guide policy making (Emang et al., 2016). The concept of discrimination, first conceived by Pigou (1920), seeks to capture the maximum consumer surplus of each consumer of a certain product, by establishing the maximum individual's WTP for each product consumed (first-degree price, or perfect, discrimination), establishing different prices for different quantities/qualities of a certain product (second-degree price discrimination) or identifying different prices for different groups of consumers defined according to objective variables (third-degree price discrimination). However, it might be challenging to apply price discrimination in policy design since most environmental goods and services are public goods, and it requires exclusion to be feasible (Lee, 1977). Most of the examples found in the literature refer to third-degree price discrimination, focusing on differences in entrance fees between local and foreign visitors (Alpízar, 2006; Emang et al., 2016) and on the effects of differential pricing of user fees at national parks (Chase et al., 1998). Notwithstanding, the user fees proposed here are an example of second-degree price discrimination. This discrimination is applied when decision makers do know how the WTP is distributed across consumers; that is, they know the fee they should collect from each class of consumer, but they cannot distinguish each type of consumer in an objective way at the time the

[1] *Crowding in effects* refer to the use of economic incentives to reinforce people's intrinsic motivations to support biodiversity and nature conservation (Rode et al., 2015).

consumer buys the product. This shows an information failure due to the presence of asymmetric information; that is, to some extent, what we show in our case study. The existence of some latent classes, defined by individuals' environmental commitment, is known to decision makers. However, they cannot know, *a priori*, the class to which each individual belongs and so they can establish different user fees for different activities according to the demand of each class, as estimated from the stated preferences. Hence, the proposed economic instruments should capture the maximum consumer surplus available if the social acceptability of such instruments is ensured.

Progressive direct green taxes not only generate revenues to funding nature management actions, but also promotes equality (Drupp et al., 2018). By implementing direct green taxes, individuals' contributions -and the amount of such contributions- to nature conservation depends directly on their household income, therefore each individual is expected to contribute what he/she can afford. The public good characteristics of most of the benefits provided by PNAs implies that the contributions to operational and maintenance costs should be supported by both users and non-users. Tax systems serve therefore to capture the value of nature conservation for both users and non-users (Voltaire, 2017). In contrast, user fees apply to the private good characteristics of the PNAs, highlighting the need to support the costs related to their use. Therefore, user fees could have a discriminatory effect on low-income households, which falls against the social function of PNAs (Dustin et al., 2000).

The establishment of user fees for activities that were free before may arouse concerns about the presence of substitution effects (Loomis & Keske, 2009). The local population, who are used to enjoying the PNA landscape for free, may reduce their visits to the PNA due to the user fee, and substitute them with visits to another PNA. However, the design of the user fees can be adapted to mitigate the possible substitution effects. Since there is a range of possible user fees to be applied, the LCC results could also be applied to policy design. Hence, the lowest user fee could be applied to the social activities demanded most by class 1 of the cluster of environmental commitment (i.e., visiting the PNA and using the public use infrastructures), while visiting the ochre mines could be the social activity with the highest fee, since it is the one demanded most by class 4, which also shows the highest WTP. Therefore, the fact that the proposed economic instruments were designed using the *ex-ante* WTP assessment and considering preference heterogeneity is expected to mitigate these effects, since the individuals stated they were willing to pay to support nature conservation in the PNA. Social acceptability emerges, therefore, as the key to ensure the long-term success of the proposed economic instruments.

In addition, the establishment of economic tools to ensure the financial support for nature conservation needs to avoid the presence of incentives for free-rider behaviour. Green taxes, based on household income in a progressive way, could be considered as an instrument to dissuade free-riders since they are strictly related to an observed variable and should be paid by the whole local population. Similarly, the proposed user fees are based on the *user pays principle*, by which those who directly benefit from the services and goods provided by PNAs are asked to contribute to the cost of their conservation (Rode et al., 2016; Emang et al., 2016). Finally, the results also outline that increased support for nature conservation is possible if the environmental commitment rises. The merging of arts and science in communication activities could achieve more pro-environmental behaviour across society (Opermanis et al., 2015).

5. CONCLUSION

The economic valuation of the benefits that PNAs provide may not be enough to ensure their conservation. It is also necessary to understand how these benefits are distributed across society and to identify the social drivers that underpin the support for nature conservation. Stated preference methods serve, therefore, to estimate the social demand for nature conservation and the value people attach to it. Preference heterogeneity in the social demand for sustainable nature conservation measures in a PNA in SE Spain reveals that income and environmental commitment are the main drivers in this area. Hence, greater household income and higher environmental commitment are related to a higher WTP for nature conservation.

Beyond identifying the significant social drivers of nature conservation, the results will guide policy makers in the design of socially acceptable environmental policies to support nature conservation. Economic instruments, such as green direct taxes and user fees, have been formulated using preference heterogeneity results and should guide policy design. It is expected that these economic instruments will aid the financial support of the implementation of sustainable management measures that enjoy public acceptability. This research is expected to contribute to the understanding of the social demand for sustainable nature conservation and to the inclusion of preference heterogeneity in the design of economic instruments to help policy making.

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Table 1. Sustainable management measures for nature conservation in the PNA

Sustainability	Management measures
Environmental	To support reforestation
	To design and implement a hydrological restoration plan for watercourses
	To improve the watercourse maintenance and cleaning
	To create protection actions/programmes for the flora
	To promote agricultural practices that mitigate soil erosion
	To create protection actions/programmes for the fauna
Social	To develop programmes to boost the ochre mines
	To develop programmes to promote use of the chasms
	To regulate the motor sport activities
	To improve the sign posts of paths
	To improve the conservation status of the public use infrastructures
	To create new recreation areas
	To improve the accesses to the Cabezo de la Jara
Economic	To support the creation of new accommodation facilities
	To support the production and selling of typical local foodstuffs

Table 2. Statements used to form each environmental commitment index (ECI)

ECI	Statement
ECI-Affective	I get indignant when I think about the damage caused to plants and animal life by pollution.
	I would like to encourage ecotourism or nature tourism
ECI-Verbal	I would stop buying products from companies that pollute the environment
	I would be willing to participate in voluntary activities and environmental education
ECI-Real	I was informed of the environmental proposals of the party I voted for in the last elections
	I have recently participated in an environmental activity (educational workshop, planting a tree,...)

Table 3. Descriptive statistics of the sample

Variable	Sample	Region of Murcia	Representativeness
Socio-demographic			T-test (p-value)
Gender (% women)	44.00	49.89[1]	-1.45 (0.15)
Age (years)	44.05	47.14[1]	-3.62 (0.00)
Income (K€/household/year)	22.21	21.53[2]	0.80 (0.43)
Household size (people)	3.13	2.73[3]	3.89 (0.00)
Education level (%)			Pearson χ^2 (p-value)
No education	2.67	3.70[4]	0.58 (0.90)
Primary	24.00	22.40[4]	
Secondary	48.00	51.70[4]	
Higher	25.33	22.20[4]	
Occupation (%)			
Unemployed	7.38	16.12[4]	18.77 (0.00)
Retired	4.70	14.61[4]	
Student	2.01	7.76[4]	
Homemaker	9.40	12.12[4]	
Worker	76.51	49.38[4]	
Attitudinal			
ECI-Affective	4.67		
ECI-Verbal	3.63		
ECI-Real	2.26		
Relationship with the PNA			
User (%)	65.33		

Source: [1] INE (2020a); [2] INE (2020b); [3] INE (2020c); [4] INE (2020d).

Table 4. Descriptive statistics of the WTP (€/household/year)

	n	Mean	Median	Min.	Max.	Std. dev.
User’s WTP	82	20.55	17.50	0.00	100.00	14.97
Non-user’s WTP	42	17.02	15.00	0.00	120.00	19.66
Total WTP	124	19.35	15.00	0.00	120.00	16.71

Table 5. Valuation of sustainable management measures for nature conservation in the PNA

Sustainability	Management measures	Importance (%)[1]	WTP (€/year)
Environmental	To support reforestation	14.85	2.87
	To design and implement a hydrological restoration plan for watercourses	14.51	2.81
	To improve the watercourse maintenance and cleaning	14.14	2.74
	To create protection actions/programmes for flora	7.16	1.39
	To promote agricultural practices that mitigate soil erosion	7.02	1.36
	To create protection actions/programmes for fauna	6.94	1.34
Social	To develop programmes to boost the ochre mines	5.92	1.15
	To develop programmes to promote use of the chasms	4.56	0.88
	To regulate the motor sport activities	4.53	0.88
	To improve the sign posts of paths	3.98	0.77
	To improve the conservation status of the public use infrastructures	2.34	0.45
	To create new recreation areas	0.53	0.10
	To improve the accesses to the Cabezo de la Jara	0.00	0.00
Economic	To support the creation of new accommodation facilities	7.88	1.52
	To support the production and selling of typical local foodstuffs	5.64	1.09

[1] The importance was obtained by rank normalization from individual ten-point Likert scale valuations

Table 6. Results from the Tobit models

	Model 1 Tobit model (pooled)			Model 2 Tobit model (restricted)				
	Coef.	Std. Err.		Coef.	Std. Err.		Marginal effects	Std. Err.
Constant	-49.87	20.06	***	-40.45	14.59	***		
Socio-demographic								
Gender	-3.05	3.52						
Age	0.13	0.18						
Income	0.30	0.18	*	0.30	0.14	**	0.25	0.12
Household size	-0.97	1.48						
Education[1]								
Primary	4.57	9.65						
Secondary	5.01	9.73						
Higher	5.43	10.31						
Occupation[2]								
Retired	-3.20	10.00						
Student	8.32	13.78						
Homemaker	2.18	7.89						
Worker	0.39	6.47						
Attitudinal								
ECI-Affective	10.50	3.52	***	9.93	3.08	***	8.42	2.55
ECI-Verbal	-0.29	1.63						
ECI-Real	2.21	1.34	*	2.47	1.21	**	2.09	1.02
Relationship with the PNA								
User	2.51	3.36						
Number of observations	124			124				
Uncensored	113			113				
Log-likelihood	-486.25			-487.64				
AIC	1,006.49			985.28				
BIC	1,054.44			999.38				

Statistically significant at a level of *0.1, **0.05 or ***0.01.

[1] Base level: No education.

[2] Base level: Unemployed

Table 7. LCC models

	Class 1			Class 2			Class 3			Class 4		
	Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.	
Cluster of income												
Mean												
Income	16.90	0.71	***	36.09	1.29	***						
Class allocation												
Prob. (%)	71.80	4.40		28.20	4.40							
Constant				-0.93	0.22	***						
Cluster of environmental commitment												
Mean												
ECI-Affective	3.72	0.06	***	4.88	0.04	***	4.89	0.05	***	4.94	0.06	***
ECI-Real	1.83	0.12	***	1.28	0.10	***	2.96	0.15	***	4.59	0.17	***
Class allocation												
Prob. (%)	16.88	3.41		40.63	5.29		28.93	4.98		13.56	3.60	
Constant				0.88	0.27	***	0.54	0.29	**	-0.22	0.36	

Statistically significant at a level of ***0.01.

Table 8. Value according to the clusters and classes

	Sample	Class 1	Class 2	Class 3	Class 4	p-value[1]
Cluster of income						
Protests (%)	17.33	19.64	10.53			0.20
Mean WTP (€)	19.35	17.06	25.44			0.01
Cluster of environmental commitment						
Protests (%)	17.33	22.22	18.46	20.00	0.00	0.16
Mean WTP (€)[2]	19.35	10.71a	18.21ab	22.03b	28.06b	0.01

[1] p-value refers to the Pearson χ^2 test for *protests* and to ANOVA for *WTP*.

[2] Different letters show significant differences among classes at 95%.

Table 9. Valuation of sustainable management measures according to the clusters and classes

		Cluster of income				*Cluster of environmental commitment*							
		Class 1		Class 2		Class 1		Class 2		Class 3		Class 4	
	Management measures	Importance (%)[1]	WTP (€/year)	Importance (%)[1]	WTP (€/year)	Importance (%)[1]	WTP (€/year)	Importance (%)[1]	WTP (€/year)	Importance (%)[1]	WTP (€/year)	Importance (%)[1]	WTP (€/year)
Environmental	To support reforestation	15.30	2.61	13.06	3.32	15.90	1.70	12.91	2.35	16.47	3.63	9.88	2.77
	To design and implement a hydrological restoration plan for watercourses	14.52	2.48	13.76	3.50	16.49	1.77	15.51	2.82	12.10	2.67	9.06	2.54
	To improve the watercourse maintenance and cleaning	14.32	2.44	13.06	3.32	15.70	1.68	14.64	2.67	11.10	2.44	10.71	3.00
	To create protection actions/programmes for flora	7.75	1.32	5.83	1.48	6.28	0.67	8.39	1.53	3.86	0.85	9.06	2.54
	To promote agricultural practices that mitigate soil erosion	7.02	1.20	7.00	1.78	5.10	0.55	4.29	0.78	9.78	2.15	9.61	2.70
	To create protection actions/programmes for fauna	7.33	1.25	6.06	1.54	8.25	0.88	8.22	1.50	1.54	0.34	9.61	2.70
Social	To develop programmes to boost the ochre mines	6.01	1.02	5.83	1.48	4.08	0.44	6.66	1.21	4.96	1.09	7.40	2.08
	To develop programmes to enhance the use of the chasms	5.13	0.88	3.50	0.89	0.00	0.00	4.75	0.86	7.33	1.62	5.49	1.54
	To regulate the motor sport activities	4.25	0.73	5.36	1.36	2.45	0.26	4.52	0.82	5.40	1.19	6.31	1.77
	To improve the sign posts of paths	3.31	0.56	5.71	1.45	5.30	0.57	1.29	0.23	6.95	1.53	5.49	1.54
	To improve the conservation status of the public use infrastructures	1.14	0.20	5.16	1.31	9.64	1.03	0.00	0.00	2.59	0.57	4.20	1.18
	To create new recreation areas	0.00	0.00	2.36	0.60	2.36	0.25	3.22	0.59	0.00	0.00	0.00	0.00
	To improve the accesses to the Cabezo de la Jara	0.31	0.05	0.00	0.00	0.41	0.04	1.07	0.19	1.29	0.28	1.10	0.31
Economic	To support the creation of new accommodation facilities	7.39	1.26	8.86	2.25	5.30	0.57	8.39	1.53	10.29	2.27	5.22	1.46
	To support the production and selling of typical local foodstuffs	6.23	1.06	4.43	1.13	2.75	0.29	6.14	1.12	6.33	1.39	6.86	1.93

[1] The importance was obtained by rank normalization from individual ten-point Likert scale valuations

Table 10. Proposal of green taxes to support nature conservation

Cluster of income		Income band (K€/household/year)	Marginal effect	Tax rate (%)	Green tax (€/household/year)
Class 1	50th percentile	Up to 12.600	0.22 **	0.022	2.81
	99th percentile	12.601 to 22.400	0.24 **	0.024	5.17
Class 2	50th percentile	22.401 to 35.000	0.25 **	0.025	8.36
	99th percentile	35.001 to 56.000	0.27 **	0.027	13.94
		Over 56.001	0.28 **	0.028	

Statistically significant at a level of **0.05.

Table 11. Proposal of user fees to support nature conservation

Cluster of environmental commitment	ECI-Affective	Marginal effect	ECI-Real	Marginal effect	User fee (€/household)	User fee (€/person)
Class 1	3.72	5.21 ***	1.83	1.30 *	6.50	2.08
Class 2	4.88	7.46 ***	1.28	1.86 **	9.31	2.98
Class 3	4.89	8.20 ***	2.96	2.04 **	10.23	3.27
Class 4	4.94	8.81 ***	4.59	2.19 *	11.00	3.51

Statistically significant at a level of *0.1, **0.05 or ***0.01.

Table 12. Economic and financial benefits from implementing sustainable nature conservation measures (€/year)

	AEB[1]	AEC[2]	B/C ratio[3]
Economic assessment			
Use value	199,050	403,866	0.49
Non-use value	1,451,295		3.59
Financial assessment			
Green tax	446,052	403,866	1.10
User fees	795,654		1.97

Note: AEC and AEB estimated for a 6-year period (T) and using a social discount rate (i) of 3.50%, considering 85,270 households.

[1] AEC: Annual Equivalent Cost. $AEC = NPC \frac{i}{1-(1+i)^{-T}}$, where $NPC = \sum_{t=1}^{T} \frac{Cost_t}{(1+i)^t}$ with NPC: Net Present Costs, and costs obtained from CARM (2021).

[2] AEB: Annual Equivalent Benefit. $AEB = NPB \frac{i}{1-(1+i)^{-T}}$, where $NPB = \sum_{t=1}^{T} \frac{Benefits_t}{(1+i)^t} \times \frac{H}{A}$ with NPB: Net Present Benefits, and benefits are obtained from use and non-use values (economic benefits) and income from green taxes and user fees (financial benefits).

[3] $B/_{C}\, ratio = \frac{AEB}{AEC}$

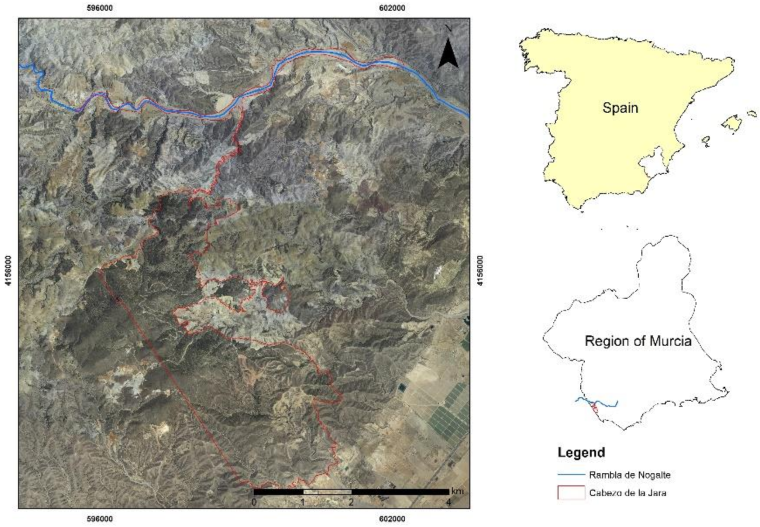

Figure 1. Case study

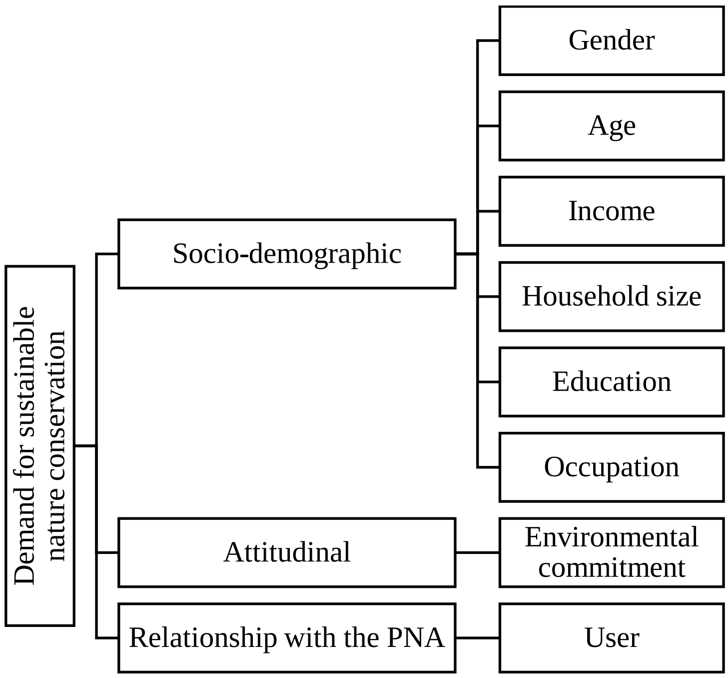

Figure 2. Factors influencing the demand for sustainable nature conservation