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Provision of ecosystem services from the management of Natura 2000 sites in Umbria (Italy): Comparing the costs and benefits, using choice experiment

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ABSTRACT

Natura 2000 is a network of habitats, the largest coordinated network of protected areas in the world, managed under the same regulatory framework. Although the main aim of the network is to protect the habitat, it also considers the economic, social and cultural needs of the people involved. Moreover, Natura 2000 is recognised for its provision of several ecosystem services and it has, therefore, put management plans in place for these areas. This paper assessed residents' preferences for provisioning, regulating and supporting ecosystem services provided by the Region of Umbria network. The Willingness To Pay for improving such ecosystems services is also estimated and used to evaluate the overall benefit provided by the management of the network in two hypothetical scenarios. The average benefit per hectare per year for achieving the less demanding scenario is €75, whereas an additional €64 is required for the more challenging policy scenario. The estimated benefit is greater than the current expenditure for the regional management of the Natura 2000 network.

1. Introduction

Natura 2000 Network (N2K) is the largest, ecological network in the world, established under a unified regulatory framework, the Habitats (Council Directive 92/43/EEC) and the Birds Directives (Directive 2009/147/EC) (Maes et al., 2012; Popescu et al., 2012). N2K stretches across all 28 EU countries, both on land and at sea, and its aim is to ensure the long-term survival of Europe's most valuable and threatened species and habitats. The network consists of Special Protection Areas (SPAs) and Sites of Community Importance (SCIs), which develop into Special Areas of Conservations (SACs). The network's core is the protection of the habitat; however, Article 2 of the Habitats Directive takes into account economic, social and cultural needs, and also regional and local features (Russo et al., 2011). The N2K is, therefore, a complex, social-ecological network (Popescu et al., 2012). Italy contributes 2613 sites to the network, which represent approximately 23% of the national land area[1]. It is well recognized that N2Kprovides several ecosystem services (ES), as do the other protected areas (MEA, 2005; Kumar, 2010). However, according to Ziv et al. (2018) and Bastian (2013), there are still few studies focusing on the relationship between the provision of ES by N2K areas and conservation strategies.

Ecosystem services are central and crucial for the EU Biodiversity Strategy: maintaining and enhancing ecosystem services is one of the six priority goals targeted for 2020. In order to implement the strategy, in 2012 the EU launched the Natura 2000 Biogeographical Process, a multi-stakeholders' cooperative process aimed at enhancing the actual implementation, management, monitoring, financing and reporting of the Natura 2000 network. It deals with seminars, workshops and other activities of cooperation. The Mediterranean and Continental biogeographical seminars have provided useful indications to prepare concrete, operational measures to manage the Umbrian Natura 2000 network within the framework of the SUN LIFE + Project (LIFE13 NAT/IT/000371[2]). The main aim of the SUN LIFE + project is to produce a strategic plan to manage the Natura 2000 network in the Region of Umbria and to develop the Priority Action Frameworks (PAFs). In compliance with the provisions of Article 8 (4) of the Habitats Directive, the PAFs are dedicated to prioritising the actions required to protect species and habitats.

According to the SUN LIFE + project, an economic valuation must be conducted to allocate resources between the various competitive, management options, justify the budget dedicated to conservation, and define the priorities. Therefore, the aim of this study is to investigate

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[1] http://www.minambiente.it/pagina/sic-zsc-e-zps-italia; last update December 2017 (available only in Italian)

[2] http://ww.life-sun.eu

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the preferences of households concerning the management of the Natura 2000 network in Umbria and to assess their Willingness To Pay to improve the quality of ecosystem services.

1.1. Integration between the valuation of ecosystem services and management strategies

Ecosystem services (ES) can be defined as the benefits produced by ecosystems, of which man takes advantage (MEA, 2005). Although the great contribution of ecosystem services to man is demonstrated, it is, nonetheless, often under-valued (Hattam et al., 2015; Kubiszewski et al., 2017). Ecosystem services fall apart when their value is partially or not valuated (Chaikaew et al., 2017). Moreover, each time ES values are not taken into account in decision-making, the results are investments and activities, which degrade the natural capital (Kumar, 2010).

In order to avoid such problems, the quantification and valuation of ecosystem services have been considered as a solution (Liu et al., 2010). Valuation can be conducted from multiple perspectives, making the link between ES and human well-being more evident (Hattam et al., 2015). In the last twenty years, the evaluation of ES has been mainly based on preference-based methods (Chaikaew et al., 2017), which make it possible to obtain a valuation expressed in common currency. The use of a monetary scale provides a means to compare costs (i.e. for environmental protection or for management plans) with the benefits which are generated (Hattam et al., 2015). According to de Groot et al., (2012), when data is collected systematically and converted to a common set of units, i.e. €/year, the monetary expression of ecosystem services can be considered meaningful. The methods most commonly used to assess non-market benefits are the Contingent Valuation Method (CVM) and Choice Experiments (CE), which use survey interviews to elicit Willingness To Pay (WTP) in a hypothetical market.

The economic valuation of ecosystem services approach has been criticised, since it interprets private households as consumers rather than as citizens (Hattam et al., 2015). Moreover, some authors see it as a kind of commodification of ecosystem services (Kosoy and Corbera, 2010; Kallis et al., 2013). However, as Kubiszewski et al. (2017) stated, a valuation in monetary units does not conflict with any other kind of analysis. On the contrary, it provides a further piece of information to the whole picture and can be used in addition to other instruments (Chaikaewet al., 2017). Such assessments can prove very useful in ecosystem management, by helping to analyse the trade-off between alternative management options, as the concept of ecosystem services has great potential in local and regional planning (Maes et al., 2012). This is particularly true when plans are dedicated to the specific aim of conservation, as with the Natura 2000 Network, which is involved in this study.

1.2. Choice experiments State of the art

The choice experiments (CE) technique is a stated preference method, widely applied to estimate non-market goods using hypothetical choice scenarios. CE have been applied to a great variety of research fields, and several works are available, which consider a wide range of ecosystem services (i.e. Chaikaew et al., 2017; Christie and Rayment, 2012; Doherty et al., 2014; Marre et al., 2015; Novikova et al., 2017), whereas applications specifically designed for N2K are still quite rare (Hoyos et al., 2012; Li et al., 2004). Implementations involving other European policies, such as the agri-environmental policy, can also be found (Alló et al., 2015; Broch and Vedel, 2012; Christensen et al., 2011; Rocchi et al., 2017).

The conceptual foundations of choice experiments rely on Lancaster's Theory of Value (Lancaster, 1966) and the Random Utility Theory (RUT) (Thurstone, 1927), although the approach was developed by Louviere and Hensher (1982) and Louviere and Woodworth (1983). In CE, respondents are asked to choose between different alternatives, consisting of several attributes, each one expressed by a certain level; repeating choices are usually applied. A monetary attribute, such as a price, tax or cost, can be included, so that Willingness To Pay can be calculated as a marginal utility for money (Aravena et al., 2014). The basic assumption is that people seek to maximise utility in each choice situation according to their preference (McFadden, 1974). The identification of the correct attributes and their space is very important, as the levels and range must be relevant to and meaningful for the issues analysed. Furthermore, a status quo scenario is usually added as a baseline (Aravena et al., 2014).

Some authors criticise Choice Experiments and the monetary valuation of natural resources (Neuteleers and Engelen, 2014). One of the issues most criticised is the presence of a hypothetical bias, especially in the case of a precise WTP evaluation (Chaikaew et al., 2017). However, a hypothetical bias does not make the CE method irrelevant (Allen and Moore, 2016), and Kubiszewski et al. (2017) demonstrated how the use of monetary evaluation can help decision makers if there is any uncertainty.

Allen and Moore (2016) used CE to demonstrate the importance of non-market valuation in a complex scenario to understand the potential benefit of a given policy. More specifically, a latent class model was used to understand a priori the preference for programme design. Novikova et al. (2017) also used the same kind of model to understand the preferences of Lithuanian citizens regarding ecosystem services provided by agriculture, in relation to the EU Common Agricultural Policy. As in our case, CE was used to compare the expenditure of one European policy with the preferences of recipient citizens. Christensen et al. (2011); Espinosa-Goded et al., 2010; Lizin et al. (2015); Rocchi et al. (2017) and Ruto and Garrod (2009) applied CE within the framework of the EU Common Agricultural Policy to understand farmers' preferences for participating in agri-environmental schemes.

2. Materials and methods

The main steps of the methodology followed in this study are: i) the specification of research objects and boundaries (i.e.: a valuation of ecosystem services management in N2K in Umbria); ii) the identification of ecosystem services provided for macro habitats, already identified by previous project actions; iii) the application of a monetary method (i.e. choice experiments construction) to assess citizens' values and preferences of; iv) a comparison between the values obtained and the current cost; v) indications based on the values and preferences of decision makers for the future management of N2K.

2.1. Case study

The N2K of the Region of Umbria in Italy consists of 102 sites, divided into 97 SACs and 5 SPAs. Fig. 1, shows the regional distribution and localisation of the Natura 2000 Network, which covers approximately 16% of the regional area. The additional material gives details on the ecosystem services provided by the N2K in Umbria, classified according to the Common International Classification of Ecosystem Service (CICES) (Haines-Young and Potschin, 2013). It takes into account the division in habitats and macro habitat categories, as it was set-up by the EU Life + project SUN LIFE. The identification of habitat and macro habitat is very important, since ecosystem services derive from the dominant habitat class of each site (Ziv et al., 2018).

2.2. Survey design

Personal surveys were conducted to assess the residents' preference' regarding the management of ecosystem services. The questionnaire presented three main parts. The first used a dichotomous choice, an open format and a 5 point Likert scale to introduce the theme of ecosystem services and investigate the respondents' general knowledge and concerns regarding N2K,. The second part consisted of the choice experiment. The third part ended the questionnaire with answers giving

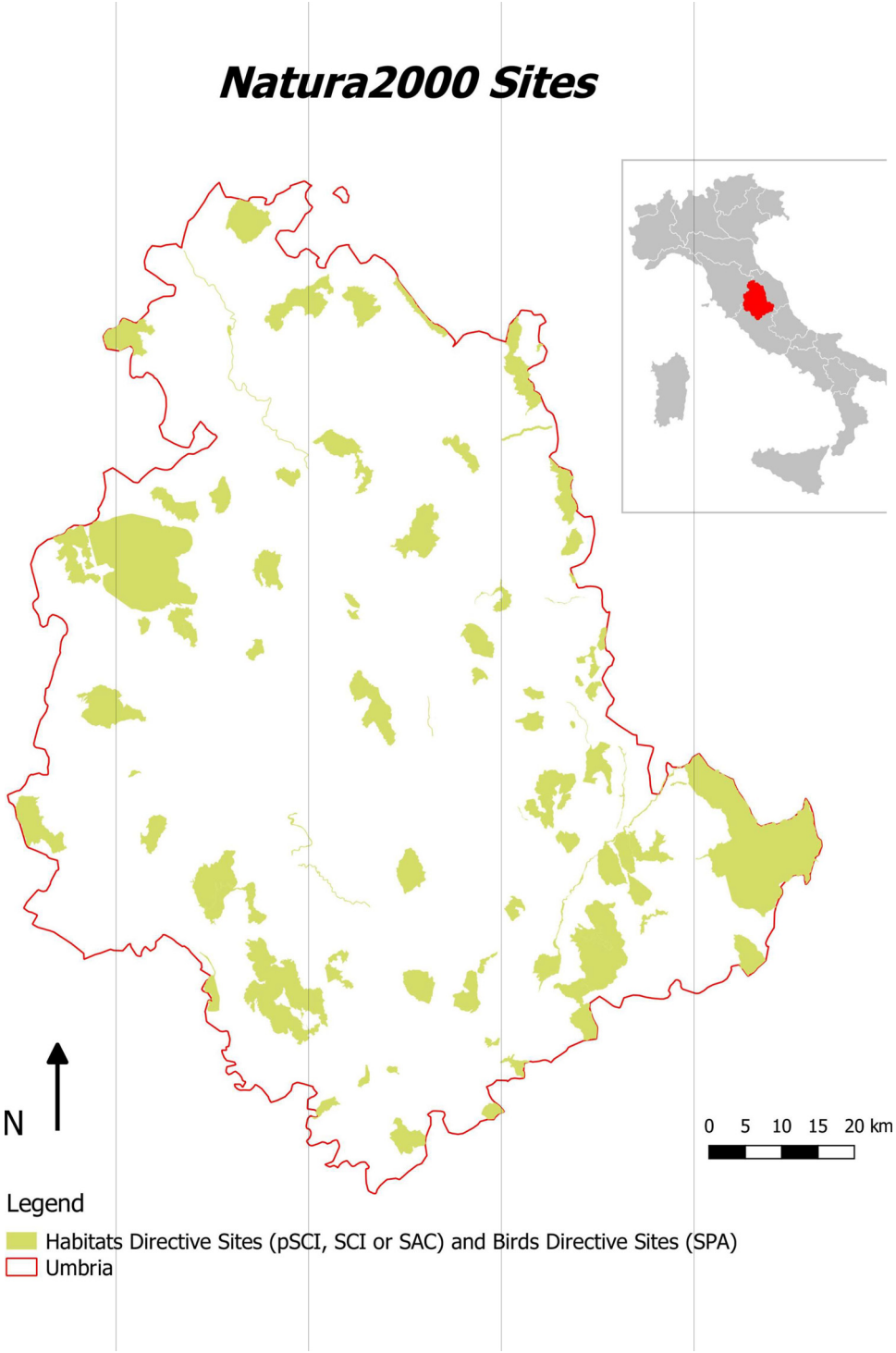

Fig. 1. Natura 2000 Network sites distribution in Umbria.

socio-economic information (i.e.: gender, age, residence, income, etc…).

As regards the application of CE, ecosystem services were selected to be used as attributes in the CE, according to an extensive literature (Allen and Moore, 2016; Christie and Rayment, 2012; Hattam et al., 2015; Hoyos et al., 2012; Li et al., 2004; Russo et al., 2011), and then reduced using focus groups with local stakeholders. The monetary attribute (i.e.: annual household tax) was identified with regional, public stakeholders. A first set of services and levels was then tested with a pilot survey. Following the pre-test, a further selection was made and the final set, based on management options for ecosystem services, was applied, as shown in Table 1. The first column gives the services and the second their levels; the third column gives the type of ecosystem services (classification) and the fourth shows the code used in the application and shown in the results tables. Given that all but the monetary services are not continuous, they were included as discrete levels. The presence of the monetary attribute enabled the Marginal Willingness To Pay (MWTP) to be calculated. It is useful to calculate MWTP in a management context, where there is a known, annual expenditure, to provide the bottom line for decision makers (Chaikaew et al., 2017).

Table 1
Services, monetary attribute and levels used in the Choice Experiments.

Services	Levels	ES Classification	Code
Access to the gift of nature (e.g. wood or fruit harvest; hunting, fishing)	Status quo	Provisioning services	–
	10% increase of withdrawal quantities		GIFTNAT1
	20% increase of withdrawal quantities		GIFTNAT2
Conservation of biodiversity	Status quo	Provisioning services	–
	10% improvement of interventions to support and protect natural biodiversity and agro-biodiversity.		BIODIV1
	20% improvement of interventions to support and protect natural biodiversity and agro-biodiversity.		BIODIV2
Climate regulation (air)	Status quo	Regulating services	–
	10% improvement forest interventions to improve CO2 capture		CLIMATE1
	20% improvement forest interventions to improve CO2 capture		CLIMATE2
Water regulation	Status quo	Regulating services	–
	10% improvement of interventions to improve infiltration in agricultural and forest soil		WATER1
	20% improvement of interventions to improve infiltration in agricultural and forest soil		WATER2
Recreational uses	10% reduction of possible uses	Cultural services	RECRN
	Status quo		–
	10% improvement of possible uses		RECRP
Monetary attribute			Code
Annual household tax (for 15 years)	Status quo	–	TAX
	EUR 50 /year		
	EUR 120 /year		
	EUR 200 /year		

Excluding unrealistic cases, a D-efficient, fractional, factorial design was adopted for each of the choice sets to provide a statistically efficient choice design for the main survey. This experiment was performed with linear D-optimal using SAS© software. The programme created 81 choice sets, which were then distributed in three blocks, with three repetitions each.

2.3. Survey sampling and implementation

All the municipalities in the Region of Umbria were initially considered, even though some municipalities did not have a N2K site within their boundaries, as the presence of the network in a nearby municipality may have positive effects. The selection of municipalities consisted of a two-stage process. In the first stage, a random sampling of the municipalities was conducted. A random group of 23 municipalities, equal to 25% of the total municipalities, which represents 80% of the residents in Umbria, was created. In a second stage, we selected the respondents in public places (post offices, waiting rooms at the hospital, public streets, mall and events), every seventh passing by. The survey phase lasted two months, mainly from Monday to Friday, from 9 a.m. to 2 pm or from 2 to 7 pm. Researchers conducted the survey also during some events, at night, for five times. The researchers proposed the survey just once and conducted face-to-face interviews. Moreover, in order to facilitate communication with the respondents, we identified environmental problems and their relationship with human well-being for each of the services and levels. A set of cards with definitions, pictures, illustrations and photos was also prepared as support materials for the respondents.

2.4. Econometric model

The conceptual model applied in the work was the Random Utility Theory (RUT). Since the random component is assumed to be a Weibull probability distribution, the probability of choosing one option over all the others can be assessed using a logistic distribution (McFadden, 1974). The basic model used for assessing the choice probability was the Multi Nominal Logit (MNL). Although it is a useful reference model, MNL is limited by several assumptions (Vivithkeyoonvong and Jourdain, 2017). Over the last twenty years, researchers have developed alternative, more complex models, to specifically take into account heterogeneity in taste and scale, since the work first completed by Train (1998). Heterogeneity can be modelled in two ways: as a continuous distribution, with mixed logit (Chen and Cosslett, 1998; Train, 2003), or as a discrete distribution, with a latent class approach (LCA) (Hynes et al., 2008; Scarpa et al., 2005). In this paper, LCA was applied. In the latent class model, the sample is divided into segments, called classes. Classes differ from each other, however the members of the same group share the same parameters (Boxall and Adamowicz, 2002), and so heterogeneity of preferences is possible among latent classes. An LCA application can be useful in a policy context, so that policy makers can identify and investigate groups of people with particular preferences (Garrod et al., 2012). Applications of LCA in a policy context are found in the work of Allen and Moore (2016); Broch and Vedel (2012); Garrod et al. (2012); Novikova et al. (2017); Rocchi et al. (2017); Villanueva et al. (2015) and Vivithkeyoonvong and Jourdain (2017).

From a mathematical point of view, the utility function can be written as follows:

$$U_{in} = V_{in}(Z_i, S_n) + \varepsilon_{in} \quad (1)$$

where

U_{in} = utility provided by alternative i to subject n,

V_{in} = systematic component of the utility,

Z_i = vector of attributes of alternative i,

S_n = vector of socio-economic characteristics of the respondent n, and

ε_{in} = random error term.

According to the MNL model, the probability that an individual n will choose alternative i (P_{in}) among other alternatives j ($j = 1…J$) of a set C_n (set of all the alternatives) can be written as:

$$P_{in} = \frac{\exp(\mu V_{in})}{\sum_{j \in C} \exp(\mu V_{jn})} \quad (2)$$

where V_{in}/V_{jn} is the systematic component of the utility provided by alternatives i/j, and μ is a scale parameter that is inversely proportional to the standard deviation of error terms and is usually assumed to be equal to one (Ben- Akiva and Lerman, 1985).

The LCA discretizes function (1), identifying S segments in the population, each with its own characteristics and taste (Scarpa et al., 2005). Therefore, the probability function (2) can be transformed to

identify the probability for n, belonging to s, to choose alternative i, as follows:

$$P_{ins} = \exp(\mu_s x_{in}\beta_s)/\sum_{jeC_n}\exp(\mu_s x_{jn}\beta_s) \quad (3)$$

While marginal probability can be calculated as follows:

$$P_{in} = \sum_{s=1}^{S}\pi_s(\exp(\mu_s x_{in}\beta_s)/\sum_{j\in C_n}\exp(\mu_s x_{jn}\beta_s)) \quad (4)$$

The scale parameter is μ_s. μ_s,nd although it can vary over segments, it is usually considered equal to 1. The number of classes has to be estimated before evaluating the parameters, because its identification is not part of the maximisation process. The Bayesian Information Criterion (BIC) and the Akaike Information Criterion (AIC) divided by the number of parameters are the criteria most commonly used to choose the correct number of classes (Bozdogan, 1987; Posada and Buckley, 2004). The best model for data interpretation is the one with the lowest information criterion values.

3. Results

3.1. Demographic

We approached 3000 potential respondents, 423 of them agreed to take part of the survey. A total of 378 completed it and usable questionnaires were returned, representing an overall response rate of 12%.. In general, respondents were more likely to be a woman (56%), young (61% aged 20–41 years old) and with a good rate of highly educated (15.6% with a bachelor's degree; 32.28% with a master degree). According to the data of the Regional Statistic Office,[3] the sample was representative for the gender distribution (in the general population women are the 55.8%), but not for the age. In particular, our sample included more young people than the general population (57.8% against 28% in the range 15–39) and underestimated the presence of aging people (5.1% instead of 28% over 65 years). On the contrary, the distribution of the 40–64 age range in the sample was quite representative (37.1% in the general population against 35.2% in the sample). Regarding household size, over 50% consisted of 3 or 4 people, whereas the annual household income fell into the categories of: €0-15000 (19%); €15001-28000 (32%); €28001-55000 (32%); €55001-75,000 (11%) and over €75,000 (6%). In 16% of the families there is at least one child under 14 years old.

3.2. Attitudes and preferences regarding the Natura 2000 network and ecosystem services

Knowledge of the N2K seems to be very high among the respondents in Umbria, higher than for Europe and Italy. According to the Flash Eurobarometer report (Eurobarometer, 2013), 73% of Europeans and 92% of Italians have never heard of N2K. In our survey, this percentage dropped to 69%. Moreover, 31% of the sample knew what N2K is and 21% had also visited one of the sites at least once. The majority of the respondents (about 70%) had visited at least one of the sites, even though they did not know they are part of N2K.

After introducing N2K, the respondents expressed their opinion on the importance and management of the network, using a five-level Likert scale. Table 2 gives the results of their answers.

As regards the importance of the ecosystem services (ES) provided by the network, the survey explained the meaning and the type of these services, according to the Common International Classification of ecosystem services (Haines-Young and Potschin, 2013): Provision of nutrition, materials and energy; Regulation and maintenance of natural flows and cycles; and Cultural. Respondents then expressed how important each category is to them on a scale of 1-5. Almost all the respondents declared that ES are Important (39%) or Very Important (59%). They then ranked the types of services (Provision, Regulation, Cultural) from the least to the most important using a scale of 1–3 (1 being the most important). The ES 'Regulation and maintenance of natural flows and cycles was considered the most important of the three (67% of the sample ranks it first), followed by Cultural services (21%) and Provision (12%).

3.3. Econometric assessment

The choice experiment data were analysed before using a MNL model, to be used as a benchmark for comparison. We then applied LCA: a two-class model was chosen according to the value of AIC/N, LL and Pseudo Rsqd, as suggested by Vivithkeyoonvong and Jourdain (2017). Class I includes 75.9% of the sample, and Class II 24.1%. Table 3 gives the results of the models. The definition of only two latent classes is also found in Allen and Moore (2016).

The MNL model was significant at both levels of the attributes *Access to the gift of nature* (GIFTNAT1 and GIFTNAT2) and *Conservation of biodiversity* (BIODIV1 and BIODIV2), the second level of *Climate regulation* (CLIMAT2) and the positive variation of *Recreational uses* (RECRP). The Annual household tax (TAX) was also significant. The sign was the one expected for all the attributes except *Access to the gift of nature* (both levels), which was negative. The LCA model had more significant attributes in both the classes. Class I, the larger, was significant for all the attributes except for RECRN; in Class II, WATER1 was also not significant. All the signs were as expected, except for GIFTNAT1 and GIFTNAT2. RECRN, which represented a reduction in possible recreational uses, was never significant, whereas RECRP, which is the possibility to improve them, always was.

The estimate of the marginal WTP (MWTP) was carried out only for the attributes which present the correct sign, as the presence of a negative sign will produce a negative MWTP. This value cannot be considered as a marginal Willingness To Accept (WTA), because the framework of the two measurements is very different. Moreover, WTP and WTA estimations produce very different values, as is well known in the literature (Horowitz and Connell, 2002). As regards the other criteria, we calculated the MWTP using just the LCA model, and applying the delta method (Krinsky and Robb, 1986): Table 4 gives the LCA results.

Thus, using the MWTP from Table 4, we estimated the values of the Provisioning, Regulation and Cultural ecosystem services supplied by the N2K management, according to the classification in Table 1. Values were estimated at household level, using only the results of the LCA model, as this is the most complete and has the better fit. Two policy change scenarios were chosen: a small change scenario and a larger one, according to the two different levels of the proposed CE attributes. Given the results of *Recreational uses*, we considered the same positive variation for it in both scenarios. We then considered the number of households by aggregating the value throughout Umbria, as Christie and Rayment (2012) did. As the LCA divided the sample into groups, we applied the same percentage of the two groups to the total number of households. The aggregate value of the ecosystem services provided by the small change management scenario is €9.75 per year, whereas for the greater change scenario an additional €8.30 per year is required. This is equivalent to a benefit of 75 and 64 €/ha. Considering the three types of ES, in the first level management scenario the greatest part of the benefit is associated with Biodiversity conservation (55% of the total benefit), and, therefore, with Provision services. In the second level scenario, the greatest benefit is associated with Regulation services management. This is partially inconsistent with Table 2. Although Provision services are ranked third in importance, the biodiversity related attributes show the highest MWTP. Biodiversity is probably not perceived as a 'proper' provision service, such as the harvesting of fruits or mushrooms. Note that the Gift of Nature attribute is the only one

[3] Data on the Umbrian population is available at: https://www.istat.it/it/archivio/109450 (only in Italian)

Table 2
Importance of N2K and its management; Likert Scale results (all results are in percentage, %).

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	I do not know - I do not want to ask	Global
Natura 2000 sites are important and must be safeguarded	0.79	0.00	0.26	6.08	91.01	1.85	4.81
The management of Natura 2000 network has to meet the needs of Mankind	5.29	19.05	2.91	39.95	32.28	0.53	3.73
Natura 2000 sites have to be protected regardless of their utility for Mankind	0.79	0.79	1.85	19.84	76.46	0.26	4.70
It is important to maintain the upkeep of the sites of Natura 2000 network for future generations	0.26	0.26	0.26	3.97	94.44	0.79	4.90
The environmental quality of the sites of the N2K depends on Mankind	0.53	1.85	1.59	24.87	68.52	2.65	4.51
N2K is an opportunity to reconnect with the natural world	0.26	0.53	2.38	19.05	75.66	2.12	4.63
Natura 2000 sites offer an opportunity for recreation and leisure	0.26	1.06	5.56	29.89	58.99	4.23	4.34

Table 3
Choice experiment results (MNL and LCA).

Services and monetary attribute (Code)[1]	MNL	LCA	
	(s.e.)	Class I (s.e.)	Class II (s.e.)
GIFTNAT1	−0.1541*	-.0840**	−0.0248**
	(-0.0091)	(0.0374)	(0.0115)
GIFTNAT2	−0.0271***	−0.0320***	-0.0207***
	(0.0045)	(0.0076)	(0.0069)
BIODIV1	0.0321***	0.1285***	0.0415***
	(0.0092)	(0 .0486)	(0.0126)
BIODIV2	0.0201***	0 .0623***	0.0239***
	(0.0046)	(0.0207)	(0.0061)
CLIMAT1	0.0131	0.0719**	0.0227*
	(0.0099)	(0.0325)	(0.0123)
CLIMAT2	0.0093*	'0.0322**	'0.0139**
	(0.0055)	(0.0145)	(0.0062)
WATER1	−0.0084	0.06511*	'-0.0006
	(0.0098)	(0.0344)	(0.0131)
WATER2	0.00244	0.03360**	0.0102*
	(0.00473)	(0.0164)	(0.0054)
RECRN	−0.0106	'-0.0061	−0.0077
	(0.0083)	(0.0164)	(0.0102)
RECRP	0.0213**	0.0397**	0.0237**
	(0.0091)	(0.0177)	(0.0102)
TAX	−0.0029***	-0.0085***	-0.0038***
	(0.0007)	(0.0023)	(0.0014)
Estimated latent class probabilities		75.9% ***	24.1% ***
PSEUDO R2	0.180	0.308	
LOGLL	−1192.3	−1165.68	
% correct pred.	36.07%	47.35%	

***, **, *: Significance at 1%, 5%, 10% level.
1the meaning of each code is reported in Table 1.

Table 4
WTPs for each attribute, for the LCA model.

Attributes (Code)	LCA	
	Class I (s.e.)	Class II (s.e.)
BIODIV1	15.14***	10.90***
	3.23	3.92
BIODIV2	7.33***	6.28***
	1.3	1.98
CLIMAT1	8.47***	5.95
	3.22	4.39
CLIMAT2	7.67***	3.65*
	2.87	2.17
WATER1	7.67***	−0.16
	2.87	3.46
WATER2	3.96***	2.67*
	1.51	1.58
RECRN	−0.72	−1.96
	1.89	2.55
RECRP	4.68**	6.24**
	0.00161	0.0009

***, **, *: Significance at 1%, 5%, 10% level.
1the meaning of each code is reported in Table 1.

with a negative sign, as people consider the collecting of natural goods by the network to be a disadvantage. Moreover, as all the respondents were informed about N2K and its role in the conservation of biodiversity, this ES is to be considered more important within the choice context.

4. Discussion

The results presented in Section 3 show there are some heterogeneities among the residents regarding N2K management. Results show the presence of two different groups of preferences among the respondents. Class I is bigger (approximately 76%) and shows significant preferences and MWTP for almost all the attributes. On the contrary, in Class II only the Biodiversity service (both levels) and the recreational service (positive variation) are significant. This result appears to be consistent with similar findings in literature, where people tend to express more concern for and interest in biodiversity management and recreation (Christie and Rayment, 2012; de Groot et al., (2012); Hattam et al., 2015; Hoyos et al., 2012; Novikova et al., 2017).

Both classes of the LCA and the MNL models show a negative sign for the services *Access to the gift of nature* (both the levels). The presence of a negative sign for this in both models is not easy to understand and comment. One hypothesis is that there is a strong propensity of respondents to avoid damage or to prevent an overuse of the ecosystems, as highlighted in other cases (Hoyos et al., 2012; Vedel et al., 2015). However, there could also have been some misunderstanding of this attribute by respondents at some point.

Our results also provide policy makers with some indications on the local stakeholders' preferences for N2K management. Not only would residents support conservation measures, which aim to improve biodiversity, water management and CO_2 capture, they would also like to have more possibilities to use N2K areas for recreational activities. A demonstration of the social benefits on a regional scale of protecting N2K sites and a presentation of well-informed land-use options from their economic viewpoint could help leverage funding for conservation management plans in N2K sites (Hoyos et al., 2012).

Moreover, there is a growing interest in the costs and benefits provided by protected areas in general and by N2K in particular (Gantioler et al., 2014; EEA, 2016). There are basically two issues (Hoyos et al., 2012; Gantioler et al., 2014): whether the costs exceed the benefits (De Lopez, 2003; Balmford et al., 2002) and whether or not the resources used for financing are truly adequate to fit the real needs of the protected areas (James et al., 2001; Balmford et al., 2002). It is important for Decision Makers to have this kind of information: there is insufficient empirical data to demonstrate the social welfare benefits

which different management options of N2K sites would involve (Hoyos et al., 2012). The values provided by our work show a medium level of Willingness To Pay to manage the entire Umbria N2K, bearing in mind that not all the ES provided by the network were included. Although it is possible to find papers reporting higher values per hectare, calculated for a single site (Gantioler et al., 2014), regional and national assessments obtain lower benefits. In her innovative work Gibson et al. (2004) estimated a net benefit for Natura 2000 in Scotland of €211.5 million, whereas according to Kuik et al. (2006), the gross benefits of the network in the Netherlands reach €4.5 billion. Using the Contingent valuation, Pouta et al., (2000) found that the value of ES for Finland is equal to FIM 449 million[4]. By applying a nested CE model again in Finland, Li et al. (2004) found that the average Willingness To Pay of respondents is low; however the median, which is usually considered in order to estimate the compensating surplus, is equal to zero. Using a Random Parameter Model, Hoyos et al. (2012) found a valuation of €1.13 million per year for developing N2K management scenarios in the Basque region. Since all the respondents had been informed about N2K, its ecosystem services and their benefits, we cannot introduce any parameter equality test as some authors did (e.g.: Christie and Rayment, 2012) in order to understand the impact of information on choice and, therefore, on the MWTP.

As part of the SUN LIFE project the costs[5] incurred to manage the Umbrian N2K were also calculated on the 2007–2013 European Structural Investment Funds programming period. Indeed, the real period of expenditure lasted from 2008 to 2015, and therefore we considered all the costs in this interval. It is very useful for policy-makers to know how much money has been used for N2K and how this money has been spent. This information can be helpful in order to know which kind of investments have been made and the difficulties that have been overcome. It can also help increase the amount of the funds available in the future, by activating synergies between different regional instruments. Furthermore, knowing the breakdown of costs that affected N2K in detail can be useful towards an assessment of the efficiency and effectiveness of the investments made.

The community funds used from 2008 to 2015 to finance the Umbrian N2K were: the European Agricultural Fund for Rural Development (EAFRD), the European Regional Development Fund (ERDF), the Financial Instrument for the Environment (LIFE+), and the Fund for Development and Cohesion, which uses additional European and national resources. These funds were used in order to co-finance activities related to the Umbrian N2K via regional operative plans. However, national and regional funds were also used. These were funds of the Ministry for the Environment and Protection of the Territory and the Sea and the resources of the Regional Wildlife Observatory. The results obtained showed that the opportunities offered by the EU community and national funds in Umbria have been exploited in a similar way to what happened in the EU and throughout Italy. The average annual expenditure for the N2K of €57/ha for Umbria is slightly lower than that of €63/ha estimated at the EU level (Gantioler et al., 2010) and is closer to that of €53/ha estimated for Lombardy (Etifor, 2015), which is the only value already present for another Italian region.

The comparison between costs and benefits show how the benefit per hectare exceeds the cost per hectare, even though we only took into account a limited number of ecosystem services. The ones we selected were chosen on the basis of their representativeness and the evaluation of stakeholders. Focus groups and the pilot survey highlighted preferences and attitudes regarding the different types of ES. We are aware, however, that some ES were not considered: for instance, there is no attribute linked to landscape management, as difficulties arose in the pilot survey to evaluate it. Moreover, we added an attribute linked to the presence of the Gift of Nature. However, we did not assess the real market value provided by these kinds of goods in the two policy scenarios considered.

[4] FIM was replaced by the Euro in 1999; the latest exchange rate was 1 EUR = 5.94573 FIM

[5] Analysis of the costs available at http://www.life-sun.eu/wp-content/uploads/2017/09/5.1.7_P1-Valutazione-delle-attivit%C3%A0-e-dei-costi-2007-2013.pdf (only in Italian)

5. Conclusions

Although the benefits associated with ecosystem services and with the protected areas, which provide them, are clear and unquestionable, there is still some debate concerning the economic reasons for financing such services. More specifically, the issue within the European Union is linked to the need for economic reasons to invest in the Natura 2000 ecological network. There is still a lack of empirical data to prove the benefits to society arising from the management options of N2K sites. Although the evaluations of individual sites are quite numerous, evaluations on a national or regional scale are not so common. However, the regional scale could be ideal to demonstrate their influence on the local communities and on the awareness of them. Furthermore, an evaluation based on the habitat approach rather than the site approach must be preferred, as ecosystem services depend on the predominant habitat.

The aim of this work was to demonstrate the cost effectiveness of management in the Natura 2000 network. To do this, a CE was conducted, based on seven ecosystem services provided by the macro habitats of the network. The results showed that the actual cost of managing the network is lower than the total benefit, even though the analysis considered a limited number of ecosystem services.

Moreover, the study demonstrated the importance of a non-market valuation as an instrument to address policy and to better understand the citizens' preferences and the range of values and heterogeneity among people. It could ultimately help to leverage funding for conservation management plans at N2K sites by establishing well-informed land-use options from an economic viewpoint.

Further developments regard the identification of the levels of ecosystem services supplied by the different habitat types and an understanding of how ecosystem services are affected by conservation and management plans. More detailed models, which allow a deeper analysis of heterogeneity, could also prove very useful.

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