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Society's preferences when ecological values and health risks are at stake: An application to the population control of a flagship ungulate (Iberian ibex) in Sierra de Guadarrama national park, Spain

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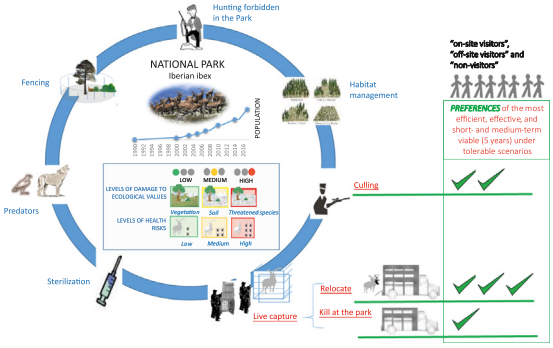
HIGHLIGHTS

- Visitors and residents of the area state that the ibex must be managed in the park.
- No ibex management produces a loss of well-being higher than the park's annual budget.
- If the ibex management plan is not successful, how it is done becomes more important.
- Live capture and culling are accepted if the results of the program are effective.
- The definition of the status quo has no major effects on preferences.

GRAPHICAL ABSTRACT



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ABSTRACT

Conflicts derived from the proactive management of ecosystems and wildlife populations abound in national parks, which can prevent the control of some animal populations, consequently causing negative effects to the ecological values and creating health risks for the ecosystems. This work quantifies a conflict related to population control of the Iberian ibex in the Sierra de Guadarrama National Park in Spain where ecological values and health risks are at stake. A discrete choice experiment was conducted of three population samples: 430 on-site visitors, 210 off-site visitors and 210 non-visitors, and two levels of *status quo* information were considered. The results show that not conducting any ibex management program in the park causes a loss of social well-being and that the design of the management program is shown to be relevant for obtaining greater or lesser acceptance by the surveyed population. In general, better ecological and health levels, as well as avoiding having to kill animals in the park, increase a program's acceptance. Management measures are also shown to take on greater importance to the extent that the results in the health and ecological indicators are worse. Finally, in aggregate terms, additional information about the status quo did not generate major differences in the estimates of a change of well-being.

1. Introduction

Within a context of global change, guaranteeing the conservation of ecosystems not only requires knowing the scientific bases of a biological,

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ecological, and technical nature of the ecosystems to be conserved, but also knowing those of an economic and social nature (Mace, 2014). Those social and economic aspects can be ever-changing (Wallach et al., 2018) yet can also contribute to achieving the objectives established in a management program.

Regarding national parks, which are the greatest icon of protection and conservation of an ecosystem, the objectives faced by managers are determined by regulatory normative (a regional example: Spanish National Parks Act 30/2014, of 3 December) and budget limitations. Despite the fact that management is multi-objective (Watson et al., 2014), the main purpose is to assure conservation of the values according to which such areas are designated as national parks (Dudley, 2008), which means – today more than ever – maintaining the health of the ecosystems ("One health" context, Zinsstag et al., 2011). To achieve the conservation objectives, it is sometimes necessary to proactively manage some of the resources (Demarais et al., 2012; van Beeck Calkoen et al., 2020), either because the landscape to be conserved originates from anthropogenic interaction over centuries (San Miguel et al., 2010); because the territories to be conserved are so small that they are not fully functioning ecological units (for example, the appearance of invasive species in the majority of European parks, McKinney, 2002); or because there are still many uncertainties about the consequences of the unrestricted evolution of natural processes in ecosystems historically managed by human beings. However, proactive management in national parks hints at a potential conflict between various social stakeholders (such as the use of water in Doñana National Park, Fernández-Ayuso et al., 2018). Such conflict is accentuated when management measures that involve the use of firearms and/or sacrificing animals are posed (Hampton et al., 2019; Martínez-Jauregui et al., 2020).

The literature shows how an over-abundance of some animal species could be harmful to the ecosystems of national parks (Demarais et al., 2012), consequently affecting others species, affecting the functioning of the ecosystems (Côté et al., 2004), and leading to the proliferation of diseases (Gortázar et al., 2007). In these cases, to protect ecosystems from the damages caused by wildlife, particularly ungulates, their populations and the damage they cause need to be addressed (Sinclair, 1998). A specific example of the consequences of active management of ungulate populations in national parks is reflected in the 2016 decision of the Superior Court of Justice of Madrid (Spain), in an appeal filed by the Animalist Party Against the Mistreatment of Animals (Partido Animalista Contra el Maltrato Animal, PACMA). The decision cancelled the Iberian ibex (*Capra pyrenaica* SCHINZ) Management Plan in the Sierra de Guadarrama National Park, a plan that had been approved that very year. That decision meant that the removal of 2700 animals had to cease until a new plan could be drafted (still not approved in mid-2020). Since then, the ibex population in the national park (with no animals removed) has continued to increase, although at a slower rate, due to the fact that the population is most likely self-regulating (Refoyo et al., 2016). However, currently there is sufficient evidence that shows that the size of the Iberian ibex population in this national park is already causing significant damage to the vegetation, consequently leading to natural regeneration problems for some species (Perea et al., 2015); causing considerable damage related to soil erosion in the park's higher elevations (García-Rodríguez, 2018); and even causing harm to threatened species (Perea et al., 2014; Velamazán et al., 2017), which could mean the disappearance of those species from the national park. Moreover, there is a history of a proliferation of sarcoptic mange in ibexes in other natural areas of Spain, which could also infect humans (Pérez et al., 2002). In these cases, managers not only need to know the various arguments and opinions of society regarding the management objectives and alternatives (Fix et al., 2010; Teel and Manfredo, 2010; Nugent et al., 2011; Nelson et al., 2016), they also need to know how to quantify those opinions and frame them within a context that is technically possible and efficient, given the available resources.

Therefore, this research analyses the conflict between active management of the Iberian ibex and conservation of the Sierra de Guadarrama National Park. The focus is on the visitors and on the residents of the national park's area of influence, who are the people that could be most affected by a new management plan for the Iberian ibex. Furthermore, in this national park's particular case, it is very close to a large city (Madrid, with over three million inhabitants), which leads to a large number of urban visitors whose lifestyles tend to be far removed from the management of rural territories (Dandy et al., 2011).

To analyze this conflict, 430 visitors to the Sierra de Guadarrama National Park were interviewed using an in-person survey ("on-site" visitors), and residents of the area of influence (provinces of Madrid and Segovia) were interviewed using an online survey (210 "off-site" visitors and 210 non-visitors during the last year). Every surveyed individual completed a discrete choice experiment (DCE), which allows quantifying the preferences of citizens regarding the ecological and management scenarios of the national park, and it allows estimating the change of well-being associated with various management scenarios. The analysis of the results also allows analyzing behavior differences between the main users of the national park (visitors) in two different contexts (when they are interviewed either at the park or outside the park), in addition to comparing their preferences with those of other citizens who have not visited the national park within the last year. Moreover, transversally, we will analyze how being more or less informed about the consequences of conducting a management program for the Iberian ibex in this national park could affect the decisions of individuals (Domínguez-Torreiro and Soliño, 2011; Glenk, 2011; Marsh et al., 2010). This latter information could be relevant with respect to designing programs to inform citizens about the Iberian ibex management plan carried out by the national park.

2. Materials and methods

2.1. Background on the study site

The Sierra de Guadarrama National Park extends over 33,960 ha and is located less than 50 km from the large city of Madrid. It was declared a national park in 2013 due to its characteristic cultural, natural, and scenic values, which represent the natural systems of Mediterranean high mountains.

The Iberian ibex is mixed feeder (browser and grazer) endemic species of the Iberian Peninsula which is wildly distributed in the mountains regions (Acevedo and Cassinello, 2009). Currently there is sufficient evidence that shows that a natural expansion of the species is taking place (Acevedo and Cassinello, 2009). The Iberian ibex (Acevedo and Cassinello, 2009; Alados and Escós, 2017), absent from the Sierra de Guadarrama over the last century, was introduced in 1990 with 67 specimens, and since then the species has become emblematic of the national park. Due to the lack of predators, the extensive availability of food resources, the low hunting pressure, and the high reproduction rate of the species, the number of specimens currently exceeds 5000 individuals (Refoyo et al., 2015, 2016, 2019). Therefore, despite the fact that the ibex is an essential element in this ecosystem (Jones et al., 1994), its current population size represents a serious ecological problem, considering that the animals are causing harm to not only the ecological values of the ecosystem but also to the species itself, which was clearly shown after comprehensive monitoring of the park was conducted (García-Rodríguez, 2018; Perea and Refoyo, 2019). The main damages attributed to the excessive concentration of ibexes in the national park are the following:

- Damage to vegetation: some shrub and tree species (30 species) are eaten or trampled by the Iberian ibex, with high browsing indexes that are incompatible with flowering and fructification (Perea and Refoyo, 2019).

- Damage to the soil: the intense passage of ibexes along some paths, above all in high elevation areas of the park, is causing soil erosion, thereby exposing the roots of plants to the air and causing the land to be unstable (García-Rodríguez, 2018).
- The risk that threatened and special-interest species will disappear: there are some species of trees and shrubs whose conservation is priority (for example: *Amelanchier ovalis, Ilex aquifolium, Sorbus aucuparia, Taxus baccata, Veronica fruticans* subsp. *cantabrica, Silene boryi*, and *Saxifraga pentadactylis* subsp. *willkommiana*), given that they could be affected by ibex over-browsing in the national park (Perea et al., 2015; Velamazán et al., 2017).
- The risk of a proliferation of diseases: not only could certain diseases affect the Iberian ibex, such as outbreaks of sarcoptic mange that have occurred in other places (Granados et al., 2001), they can also cause problems to other wild and domestic animals, and even to human beings (Gortázar et al., 2006; Perea and Refoyo, 2019).

Currently, because of the aforementioned effects, park managers must act – according to the guidelines that define the national park – whenever they find themselves facing two situations: 1) when there is damage to the ecological values and 2) when there are health risks. Therefore, a short- and medium-term (5 years) ibex management program urgently needs to be designed. Defining an overabundant population and the intolerable damages of a species is no simple task, most likely depending on the context of the territory and its management objectives (Mysterud, 2006). In our case, as an intolerable management scenario we have defined one that involves the disappearance of threatened species from the Park and the high risk of transmission of parasites and diseases to humans.

There are a variety of management alternatives at the park's disposal for containing damages: the installation of fences and the protection of certain plant species, favoring populations of local predators, trapping and relocating Iberian ibex specimens to another natural environment (trap and relocate), live capture of specimens for subsequent sacrifice in the park (trap and kill at the park), culling, favoring natural dispersion through habitat management, sterilization, promoting recreational hunting permits of this species in the surrounding areas of the national park, etc. However, not all of these measures are equally viable, efficient, and effective over a 5-year time horizon. Therefore, technicians place more emphasis on measures that allow decreasing the population size to a level such that damages to the ecological values are prevented and a high health risk is avoided. Even though there is uncertainty about the results (Massei et al., 2010; Walter et al., 2011; Simard et al., 2013), technicians place more emphasis on measures such as trap and relocate, culling, and trap and kill at the park. Other management alternatives that directly reduce the population of ibexes have been considered to be more uncertain and controversial. For example, promoting or re-introducing predators would not seem to be sufficient for containing the high population of ibexes, above all when there are also other, more accessible species as food for predators (Nilsen et al., 2007; Ripple and Beschta, 2012; Ritchie et al., 2012). Likewise, the sterilization of individuals also is not being considered, given the financial and animal handling efforts that this would involve (Boulanger et al., 2012), nor is habitat management to facilitate ibex migration, which, in addition to requiring longer time for territory management, does not assure the necessary results over the next 5 years (Alerstam et al., 2003; Berg et al., 2019).

2.2. Choice experiments

Discrete choice experiments (Louviere et al., 2000) are a stated preference method that allows identifying and giving a hierarchical structure to the determinant attributes in the assessment of individuals, as well as obtaining estimates of the change of well-being (measured by the willingness to pay) due to marginal changes in each one of the attributes. Moreover, this method allows us to estimate the total economic value of different ecological and management scenarios that are defined based on a combination of changes in the levels of the assessed attributes. In this study, every individual was presented with 6 cards that have 4 management programs for the Iberian ibex in the Sierra de Guadarrama National Park.

On each card, a choice is made to indicate the preferred scenario. Among the four programs of each card, the *status quo* (SQ) scenario was always presented. The SQ can be presented in different forms, for example as a non-specified or "opt-out" alternative (SQ-optout) such as "no-choice" or "none of the above"; as a provided profile of current or future levels (SQ-provided); or as incorporating self-perception in the design of the SQ alternative (SQ-perceived). We set up two experimental designs, one considering a set of choice cards in which the status quo was not made explicit (SQ-optout), and another in which it was made explicit, thereby considering the future effects of not implementing any program (SQ-provided). Both experimental designs were generated using Ngene 1.1.1® software under D-efficiency criteria and a pivot design for the SQ-provided approach.

Each experimental design was given on 6 choice cards (a total of 12 cards), and we decided to follow a blocking strategy and present each individual with six cards: the first three with SQ-optout and the last 3 with SQ-provided. Each individual randomly faced one of the blocks. In this case, we did not resort to split sample strategies (Domínguez-Torreiro and Soliño, 2011), given that we were interested in learning the individual effect of the additional information about the status quo on the preferences of each individual.

Likewise, each one of the scenarios was formed by different levels of the selected attributes that are presented in Table 1. The monetary attribute is especially relevant because including it allows us to both calculate the implicit prices and subsequently estimate the changes of well-being associated with different management scenarios. The payment vehicle deemed to be the most credible in this study case was a donation, given that the park is a public asset in which an entry fee cannot be charged under the current legislative framework. Therefore, a single and voluntary donation for executing an ibex management program in the national park was posed to the respondents. Prices similar to those that could represent three hypothetical entry fees were used. Likewise, the respondents were reminded that they could have budget restrictions and that making a donation means a reduction in their consumption of other consumer goods or services or in savings. The WTP for each level k of attribute j is estimated using the following formula (Lusk et al., 2003; Varela et al., 2014; Talpur et al., 2018):

$$MWTP_k^j = -\frac{\beta_k^j - \beta_{baselevel}^j}{\beta_{cost}} \quad (1)$$

where $\beta^j_{excluded\ level} = -\sum \beta^j_k$ and represents the estimated coefficient associated with the excluded level of attribute j.

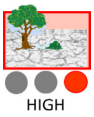
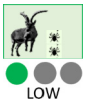
The econometric model used for the analysis – the random parameter logit model (Train, 2009) – is one of the most-used in literature (Sagebiel, 2017). In our econometric approach, we assume that the attributes and levels, except for the price and the specific alternative constant of the model, follow random parameters with a normal distribution. This model allows the coefficients to vary randomly among people. For an individual, i, their indirect utility function (V_i) can be represented as:

$$V_{ij} = \alpha_j + S_{ij}\overline{\beta} + S_{ij}\Psi_i + \varepsilon_{ij} \quad (2)$$

where α_j is an alternative specific constant (ASC) that takes the value 1 for change alternatives and the value 0 for the status quo; S_{ij} is the attribute vector; $\overline{\beta}$ is the vector of average preference values; Ψ_i represents the deviations in individual preferences with respect to the average values; and ε_{ij} is an *i.i.d.* type I extreme value random component.

This econometric approach was chosen for reasons of simplicity in the subsequent formulation of action scenarios, therefore avoiding more advanced models such as latent class models with inter- and

Table 1
Definition of the attributes and levels of the choice experiment.

Attributes	Levels	Description
Measures for controlling overabundance of the Iberian ibex. Various measures are contemplated at the national park, but the ibex management program will place more emphasis on one of the following measures due to being technically the most efficient in the short and medium term.	 *Culling*	**Culling**: park agents use firearms to take down an animal, and they subsequently transport the meat to be sold, to be left for scavengers, or to be incinerated.
	 *Trap and kill at the park*	**Trap and kill at the park**: box traps are installed at the park, which must be regularly monitored. When a specimen is trapped, the animal is sacrificed in the field, and the meat is subsequently transported to be sold, to be left for scavengers, or to be incinerated.
	 *Trap and relocate*	**Trap and relocate**: box traps are installed at the park, which must be regularly monitored. When a specimen is trapped, they are taken to an enclosed premises under quarantine. After the quarantine period, the live animals are transported and released in a private preserve, in a game preserve, or in another natural area.
Damage to ecological values: The concentration of ibexes in some locations increases the level of damage to ecological values and can affect the vegetation, the soil, and threatened species of the park (Perea et al., 2015; Velamazán et al., 2017; García-Rodríguez, 2018; Perea and Refoyo, 2019).	 LOW	**LOW**: Some plants are eaten or trampled by the Iberian ibex. This can make it difficult for new plants to grow.
	 MEDIUM	**MEDIUM**: In addition to the damage to plants, the quantity of ibexes can cause soil erosion, consequently exposing the roots of plants to the air and causing the land to be unstable.
	 HIGH	**HIGH**: In addition to the damage to plants and the soil, excessive damage in specific areas of the territory can affect threatened species whose conservation is a priority.
Health risks: the concentration of ibexes in some places increases the risk of transmission of parasites and diseases, which are harmful to not only the species itself (the Iberian ibex) but also to other wild fauna, livestock, and even humans (Granados et al., 2001; Gortázar et al., 2006; Gortázar et al., 2007; Alados and Escós, 2017; Perea and Refoyo, 2019).	 LOW	**LOW**: Parasites and diseases with a low probability of infecting other species.
	 MEDIUM	**MEDIUM**: Parasites and diseases with a medium probability of infecting other species, in addition to causing problems to other wild and domestic animals.
	 HIGH	**HIGH**: Parasites and serious diseases with a high probability of infecting other species, therefore jeopardizing other wild animals, domestic animals, and human beings.
Donation: Since an entry fee cannot be charged at the park, a single donation is posed to respondents	€5, €10, €15	

intra-class heterogeneity (Soliño et al., 2018), which would allow the heterogeneity of the preferences to be better captured, but at the same time they would complicate posing simple action scenarios to policy makers, who would encounter legal difficulties in applying non-uniform programs among the population.

2.3. Description of the samples

A team formed by 16 workers from the national park conducted 430 in-person surveys in the winter of 2020 (from 15 January to 15 February). The sampling design was set up considering information provided by the park about the visits received during 2018, considering the distribution of those visits throughout the different zones into which the park is divided, and considering if the visits were made on a weekday or over the weekend.

The same questionnaire was given online to a panel of 420 people residing in the park's area of influence (from 13 to 19 March 2020). Using the platform, www.tickstat.com, 210 surveys were conducted of people who visited the Sierra de Guadarrama National Park some time during the year (2019), and the remaining 210 surveys were conducted of people who did not visit the park.

2.4. Questionnaire

The first part of the questionnaire (Annex 1) includes preliminary questions about demographics and about the individual's relationship with the Sierra de Guadarrama National Park, thereby recording if they have visited the park at some point in the last year and the number of times they have done so. Subsequently, twelve aspects of the conservation program that is currently being developed at the park were presented. Individuals were asked to assess the importance of those aspects on a 5-point Likert scale and to highlight which aspect was the most important.

In the second part of the questionnaire, the Iberian ibex was introduced using images, and the respondent was focused on the problem of controlling the Iberian ibex populations in the park. They were informed about the situation of the ibex in the park and about the two situations in which the park must take action (damage to ecological values and the risk of disease), and they were informed about different ecological and management scenarios of the park in the upcoming 5 years. Subsequently, the choice experiment was conducted, in which each individual first chose on three cards where the status quo was not specified (SQ-optout) (Fig. 1). After having made those three choices, the respondent was informed about the consequences of the status quo, which is defined as the medium-term situation in which none of the management measures are prioritized, thereby causing a high level of damage to the ecological values and a high health risk. After informing the individual about the consequences of not conducting any program, another three cards were shown, where the levels of the *status quo* were made explicit *(SQ-provided)* (Fig. 2). After the choice made on the six offered cards, we followed up on those respondents who always marked "none" of the proposed programs to find out the reasons for not having chosen any of the programs. In the analysis, we considered the totality of the responses obtained, thereby avoiding a sample selection bias.

The last part of the questionnaire contains some personal questions that characterize the individual, such as their level of studies, income, sex, age, if they belong to any association linked to nature conservation, if they have a job linked to nature, or if they are a hunter.

3. Results

3.1. The sample

The in-person questionnaire given to 430 visitors to the national park lasted 14 min (6 min of standard deviation, SD), while the duration of the online questionnaires was less. The respondents in the sample of "off-site" visitors and the sample of non-visitors took an average of 8.70 min. (4.88 min. of SD) and 8.74 min. (4.90 min. of SD), respectively. Table 2 describes and compares the three samples used in this study while considering the main socioeconomic characteristics of the respondents regarding sex, age, place of residence, studies, and individual and family income.

In addition, Fig. 3 shows the relative importance of 12 aspects of the General Conservation Plan of the Sierra de Guadarrama National Park. Controlling overabundant animal populations is observed to be a minor concern with respect to other aspects, while promoting measures

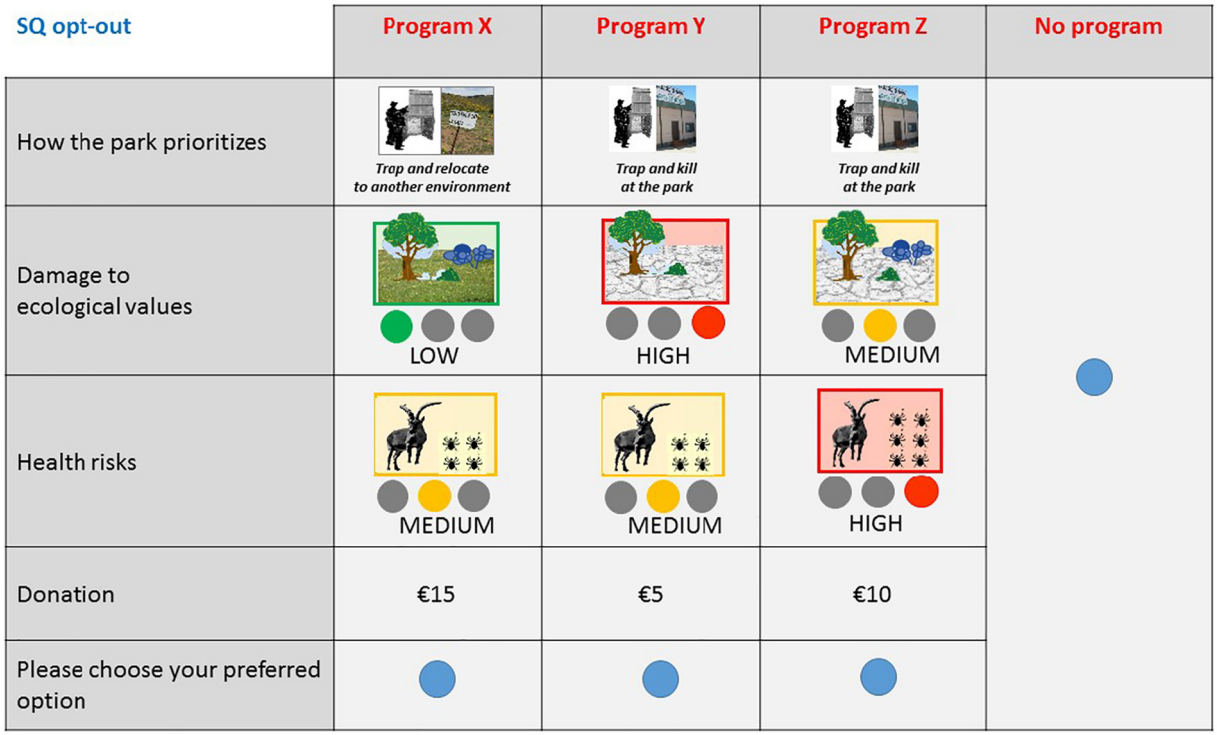


Fig. 1. Example of a choice card with SQ-optout.

of climate adaptation and the conservation of threatened species are the most relevant for all the surveyed individuals.

The questionnaire presented two images to the respondents: one that represented the existence of the Iberian ibex in ecologically suitable densities and another that represented the overabundance of the ibex in the national park (Fig. 4). It should be pointed out that less than 38% of the respondents (38% of the respondents of the "on-site" visitors sample, 30% of the sample of "off-site" visitors, and 24% of the non-visitors) chose the first image and that more than 61% chose the second one. This means that actually being able to see the ibex in the park is initially more important than any concern for an excess of animals in the park.

3.2. Discrete choice experiment

First of all, it should be noted that the goodness of fit of the models is far above the recommended minimum values (Annex 2, McFadden

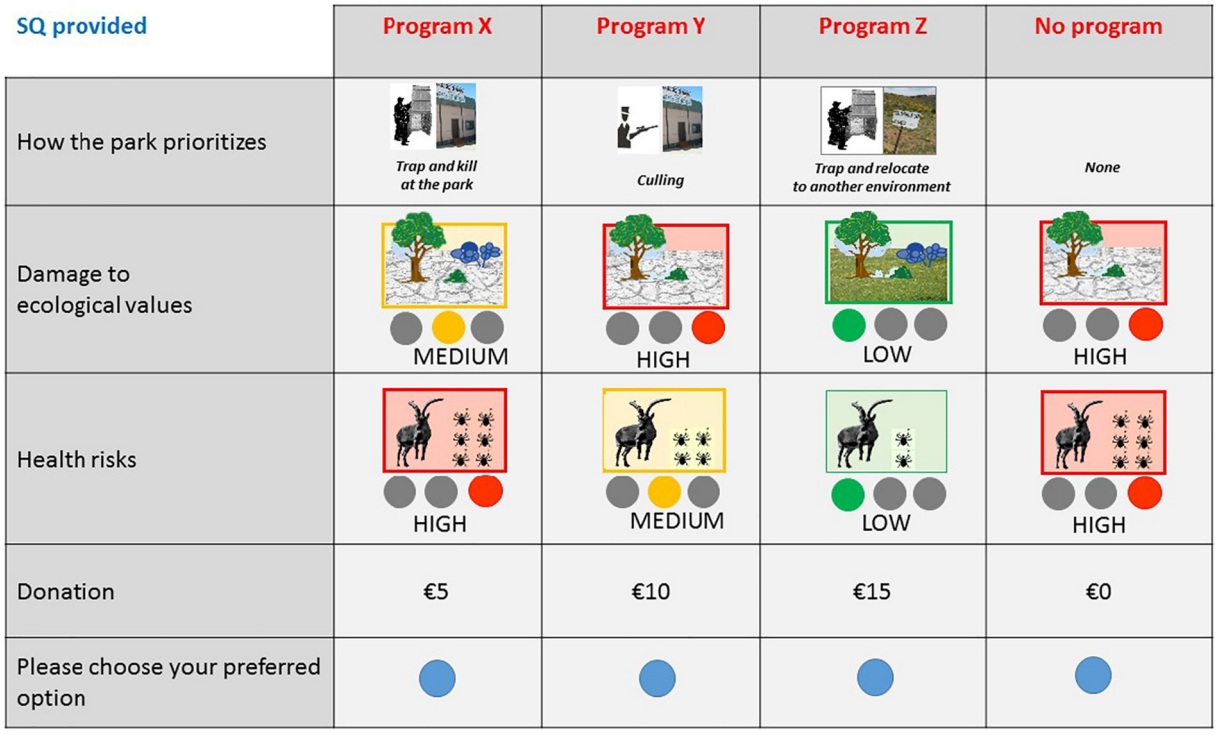


Fig. 2. Example of a choice card with SQ-provided.

Table 2
Characteristics of the respondents in the three samples used in this study (figures in percentages).

		"On-site" visitors	"Off-site" visitors	Non-visitors
Sex	Women	34	52	53
	Men	63	48	47
Age	18–34	24	30	29
	35–49	36	34	31
	50–64	30	25	25
	>65	10	11	15
Reside in the capital of the province	Yes	46	48	48
	No	54	52	52
Studies	Basic/primary education	7	0.5	6
	Vocational training, high school	38	32	38
	University graduate	51	60	50
	Doctoral degree	3	7	5
Net monthly income	<€981	22	13	30
	€981–2200	61	61	53
	€2201–4000	14	21	14
	>€4000	2	5	1
Net monthly income of the home	<€981	5	4	11
	€981–2200	39	33	45
	€2201–4000	45	46	34
	>€4000	11	17	10

Pseudo R-squared = 0.352 for the "on-site" visitors model; McFadden Pseudo R-squared = 0.260 for the "off-site" visitors model; McFadden Pseudo R-squared = 0.251 for the non-visitors model) (Louviere et al., 2000). The results of the models allow us to estimate the willingness to pay for all attribute levels (Table 3), thereby considering that the variables are coded as effect codes (Bech and Gyrd-Hansen, 2005), and the excluded levels are represented by trap and kill at the park and by very unfavorable indicators for ecological values and health risk.

In general, the results show that the visitor model ASCs are positive and significant, which indicates that the mere fact that an Iberian ibex management plan is conducted in the national park is positively valued. The results also show that trap and relocate is the preferred option for all respondents, then culling (which is only significant and positive for the case of "on-site" visitors), and that trap and kill in the park represents a loss of well-being for the respondents. Regarding the results of the program, it should be pointed out that achieving good indicators on the ecological values and health risks is positively valued, while keeping damage and risks at unsustainable levels generates disutility. Finally, it should be added that when the sample was informed about the resulting situation if no program were carried out (SQ-provided), some statistically significant changes in the estimators of a change of well-being were obtained, although they only affect the "on-site" visitors, which leads us to believe that specifying the status quo did not cause major changes of behavior. This is perhaps due to the abundant information about the program that was shown in the explanation of the assessment scenario for the sake of making it credible and realistic, with no additional significant effects caused by providing more information on the choice cards.

3.3. Simulation of scenarios

Based on the average WTP estimates (Table 3), various ecological and management scenarios for the Iberian ibex in the Guadarrama Park are posed for the three samples of analyzed stakeholders involved ("on-site" visitors, "off-site" visitors, and non-visitors), thereby considering the two experimental approaches to the information on the status quo (Table 4). The scenarios have been defined with all the possible combinations of management measures and considering that the effects of overabundance should never be at the most prejudicial levels, such that an ecological and health minimum is guaranteed in all the simulated scenarios. A case used to represent a hypothetical scenario in which no program was developed was also added, which would mean a *laissez faire* situation and therefore the abandonment of proactive management.

Considering that the results of our models with differentiated treatment of information on the status quo, the simulation of scenarios shows that not conducting any Iberian ibex management program in the Sierra de Guadarrama National Park (scenario i) involves a loss of well-being for society as a whole. Once a program is implemented, the one that provides the most well-being is the one that reaches the best indicators on the effects of ibex overabundance, which is the case for all the stakeholders involved and all the contemplated management tools. "Off-site" visitors are those that benefit the most from scenario ii. If either of the two levels (ecological or health) do not reach the low level (scenarios iii and iv), all the stakeholders prioritize achieving a low level of damage to ecological values. The population control tool does not condition the positive result of scenarios iii and iv, although in the case of trap and kill in the park, the results can be neutral with respect to a change of well-being (the effect is statistically zero).

Finally, in scenario v, in which the ecological and health damages are at an intermediate level, fewer gains in well-being are observed for each animal control instrument. Even still, using the measure of trap and relocate and the culling measure place us in ibex management scenarios that contribute well-being to the various stakeholders involved. Rejection of the ibex management scenario occurs for "on-site" visitors when trap and kill at the park is used, given that in this case it causes a loss of well-being. In brief, it can be observed that the weight of the preferences on the management measures in the management program is greater to the extent that the results of the program are worse (meaning, greater damage to the environment and to other species because of ibex overabundance).

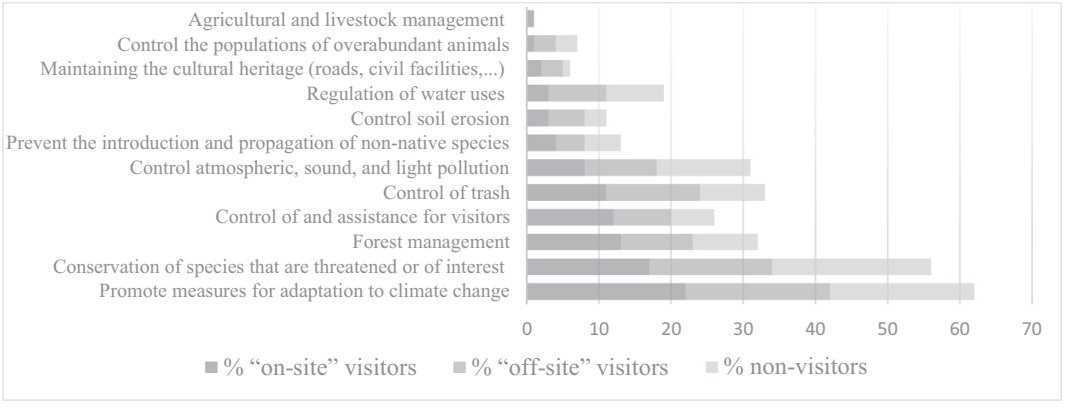


Fig. 3. Relative importance of 12 aspects of the Conservation Program of the Sierra de Guadarrama National Park for respondents of the three samples ("on-site" visitors, "off-site" visitors, non-visitors).

Fig. 4. Images presented to the respondents (images' authorship: S. Martín-Romero, S. Rubio-Sánchez, A. San Miguel).

Finally, it should be pointed out that contemplating the additional information given in the SQ-provided approach has had some significant effects on the simulated scenarios and the "on-site" visitors' sample, but it has not resulted in significant differences in the remainder of cases. Therefore, the prior explanatory information about the measures and effects of the program seems to have been sufficiently detailed and has allowed the respondents to shape their decision patterns according to the proposed assessment scenario, regardless of the status quo specification.

4. Discussion

The results obtained in this research constitute an argument in favor of designing programs for the collection of voluntary funds to be used for the conservation of national parks. Within a context of insufficient funding, this strategy could contribute to improving the conservation of these protected spaces (Watson et al., 2014), which normally opt for downgrading, downsizing, or partial or full "degazettement" (Mascia et al., 2014).

Specifically, information is provided about the possible differences in the preferences for managing the Iberian ibex among the main users of the park (visitors), whether surveyed at the park or away from it, and among persons who reside in the area of influence and others who have not visited it recently. Despite the fact that there could be significant differences in the intermediate scenarios, in general the results show that not implementing any Iberian ibex management program at the Sierra de Guadarrama National Park generates a loss of social well-being that

Table 3
Results of the willingness to pay (WTP) calculated based on the RPL model with 430 visitors to the park surveyed "on-site", in addition to 210 "off-site" visitors and 210 non-visitors (*** significant at 1%, ** significant at 5%, * significant at 10%). The abbreviations used are: EV_HIGH: high level of damage to ecological values; EV_MED: medium level of damage to ecological values; EV_LOW: low level of damage to ecological values; HR_HIGH: high health risk; HR_MED: medium health risk; HR_LOW: low health risk; ASC: alternative specific constant when conducting a program; info: dummy variable that takes the value 1 if the design is SQ-provided.

	"On-site" visitors		"Off-site" visitors		Non-visitors	
	Average WTP	Standard error	Average WTP	Standard error	Average WTP	Standard error
ASC	5.074***	1.671	11.773***	2.229	3.989	4.071
Trap and kill	−19.373***	3.973	−12.910**	6.082	−7.747*	3.971
Trap and relocate	16.102***	3.539	15.038**	7.381	10.169**	4.759
Culling	3.271**	1.359	−2.128	3.256	−2.422	3.280
EV_HIGH	−11.044***	3.400	−16.253*	9.737	−15.970*	9.130
EV_MED	0.641	1.821	7.075	6.341	2.546	4.327
EV_LOW	10.403***	2.341	9.178**	4.649	13.425**	6.092
HR_HIGH	−5.000*	2.704	−16.457	10.759	−18.687*	11.144
HR_MED	−0.189	1.188	3.668	4.263	5.982	5.000
HR_LOW	5.177**	2.157	12.788*	7.428	12.705*	7.041
Trap and kill:info	3.675*	2.005	−2.428	4.052	−6.611	5.049
Trap and relocate:info	4.307**	1.927	7.673	5.289	4.196	4.002
Culling:info	−7.982***	2.343	−5.245	4.268	2.415	3.799
EV_HIGH:info	1.973	1.817	6.665	5.218	3.768	4.175
EV_MED:info	−1.264	1.572	−6.210	5.033	−0.366	3.217
EV_LOW:info	−0.708	1.416	−0.455	3.093	−3.402	3.179
HR_HIGH:info	−5.185**	2.157	3.898	5.171	4.827	5.088
HR_MED:info	4.801***	1.758	2.478	3.028	0.429	2.614
HR_LOW:info	0.383	2.000	−6.377	5.820	−5.257	5.240

Table 4
Willingness to pay for different Iberian ibex management scenarios in the Sierra de Guadarrama National Park, considering the surveyed sample and if the status quo is reported (Info.: the effect of the additional information on status quo is considered) or is not reported (No info.: the effect of the additional information on status quo is not included). Significance calculated using the Wald procedure (*** significance at 1%, ** significance at 5%, * significance at 10%).

Description of the management scenarios	"On site"visitors		"Off site" visitors		Non-visitors	
	No info.	Info.	No info.	Info.	No info.	Info.
No management program (i)						
	−27.469***	−19.245***	−22.427**	−22.146*	−22.443**	−26.062*
Management that prioritizes low damage and risks (ii)						
Trap and relocate	40.192***	40.738***	42.420***	49.617***	32.745***	35.826***
Culling	22.379***	15.618***	23.185***	19.533***	20.606***	21.454***
Trap and kill	9.771***	4.631*	12.107***	11.568***	8.374**	7.102
Management that prioritizes low damage to ecological values (iii)						
Trap and relocate	32.294***	39.790***	38.277***	49.352**	30.991***	34.789***
Culling	14.480***	14.670***	19.042***	19.269***	18.853***	20.416***
Trap and kill	1.873	3.684	7.964**	11.304**	6.620**	6.065
Management that prioritizes low health risks (iv)						
Trap and relocate	34.465***	30.419***	38.620***	41.760***	26.445***	27.983***
Culling	16.652***	5.300*	19.385***	11.677**	14.307***	13.610***
Trap and kill	4.044	−5.687	8.307**	3.711	2.075	−0.741
Minimum management that guarantees medium levels of damage and risks (v)						
Trap and relocate	26.567***	29.472***	34.477***	41.496**	24.692***	26.946***
Culling	8.753***	4.352**	15.242***	11.412***	12.554***	12.573***
Trap and kill	−3.854	−6.635**	4.164	3.447	0.321	−1.778

Note: (i) EV_HIGH and HR_HIGH; (ii) best management results: there is a program, EV_LOW and HR_LOW; (iii) intermediate results: there is a program, EV_LOW and HR_MED; (iv) intermediate results: there is a program, EV_MED and HR_LOW; (v) intermediate results: there is a program, EV_MED and HR_MED.

exceeds the annual budget of the park itself. This clearly shows that, just like it has occurred for society in other parks with problems of ungulate overabundance (Martínez-Jauregui et al., 2020), not only visitors ("on-site" or "off-site") but also residents in the park's area of influence understand that it is necessary to actively manage overabundant populations of wildlife in parks, even when this involves the direct death of animals by firearm, a very conflictive issue for a certain part of society.

It has also been shown that the design of the management program is relevant for obtaining greater or lesser acceptance of the management plan by the surveyed stakeholders. As expected, those measures that represent the "direct" sacrifice of animals are less preferred than other types of measures, and this is supported by scientific literature, which has shown similar results in other environments and for the management of other species (Dandy et al., 2011; Fischer et al., 2013; Garrido et al., 2017; Liordos et al., 2017; Martínez-Jauregui et al., 2020). The scientific literature also clearly shows that the tolerance for these types of management alternatives increases in accordance with the damages caused by the overabundance of species (Garrido et al., 2017; Martínez-Jauregui et al., 2020). In our case, there is also the fact that to the extent that the program's results are worse, the greater the weight of the chosen control measure, meaning that if the plan is not successful, how it is done becomes more important. We have demonstrated that not only using the measure of trap and relocate but also the culling measure involve acceptance of the ibex management program, as long as the results obtained are successful. In other words, at least the medium level of damage to ecological values is reached (threatened species do not disappear from the park), in addition to the medium level of health risks (the probability of infection does not affect human beings). However, the best possible program for all the respondents is, as expected, the one in which low levels due to the effects of ibex overabundance are maintained and in which trap and relocate to another environment is the management alternative used for controlling populations.

The results obtained allow specifically informing about the management alternatives that are needed for reaching the objectives of the next ibex management plan at the Sierra de Guadarrama National Park, and they support decision-making that optimizes management of the protected territory. The success of a management alternative is often conditioned by acceptance of the techniques used and by collaboration from the stakeholders involved (Treves et al., 2006; Redpath et al., 2013; Mace, 2014; Martín-López and Montes, 2015), especially when there are conflicts of an ecological and socioeconomic nature. This approach could be used for other types of management and conservation conflicts in national parks that are highly influenced by the opinion of society and visitors. This study could also be improved by considering other stakeholders, such as farmers, hunters or conservationists.

5. Conclusions

Economic assessment applied to the environment is shown to be a useful tool for informing policy makers. The conservation and management objectives of a territory can be aligned with the values and preferences of society regarding wildlife and the management thereof, consequently reducing possible conflicts between different parts of society. The systematic study of the preferences of citizens, extrapolated to measures of change of well-being, should be taken into account in the decision-making process, given that it constitutes a relevant source of information that goes far beyond isolated individual opinions or the opinions of pressure groups.

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CRediT authorship contribution statement

Martinez-Jauregui María: Conceptualization, Data curation, Methodology, Software, Funding acquisition, Writing – original draft. **Soliño Mario:** Conceptualization, Methodology, Software, Writing – review & editing.

Declaration of competing interest

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

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