"First economic assessment of ecosystem services from Natura 2000 network in Lombardy (Northern Italy)"

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Summary

Natura 2000 network is a cornerstone for biodiversity conservation and the implementation of the European Union Biodiversity Strategy to 2020. Despite this, the great potential of the ecosystem service (ES) concept to add value to current conservation approaches remains insufficiently explored and there is a lack of quantitative and monetary data for the potential socio-economic benefits associated to the network.
Information gaps on the economic value of ES provided by Natura 2000 are relevant in the case of Italy and, in particular, Lombardy, the Italian region hosting the highest number of Natura 2000 sites (242). The study considers the main potential ES delivered by the Natura 2000 network in Lombardy and performs a choice experiment exercise on two pilot areas (Adamello and Ticino Regional Parks) involving about 3,000 resident panellists at regional scale. Value function benefit transfer based on individual characteristics of respondents, land use and socio-economic characteristics of all regional municipalities has been performed as well. With few exceptions, results show an increase in willingness-to-pay (WTP) values that is consistent with the increase in the levels for attributes covered by the surveys. Besides providing some preliminary economic values, the research contributes to the development of a methodology for assessing and monitoring ES over time, with the aim to inform future policies and decision-making processes.

Keywords: natura 2000, protected areas, ecosystem services, choice experiment, benefit transfer

JEL Classification codes: Q57

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1. INTRODUCTION

Although the concept of ecosystem services (ES) dates back decades (Marsh, 1864) attention on and recognition of their role by both the scientific community and policy makers have increased in the last thirty years (Gómez-Baggethun *et al*., 2010) and brought to an explosion of interest in both the public and private sectors (Ruckelshaus *et al*., 2015). In recent years interest has grown in the investigation of ES monetary value to develop economic incentives for conservation (Jack *et al*., 2008) trough the creation of markets for ES and the implementation of Payment for Ecosystem Services (PES) schemes (Wunder, 2005).

ES are central to the European Union (EU) Biodiversity Strategy and their valuation can contribute to better-informed decision-making. In its resolution of 12 December 2013 on green infrastructure, the EU Parliament underlined the need to strengthen capacity and knowledge in relation to the mapping and assessment of ecosystems and ES. A crucial contribution in achieving goals set-up by the EU Biodiversity Strategy is expected by Natura 2000 (COM, 2011). Natura 2000 is the EU-wide network of nature protection areas designated under the 1979 EU Birds (79/409/EEC, replaced by 2009/147/EC) and the 1992 EU Habitats (92/43/EEC) Directives to assure the conservation of valuable and threatened species/habitats. It consists of 27,308 terrestrial and marine Sites of Community Importance (SCI) and Special Protection Areas (SPAs) stretching over more than 100 million ha (i.e. roughly 18% of EU territory) (European Commission, 2016). While Natura 2000 network is a cornerstone for biodiversity conservation and the implementation of the EU Biodiversity Strategy to 2020, the great potential of the ES concept to add value to current conservation approaches remains insufficiently explored (Harrison *et al*., 2010) and socio-economic as well as policy research on Natura 2000 is under-represented Popescu *et al*. (2014). As a consequence, there is a lack of quantitative and monetary data for the potential socio-economic benefits associated to the network (Gantioler *et al*., 2014).

Information gaps on the economic value of ES provided by Natura 2000 and protected areas are very much relevant in the case of Italy, one of the most bio-diverse countries in Europe (UNEP-WCMC, 2004), where the SCI and SPA network covers about 19% of the national area (European Commission, 2016). Italian territory and natural resources are strongly affected by anthropogenic factors and local ecosystems are at the same time threatened by human activities and a great resource for human wellbeing (MELS, 2013). This is particularly true for Lombardy (Northern Italy), the Italian region hosting the highest number of Natura 2000 sites (242) covering a total area of about 372,000 ha (i.e. 16% of regional area). These sites are home to 56 different habitats, 12 of which are considered of priority relevance according to EU Directives, as

well as to 82 bird, 83 other animal (i.e. mammals, fishes, invertebrates and amphibians) and 27 plant protected species.

The present study has been developed in the framework of Life+ Gestire Project (www.lige-gestire.eu) and aims to:

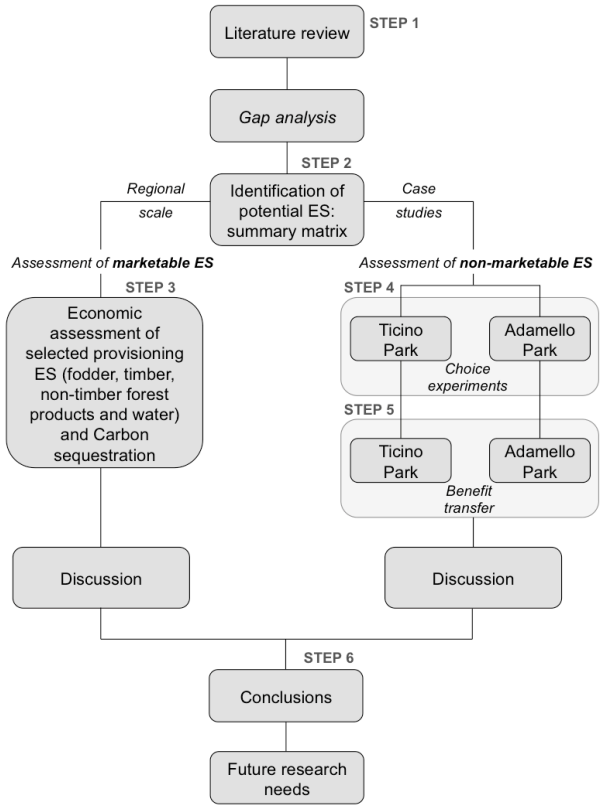
- Investigate available literature and identify information gaps on the economics of ES provided by Natura 2000 sites in Lombardy,
- Perform an economic assessment of the main ES provided by Natura 2000 network in Lombardy,
- Inform policy makers and set-up guidelines for future periodical recording and accounting of ES values.

The study is a premiere since no economic assessment of ES provided by protected areas at regional scale has been performed so far in Italy and only few of them have been performed within EU (Gibson *et al*., 2004; Chuan-Zhong *et al*., 2004; Hoyos *et al*., 2012). Study outcomes can then contribute to inform future policies in this sector, providing valuable inputs for decision-makers.

2. DATA AND RESEARCH METODOLOGY

The study builds on six methodological steps (Figure 1) that are described below.

Figure 1: overview of the methodological approach



(1) an **extensive literature review** of economic assessments of ES and Natura 2000 sites in Lombardy and area presenting comparable eco-geographical conditions, in order to identify data/knowledge gaps. The review has been conducted both through international scientific literature databases (e.g. JSTOR, Ideas, etc.)

and grey literature (e.g. project reports, thesis, monographs etc.) and has not included studies regarding marketed ES;

(2) the **development of a summary matrix** identifying the three main potential ES provided by each Natura 2000 site at regional scale. This included (i) an extensive analysis of the most recent (i.e. October 2014) official Standard Data Forms for each regional Natura 2000 site as available from the Ministry of Environment, Land and Sea, and (ii) identification and assessment of main potential ES per site based on a scoring system. Assessments and scoring systems adopted in similar studies (Bastian, 2013; Schirpke *et al*. 2013) were revised and adjusted according to: habitat state of conservation (i.e. A, excellent conservation, B, good conservation, and C, average or reduced conservation, as from official Natura 2000 Standard Data Forms), intrinsic heterogeneity and biodiversity (e.g. priority habitats), and ES density (i.e. score per hectare). The three ES with the highest scores were identified for each site. As for ES classification, the Common International Classification of Ecosystem Services (CICES) version 4.3 (CICES, 2016) was taken into account and adapted according to the Making Good Natura (MGN) Project[1] approach: a total number of 20 potential ES were taken into account and distinguished into provisioning, regulating and cultural services;

(3) **economic assessment of selected marketed ES** (i.e. fodder, timber, non-timber forest products (NTFPs), water provision, and carbon sequestration) provided by Natura 2000 network in Lombardy. Different market value approaches were used (transformation costs, substitution costs, etc.) depending on the ES, however since results for step 3 will not be presented in this paper, methodological details are not provided;

(4) a **choice experiment exercise** (McFadden, 1973; Louviere, 1991; Boxall *et al*., 1996) to estimate the marginal willingness-to-pay (WTP) for improving the quality of a set of attributes (i.e. ES) identified on the basis of step (2) above. Two different online questionnaires were developed for two pilot-sites in Lombardy as representative of both lowland (Ticino River Regional Park) and mountain (Adamello Regional Park) areas within the region (Figure 2). About 1,500 panellists were interviewed for each site: samples included visitors and non-visitors, living within Lombardy and ageing 18-65, and were stratified according to socio-economic characteristics and the distance from the sites (5 zones). For each site a set of 5 attributes was developed and different levels were identified for each attribute: both attributes and levels were discussed and agreed with the management staff of the two parks. A 5-year regional tax to improve quality of protected areas was used as a payment vector (Tables 1 and 2). Additional questions - based on a Likert-scale approach - were used to detect protests, thus allowing the choice experiment to be performed also by some of the respondents who stated they were not willing to pay the regional tax but gave positive replies (i.e. score>2 on a Likert-scale) to questions aiming to investigate reasons for them not to be available to pay.

Panellists were presented with 12 different scenarios with randomized distribution and they were asked to choose the most preferred among three alternatives. A total number of 120 choice sets were developed through an experimental design, selected through a statistical analysis software (Choicemetrics, 2014) and randomly distributed among questionnaires. Results from preliminary pilot studies (about 30 per study-site) were used to design the surveys through a Bayesian efficient design approach. Data collected were then tested and elaborated to estimate individual marginal WTP (WTPm) through both Multinomial Logit (MNL) (Boxall *et al*., 1996) and Latent Class Models (LCM) to take into account differences among respondents (McFadden, 1986; Kamakura and Wedel, 2004). MNL models were estimated through NLOGIT version 5.0 software, while LCM through Latent Gold Choice version 4.5. Based on individual WTPs,

[1] For further information see: www.lifemgn-serviziecosistemici.eu/EN/home/Pages/default.aspx

average WTPs per municipality were computed and mapped via ArcGis for municipalities covered by the two surveys;

Table 1. Attributes, their abbreviations and levels adopted for the choice experiment in the Adamello Park

Attributes	Abbreviations	Levels
Slope Stability	*STAB_10*	10 km safe roads (1/6 on 60 km) (baseline)
	STAB_20	20 km safe roads (1/3 on 60 km)
	STAB_35	35 km safe roads (7/12 on 60 km)
	STAB_45	45 km safe roads (9/12 on 60 km)
Flora Conservation	*CON_0*	0 ha meadows managed (baseline)
	CON_200	200 ha meadows managed (1/16 of total meadow area)
	CON_250	250 ha meadows managed (1/13 of total meadow area)
	CON_300	300 ha meadows managed (1/11 of total meadow area)
Fauna	*FAUN_2*	2 fauna sighting sites (baseline)
	FAUN_5	5 fauna sighting sites (+3 sites)
	FAUN_7	7 fauna sighting sites (+5 sites)
	FAUN_10	10 fauna sighting sites (+8 sites)
Recreation	*FLOR_1*	1 floristic trail (baseline)
	FLOR_2	2 floristic trails (+1 trail)
	FLOR_4	4 floristic trails (+3 trails)
	FLOR_6	6 floristic trails (+5 trails)
Landscape	*SEC_450*	450 ha dry-stone wall in good state (baseline)
	SEC_453	453 ha dry-stone wall in good state (+3 ha)
	SEC_455	455 ha dry-stone wall in good state (+5 ha)
Tax	*COST*	Regional Tax (0€, 2€,5€,10€,15€,20€)

Table 2. Attributes, their abbreviations and levels adopted for the choice experiment in the Ticino Park

Attributes	Abbreviations	Levels
Carbon sequestration	RCO_0	0% CO_2 emission reduction (baseline)
	RCO_5	5% CO_2 emission reduction (-0,42 tCO_2/year/inhabitant)
	RCO_10	10% CO_2 emission reduction (-0,84 tCO_2/ year/inhabitant
	RCO_20	20% CO_2 emission reduction (-1,67 tCO_2/ year/inhabitant)
Water quality	WATQ_2	Ticino River water quality (2 indicator species) (baseline)
	WATQ_3	Ticino River water quality (3 indicator species) (+1 species)
	WATQ_4	Ticino River water quality (4 indicator species) (+2 species)
Biodiversity	MAR_320	320 ha water meadow (baseline)
	MAR_400	400 ha water meadow (+80ha managed meadows)
	MAR_450	450 ha water meadow (+130ha managed meadows)
Landscape	BVED_0	0 scenic views with screened detractors (0 on 25) (baseline)
	BVED_6	6 scenic views with screened detractors (1/4 of total detractors)
	BVED_8	8 scenic views with screened detractors (1/3 of total detractors)
	BVED_12	12 scenic views with screened detractors (1/2 of total detractors)
Recreation	ITIN_62	62 thematic trails (baseline)
	ITIN_65	65 thematic trails (+3 trails)
	ITIN_67	67 thematic trails (+5 trails)
Tax	*COST*	Regional Tax (0€, 2€,5€,10€,15€,20€)

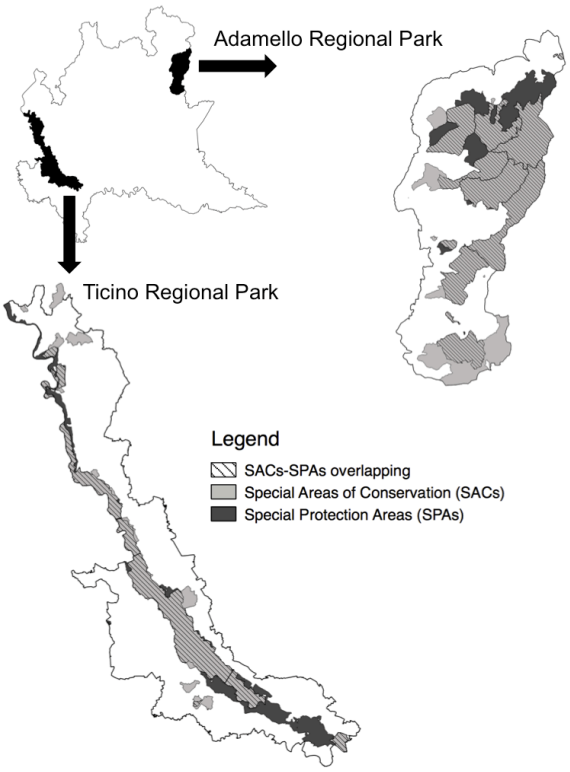
(5) **benefit function transfer (BFT)** from study sites to policy sites (i.e. all municipalities within Lombardy), based on about 60 different variables: 13 socio-demographic variables referred to single respondents and gathered through the questionnaires (e.g. age, gender, income, education level, number of

household members, etc.), 28 socio-demographic variables referred to single municipalities in Lombardy and gathered from official statistical sources at both national (Istat) and regional (Lombardy Region) scale (total population, population density, education levels, employed people, income levels, etc.), and 14 geographic and territorial variables referred to single municipalities in Lombardy (e.g. land cover, log distance from the two Parks, etc.) variables. As for the last group, reference was also made to substitute-sites (urban parks and green areas, camping areas, reserves, etc.) identified through geo-referenced data (layers) available from regional official geo-data databases. In particular the logarithmic distance of each municipality from substitute sites (as from ArcGis 'near' function) and the coverage of substitute sites within each single municipalities (as from ArcGis 'intersect' function) were taken into account. Different benefit transfer functions were analysed through multiple regressions. Once the BFT for a certain ES (i.e. attribute and level) was obtained it was used for inferring the corresponding ES value to all municipalities not covered by the surveys, adapting the inferred value to the characteristics of the policy sites;

(6) **drawing of conclusions** and identification of future research needs.

Results presented in this paper focus on all steps of the methodology except for steps (1) and (3). Special emphasis will be given to steps (4) and (5), while step (6) will be addressed within the discussion and conclusion sessions.

Figure 2: Study areas – Adamello and Ticino Regional Parks



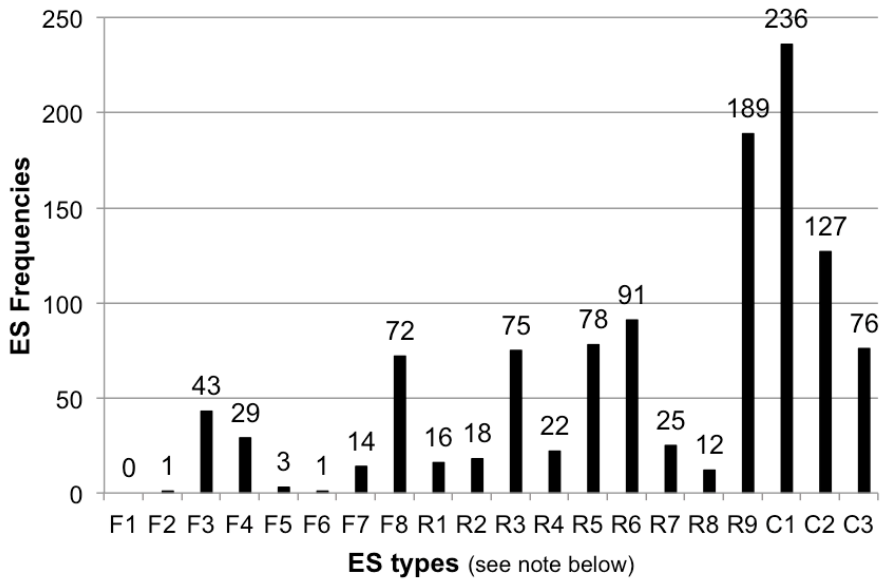
3. RESULTS

3.1. Main potential ES provided by the regional Natura 2000 network

When considering the main potential ES produced by Natura 2000 sites in Lombardy, the most represented among ES groups are regulating (47%) and cultural ones (39%), while provisioning ES are less present (14%). As for single ES, three of them prevail, covering about 50% of total ES potential production in Lombardy: C1, aesthetic value (21%), R9, biodiversity (17%) and C2, tourism and recreation (11%) (Figure 3). These top-3 ES are followed by a group of additional ES mostly dealing with water-related and hydrogeological issues -provision of drinkable water (F8), water-cycle regulation (R3), protection against erosion (R5) and hydrogeological services (R6)- as well as cultural and spiritual values (C3). Apart from the provision of drinkable water (F8) provisioning services seem to play a secondary role, with marginal contribution by game/fish (F3) and raw materials (F4).

When focusing on first, second and third ranking ES, the general trend is confirmed: aesthetic value (C1) ranks first in 209 out of 242 sites (86% of total), tourism and recreation (C2) is the most frequent among the second (26%) and third (25%) ranking ES and biodiversity (R9) is the second most frequent among the third ranking ES (19%).

Figure 3: Main potential ES provided by Natura 2000 network in Lombardy



Note:
Provisioning ES: F1: crops; F2: fodder; F3: game/fish; F4: raw materials; F5: non-timber forest products; F6: medicinal plants; F7: genetic resources; F8: drinkable water.
Regulating ES: R1: Carbon sequestration; R2: climate regulation; R3: water-cycle regulation; R4: water purification; R5: protection against erosion; R6: hydrogeological services; R7: pollination; R8: pest control; R9: biodiversity.
Cultural ES: C1: aesthetic value; C2: tourism and recreation; C3 cultural, education and spiritual value

3.2. Choice experiment

Results for choice experiments are reported separately for the two pilot sites, with a specific attention on issues dealing with WTP assessment.

a. Adamello Regional Park

The total number of respondents corresponds to 1,502 persons, consisting of both visitors (60%) and non-visitors (40%). About 97% of them (i.e. 1,461) performed the choice experiment. The MNL model was developed starting from a total number of 17,532 observations (i.e. 1,461 respondents x 12 choice sets). WTPm grows together with attribute levels but with significant differences depending on the ES taken into consideration. WTPm values are higher for meadow flora conservation (up to 8.19€ for 300 ha of managed meadow areas) and slope protection (up to 4.43€ for 45 km of safe road network). Increase in fauna sighting sites to observe wild fauna within their natural habitats is the less valued service: it ranges within 0.91€ and 1.07€ for additional five and eight sites respectively. Low WTPm values were observed also in the case of new floristic trails: WTPm for an additional trail is 1.09€, while WTPm for three and five additional trails is 0.76€ and 1.93€ respectively.

As regards LCM, a 8-class model was identified as the best econometric model due to the lowest Bayesian information criterion (BIC) and Akaike's information criterion (CAIC) values. A total of 127 parameters were estimated and the maximum log-likelihood value observed was 11,847.08. As a general remark the LCM seems to catch differences among respondents better than MNL, and all choice-variables are significant for all classes, expect for classes 3, 5, 7 and 8 (Table 3). The COST coefficient is negative for all classes, except for class 7, and significant for six of them. Outcomes of the LCM highlight differences among the eight classes. Class 1 tends to privilege slope stability but there are no evident differences with the other attributes taken into account. In addition to slope stability, Class 2 is sensitive to flora conservation within meadow habitats close to the forest margin, but not very willing to pay for the maintenance/restoration of dry-stone walls to enhance landscape value. Class 3 shows only two negative coefficients: flora conservation over a 300ha area (CON_300) and the building of five additional floristic trails (FLOR_6). This group seems to be interested to conservation and recreation aspects dealing with vegetation within the Park. This is also the case for Class 4 that however gives value to many other attributes, as confirmed by the fact that it shows significant coefficients for all attributes but dry-stone walls. As for Class 2, Class 5 shows higher WTPm values for slope stability and flora conservation within meadow habitats close to the forest margin. Class 6 includes respondents with high WTPm for flora conservation if large areas are involved (at least 300 ha) and, above all, the higher WTPm for the restoration of dry-stone walls among all the 8 classes. As for Class 7, characterised by a positive COST coefficient, the most relevant WTPm can be identified for slope stability (STAB_45), meadow-flora conservation (CON_250 and CON_300), and the building of five new floristic trails (FLOR_6). Finally Class 8, i.e. the smallest among the 8 classes, has primary interest for slope stability and flora conservation within meadow habitats close to the forest margin.

Table 3. Outcomes of the LCM for the Adamello Park

Choice (see Table 1)	**Class 1**		**Class 2**		**Class 3**		**Class 4**		**Class 5**		**Class 6**		**Class 7**		**Class 8**	
	Coeff.	z	Coeff.	z	Coeff.	z	Coeff.	z	Coeff.	z	Coeff.	z	Coeff.	z	Coeff.	z
COST	-1.20	-9.45	-0.22	-15.91	-0.01	-1.80	-0.05	-5.97	-0.37	-6.35	-0.09	-8.11	0.14	7.04	-0.03	-1.91
STAB_20	-0.18	-0.82	-0.02	-0.22	0.10	1.51	0.11	1.02	0.78	2.28	-0.17	-1.39	0.15	0.77	2.25	2.91
STAB_35	0.57	3.07	0.13	1.28	-0.14	-1.78	0.30	2.52	1.45	2.67	-0.57	-3.18	0.06	0.28	3.28	4.86
STAB_45	0.96	5.29	0.65	6.76	0.08	0.95	0.88	6.47	1.48	4.05	0.47	2.64	0.76	4.02	4.66	5.98
CON_200	0.69	2.88	0.33	3.17	-0.01	-0.19	2.33	8.44	5.56	4.10	-0.27	-1.25	0.37	1.66	1.39	4.85
CON_250	0.72	4.02	0.46	4.17	0.06	0.86	2.87	10.20	6.01	4.15	-0.53	-2.91	0.44	2.19	1.10	3.15
CON_300	0.69	4.16	0.82	7.75	0.20	2.50	3.83	12.56	6.86	4.62	1.19	8.37	0.88	4.49	1.88	6.28
FAUN_5	-0.13	-0.68	0.16	1.63	0.03	0.42	0.39	3.18	0.34	0.95	-0.42	-3.06	0.10	0.56	0.30	1.11
FAUN_7	0.48	2.49	0.44	4.63	0.11	1.41	0.28	2.17	0.09	0.32	-0.21	-1.33	-0.06	-0.36	0.29	1.06
FAUN_10	0.40	2.09	0.41	4.42	0.06	0.75	0.58	4.59	0.47	1.60	0.34	1.95	0.11	0.55	0.27	1.08
FLOR_2	0.06	0.23	0.10	1.18	0.11	1.50	0.39	3.72	0.28	1.12	-0.19	-1.39	-0.11	-0.60	-0.41	-1.35
FLOR_4	0.02	0.10	0.37	4.14	0.13	1.85	0.50	4.60	0.28	1.28	-0.66	-4.50	0.05	0.24	-0.36	-0.75
FLOR_6	0.61	3.18	0.47	5.49	0.32	4.13	0.87	8.06	0.41	1.54	-0.19	-1.22	0.42	2.17	-0.22	-0.43
SEC_453	-0.04	-0.26	-0.27	-3.67	-0.10	-1.75	-0.08	-0.84	0.10	0.45	0.30	2.02	0.00	-0.01	0.07	0.24
SEC_455	-0.03	-0.16	-0.06	-0.74	0.04	0.72	-0.07	-0.80	0.32	1.53	0.58	4.14	-0.01	-0.06	-0.10	-0.44
Log-likelihood	-11,847.08															
Size	26.64		21.33		15.97		12.07		8.60		8.59		3.54		3.26	

Source: own elaboration

b. Ticino River Regional Park

Total respondents were 1,500, including both visitors (51%) and non-visitors (49%). About 97% of respondents (i.e. 1,457) performed the choice experiment.

The MNL model considered a total number of 17,484 observations (i.e. 1,457 respondents x 12 choice sets). The highest WTPm values are identified for carbon sequestration: respondents are willing to pay from 2.77€ for 5% emission reductions to 9.61€ for 20%. Positive WTPm are observed also for Ticino River water quality (0.58€ for 1 additional indicator species and 1.55€ for two), water meadow conservation (0.89€ for the conservation of additional 80 ha and 1.18€ for additional 130 ha), and scenic views with screened detractors (0.87€, 0.56€ and 1.43€ for additional 6, 8 and 12 screened detractors respectively).

With reference to LCM, based on BIC and ACAIC values, a 7-class model was chosen and a total of 97 parameters were estimated. The maximum log-likelihood value observed was 11,839.64.

As for the Adamello Park, the LCM highlights the variability of conditions that can be identified within respondents and their choices: most of choice-variables are significant for all classes, expect for classes 2 and 4 (Table 4). Class 4 is also the only one showing a positive COST coefficient.

Class 1, covering about 22% of respondents, includes people who appreciate all attributes except for thematic trails that might have been considered to be already appropriate. The highest WTPm values are observed for CO_2 emission reduction (RCO_20) and landscape (BVED_12). Class 2 is mostly focused on CO_2 emission reduction as it might include non-visitors (as suggested by negative or limited WTPm values for landscape beauty and trails) who are likely to live in areas with relevant air-pollution conditions. Some (limited) interest on water quality can be identified as well. Similar conditions are found in Class 3 that however shows much higher WTPm values for CO_2 emission reduction compared to Class 2. Despite an anomalous positive value for COST, Class 4 presents positive WTPm values for both water quality (WATQ_4) and landscape (BVED_12). This class might consist of people who rely on water courses/bodies

for recreation activities. Class 5 shows interest for the highest attribute levels and negative WTPm values for lowest ones with reference to water meadows, landscape quality and, partly, CO_2 emission reduction. Class 6 shows positive WTPm values for all attributes except for thematic trails, with high WTPm values for CO_2 emission reduction. Finally Class 7 presents high WTPm values for CO_2 emission reduction, as well as the highest attribute levels for landscape beauty (BVED_12) and thematic trails (ITIN_67). On the contrary negative WTPm values are observed for both water quality and water meadow conservation.

Table 4. Outcomes of the LCM for the Ticino Park

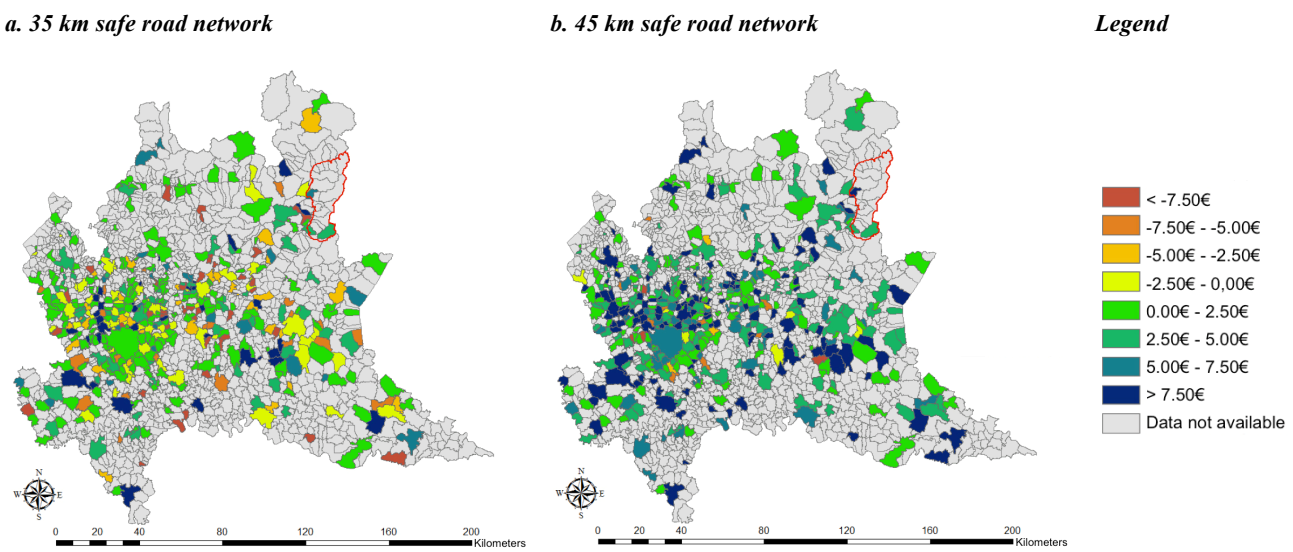
Choice (see Table 2)	**Class 1**		**Class 2**		**Class 3**		**Class 4**		**Class 5**		**Class 6**		**Class 7**	
	Coeff.	z	Coeff.	z	Coeff.	z	Coeff.	z	Coeff.	z	Coeff.	z	Coeff.	z
COST	-0.20	-18.88	-1.68	-9.32	-0.23	-15.81	0.02	3.47	-0.10	-9.88	-0.02	-2.90	-1.84	-3.76
RCO_5	0.25	2.88	-0.56	-2.15	2.53	11.86	-0.06	-0.81	0.27	2.25	1.49	5.52	22.66	3.31
RCO_10	0.33	3.47	0.13	0.48	3.00	13.36	0.00	-0.01	-0.23	-1.54	3.28	12.26	9.35	2.73
RCO_20	0.58	4.88	1.76	4.57	4.54	15.74	0.08	0.96	2.07	10.14	5.07	16.52	53.59	3.58
WATQ_3	0.03	0.40	0.28	1.21	0.17	1.87	0.09	1.53	-0.64	-5.80	0.20	1.69	-6.14	-3.76
WATQ_4	0.20	2.96	0.43	1.79	0.49	5.46	0.29	4.71	-0.56	-5.15	0.33	2.79	-2.51	-2.59
MAR_400	0.20	3.01	0.28	1.14	0.05	0.58	-0.08	-1.43	-0.12	-1.35	0.13	1.14	-6.14	-3.11
MAR_450	0.16	2.57	0.17	0.89	0.01	0.11	-0.01	-0.12	0.27	2.99	0.43	3.88	-0.16	-0.20
BVED_6	0.41	5.01	-0.34	-1.50	-0.06	-0.58	0.13	1.77	-0.05	-0.37	0.47	3.51	1.47	1.48
BVED_8	0.28	2.91	-0.96	-2.54	-0.45	-3.39	0.26	3.21	-0.85	-4.68	0.18	1.36	-7.56	-4.08
BVED_12	0.57	5.80	0.52	1.73	0.03	0.24	0.27	3.58	1.22	8.82	0.33	2.30	25.42	3.48
ITIN_65	-0.06	-0.86	-0.15	-0.66	-0.23	-2.44	-0.05	-0.83	-0.47	-5.09	-0.25	-2.13	-2.78	-2.67
ITIN_67	0.08	1.23	0.03	0.17	-0.06	-0.71	-0.01	-0.23	-0.03	-0.36	-0.07	-0.65	3.94	2.48
Log-likelihood	-11,839.64													
Size	21.96		21.41		16.49		13.77		11.43		11.42		3.52	

Source: own elaboration

3.3. Mapping

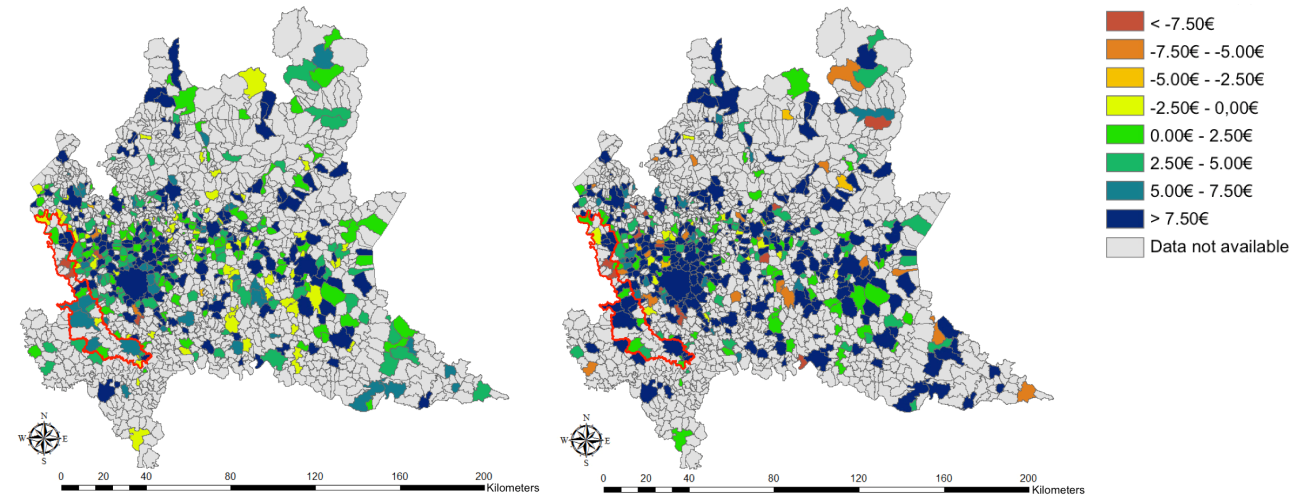
Based on individual WTP values estimated through LCMs, average WTP values were computed for each municipality included within the two surveys. Then values were used for a preliminary mapping of WTP values for attributes taken into account. Maps have been developed for all attributes, however results are just reported as examples for slope stability (Adamello Park) and carbon sequestration (Ticino Park) (Figures 4 and 5). Average WTPs for slope stability range between 2.28€ for 35 km (STAB_35) and 7.64€ for 45 km (STAB_45) of safe road network (baseline: 10km). In general terms Municipalities closer to the Adamello Park show more coherent WTP values compared to faraway Municipalities: this seems to suggest this attribute is mainly appreciated by locals. While WTP values identified for the 45km level are positive for most of Municipalities, the number of Municipalities showing negative WTP values is much higher for the 35km level.

Figure 4: Distribution of average WTP (€) within Lombardy Municipalities covered by the survey for 2 different levels of the attribute "slope stability" in Adamello Park



Average WTP values for reduced CO_2 emissions range between 8.30€ for 5% reduction and 24.75€ for 20% reduction (baseline: 0%). As regards the geographical distribution of WTP values for a 5% reduction, the average WTP values are positive for almost all Municipalities, with many of them (mostly in Milan area and in the central part of the region) ranking over 7.50€/person. This is even more evident when considering a 20% reduction level, especially in the Central-Southern part of the region, but also in Municipalities within and close-to the Ticino Park. Carbon sequestration therefore seems to be perceived as a relevant ES by population throughout the region and for any attribute level.

Figure 5: Distribution of average WTP (€) within Lombardy Municipalities covered by the survey for 2 different levels of the attribute "carbon sequestration" in Ticino Park



3.4. Benefit transfer

While in most of cases WTP values increase according to the improvement of investigated attributes some exceptions were found. This is for example the case of WTPs linked to the development of further thematic trails for recreation within the Ticino Park: WTP values observed in the case of 67 thematic trails (+5 trails) were often lower than those observed for 65 thematic trails (+3 trails).

When outcomes were found to be reliable, WTP values were estimated for the whole population at municipality scale by multiplying WTP values estimated through the BFT times the number of inhabitants per municipality. This was done, for example, for floristic trails in the Adamello Park: benefits estimated for additional trails mostly fall between 0 and 10,000 €/municipality (up to about 74% in the case of 2 additional trails, 68.5% in the case of 4 and 42.4% in the case of 6), nonetheless in the case of 6 additional trails a total WTP higher than 30,000€ is estimated for about 21% of Lombardy municipalities (Table 5).

Table 5. Distribution of Lombardy municipalities within different total WTP classes for different levels of the attribute "Floristic trails" in the Adamello Park (absolute and % values)

	2 floristic trails		**4 floristic trails**		**6 floristic trails**	
Total WTP (€)	n. Municipalities	% on total	n. Municipalities	% on total	n. Municipalities	% on total
Less than 0	81	5.2	110	7.1	89	5.8
0 – 5,000	863	55.9	748	48.4	383	24.8
5,001 – 10,000	277	17.9	311	20.1	271	17.6
10,001 – 15,000	118	7.6	138	8.9	177	11.5
15,001 – 20,000	50	3.2	68	4.4	137	8.9
20,001 – 25,000	24	1.6	27	1.7	89	5.8
25,001 – 30,000	12	0.8	17	1.1	73	4.7
More than 30,000	119	7.7	125	8.1	325	21.0
Total	**1,544**	**100.0**	**1,544**	**100.0**	**1,544**	**100.0**

Source: own elaboration

4. CONCLUSIONS

The economic rationale behind investing in protected natural areas, including Natura 2000 sites, is largely debated in Europe (Hoyos *et al*., 2012). Since management costs for Natura 2000 network are expected to increase (Gantioler *et al*., 2014) financing the costs of such investments represents a key political issue. At the same time it remains crucial to highlight the social benefits related to management choices and activities within the network, to increase its social acceptance and encourage new investments and co-funding initiatives.

This paper analyses non-marketed ES provided by protected areas and the economic value associated to management choices that might affect them. The research builds on the existing knowledge gap regarding ES provided by Natura 2000 network in Lombardy and aims to contribute filling this gap by investigating the value of such ES. Estimates highlight that respondents are more interested to and willing to pay for ES that are not strictly limited to surveyed areas, e.g. carbon sequestration. With few exceptions, results from both MNL models and LCMs show an increase in WTP values that is consistent with the increase in the levels for attributes included within the surveys. Furthermore LCMs stress different preferences within respondents, highlighting a broad diversity (and complexity) of choice behaviours that should be appropriately taken into account by policy-makers.

Besides providing some preliminary economic values, the research contributes to the development of a methodology for assessing and monitoring ES over time. It is recommendable to further assess variables influencing WTP by revising the list of socio-demographic and territorial variables used to develop the BFT as well as to adopt spatial-econometric approaches, in order to take into consideration spatial correlation among data/WTP values. Although it is not possible to identify impacts of these measures *a priori*, it can be assumed they are likely to improve the quality of BFT outputs,

Through further development and implementation of this methodology regular monitoring and assessment of Natura 2000 benefits could be achieved. This would be in line with the requirements recently set by the environmental norms included within the 2015 Italian Budget Law and -in more general terms- could provide an informative basis for developing future policies as well as supporting decision-making by other relevant actors (companies, citizens, private donors, etc.) in order to sustain the contribution of Natura 2000 areas to rural development and bio-based economy.

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