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Valuation of Ecosystem Services in Protected Areas: The Case of the Abisko National Park (Sweden)

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Abstract

Sub-Artic ecosystems have evolved and adapted to extreme environmental condition. Yet, these ecosystems are vulnerable to local and global impacts due to human activities and climate change. In addition, a controversial debate over land use in the Swedish Lapland is still open, involving different stakeholders' interests and activities. The Abisko National Park (Swedish sub-Arctic Lapland) is one of the Europe's largest remaining wilderness areas and an important tourist attraction. In this study, an economic valuation of the main ecosystem services (ES) was performed by using the Contingent Valuation (CV) method. The categories of ES generated in the Park were identified and tourists were chosen as main stakeholders in the area. Tourists were then interviewed about their perception on ES and their willingness to pay (WTP) for supporting conservation activities capable of preserving the functionality of the Park to provide different goods and services. Results show that 61% of the respondents were willing to pay for the implementation of adaptation strategies coping with climate change impact. The mean individual WTP were found to be 6.20 € for the provisioning services, 5.69 € for the regulating services, 6.35 € for supporting services, 4.09 € for cultural services, while the total mean WTP per tourist was found to be 22.33 €. In addition, statistically significant correlations between tourists' perceptions and individual WTP for three ES categories were found. These outcomes could support local decision makers in charge for the implementation of climate change adaptation strategies in the Park. However, it is important to remark that for a more comprehensive assessment of ecosystem services and their role in support of human well-being, the economic valuation should be integrated by a solid biophysical accounting.

1 Introduction

The establishment and management of protected areas are recognized as viable strategies to promote nature

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conservation while facing the increasing problem of global biodiversity loss (Emerton et al., 2006). Over the years, conservation mandates have expanded to include the improvement of human welfare and contribution to local sustainable development (Naughton-Treves et al., 2005; Baral et al., 2008). It is often stated that the establishment of protected areas can have a positive influence on employment and local economy, especially in rural and sparsely populated regions (Fredman, 2004; Swedish Environmental Protection Agency, 2004). However, many human-induced pressures like land use change (e.g., logging, mining, agricultural expansion) around protected areas (DeFries et al., 2007), climate change (Turpie, 2003), biological invasions (Pejchar and Mooney, 2009) and financial underfunding (Baral et al., 2008) can compromise the long term maintenance of protected areas. Hence, efforts in both academic and policy area are needed to show the potential value of protected areas, also allocating adequate resources for their management.

One of the emerging approaches used to show the ecological and socio-economic role played by protected areas is the ecosystem services assessment (Tallis et al., 2008; Berghöfer and Dudley, 2010; Häyhä and Franzese, 2014; Häyhä et al., 2015). Ecosystem services (ES) represent the benefits that humans obtain directly and indirectly from well-functioning ecosystems (Fisher and Turner, 2008). Several studies have already illustrated win-win scenarios that can emerge between conservation practices and enhancement of ES (Chan et al., 2006; Reyers et al., 2012). In fact, protected areas are considered to be hotspots for many ES such as biodiversity maintenance, climate, nutrient, and flood regulation, wood, food, and water provision as well as tourism and recreation (Figueroa and Aronson, 2006).

Over the past two decades numerous studies have investigated the coupled human-environment systems within the protected areas under three main perspectives: 1) biophysical assessment of natural and human-driven flows supporting ecological structures and functions as well as the exploitation of ecosystems' goods and services (e.g., Franzese et al., 2008; Viglia et al., 2013), 2) social assessment based on perceptive analysis of ES among different stakeholders (e.g., Sodhi et al., 2009; Martín-López et al., 2012), and 3) economic valuations (e.g., ten Brink et al., 2011).

In relation to the latter, various economic valuation methods have emerged and improved over time to estimate the value of the ES. Cost-based (mainly avoided damage cost and replacement cost method), revealed (travel cost and hedonic price method) and stated preference (contingent valuation, choice experiment and conjoint analysis) methods have been developed to assess the economic value of many ES that are not fully reflected in the monetary transactions in the market (Wittmer et al., 2010). The reason origins in the "public good" nature of some ES: any number of people may enjoy a public good without affecting the amount available for others (Boyd and Banzhaf, 2007).

The decision to apply stated preferences methods in this study is motivated by the type of ES categories (provisioning, regulating, supporting and cultural) and the target beneficiaries (tourists). It can be argued that indirect approaches could not be suitable in some cases of ES (e.g. biodiversity) since relevant market could be missing (Kriström, 1990). Among the stated-preference methods, Contingent Valuation (CV) has been commonly used for valuing variety of ES in different natural areas (Mitchell and Carson, 1989; Alberini and Kahn, 2006). CV is a survey-based method where respondents directly state their preferences for quantitative or qualitative changes in ecosystem goods and services. Particularly in protected areas, CV has been employed to assess the economic value of a single ecosystem service like recreation (Lee and Han, 2002) and biodiversity (Martìn-López et al., 2007a; Voltaire et al., 2013) or of bundle of ES (Mattsson and Li, 1993; Martìn-López et al., 2007b; Castro et al., 2011). Some studies have examined the relationship between people's attitudes towards protected areas (e.g., nature users, culture users, one-day visitors) and stated willingness to pay (WTP) for provision of multiple ecosystem services (e.g., Martín-López et al., 2007b).

The intent of this study is to assess tourists' perception on the value of each category of ES generated in a Swedish protected area. Abisko National Park was chosen as an example of protected area affected by climate change and facing different environmental pressures: e.g., mining activities in the surrounding areas, reindeer pasture, and tourism expansion (Gordon et al., 2002). The first research question of this study was to explore whether is possible to estimate the potential financial benefit supported by tourists that visited ANP during the summer period. For this purpose, CV was used to estimate the tourists' WTP for the conservation activities oriented to preserve the provision of ES. The second research question of this study was to investigate whether tourists' attitudes, their current awareness and perceived importance of the chosen ES category could

influence their WTP for the same ES category (provisioning, regulating, supporting, and cultural services).

2 Material and methods

2.1 Study area

Abisko National Park (N 68°21′34″, E 18°46′39″) is situated in the sub-Arctic Lapland, in the northwest of Sweden. Established in 1909, with the aim of preserving the typical Nordic mountain environment and its scenic beauty, this Park represents one of the Europe's oldest and last remaining wilderness areas. It is an important tourist attraction due to the presence of the famous hiking path Kungsleden. It is situated near the Abisko village which has 110 inhabitants and it is 100 km and 80 km away from respectively Kiruna (Sweden) and Narvik (Norway), the two closest bigger cities (Statistics Sweden, 2010).

ANP is characterized by 7,700 ha of mainly sub-alpine birch forests (*Betula pubescens ssp. czerepanovii* (Orlova) Hämet-Ahti) (43.6%), natural grasslands (34.1%), water bodies and courses (10.2%), mixed forest, composed by Scots pine (*Pinus sylvestris* L.) and sub-alpine birch, (9.6%) and a small fraction of bare rocks and dunes, beaches and sands (2.4%). ANP incorporates a part of the Swedish largest alpine lake Torneträsk and the Abiskusuolu island (Figure 1).

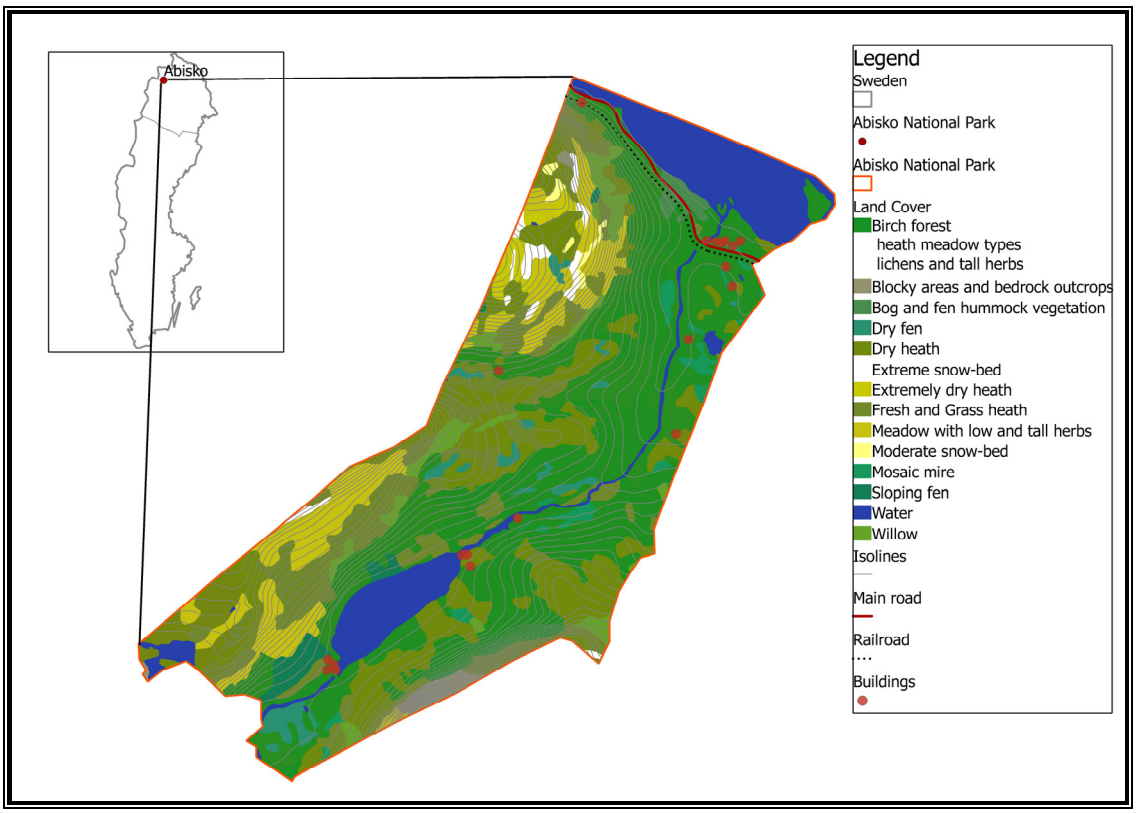

Fig.1 Land use and land cover of the Abisko National Park, Sweden

The Abisko area has the lowest annual rainfall in the country with around 300 mm per year. The highest average temperature is +11°C while the lowest is around -12°C. Its altitude ranges from 340 m a.s.l. in the low valley up to 1750 m a.s.l. in the surrounding mountains.

ANP is part of a complex cultural and ecological context affected by a controversial debate over land use which makes its presence important for socio-economic and conservation interests. The Park area is used for reindeer herding, tourism activities, and it is a cornerstone for subarctic and environmental research. ANP is

part of the reindeer herding core area of the Gabna community. The reindeer pasture is a centenary Sàmi tradition still practiced nowadays, even though more heavily supported by technology (e.g., use of snow bikes and helicopters to follow migrations). On the other hand, the establishment of the railway and the main road built as a consequence of mining activities and tourism expansion created a solid ground for regional development (Tolvanen et al., 2005). Two main tourism facilities are located in the ANP: the Abisko Tourist Station and the Abiskojaure hut hosting the majority of the tourists visiting the Abisko area. In addition, a modern research station (the Abisko Scientific Research Station) also takes place in the near surroundings.

The presence of the railway (used also for transporting ore from the mining located in Kiruna), the road, and the reindeer herding were considered major environmental pressures within the ANP (Emanuelsson, 1987). Pressures consist mainly in cutting trees for firewood and fences, increased reindeer husbandry, and later on, tourists' activities. However, at present, the influence of tourism is considered to be weak to moderate (Gordon et al., 2002; Callaghan et al., 2013).

2.2 Ecosystem services in ANP

Many goods and services characteristic of the Arctic ecosystems are also found in the ANP.

Provisioning services include wood, food, and water provision as well as forage for the livestock (reindeers). Despite the large use of Swedish forest for production purposes, national parks have their own regulation which prohibits wood extraction for individual or commercial purposes. In the ANP, the sub-alpine birch forest cannot be used by Park's users except for the Sàmi people that are allowed to collect branches for fires or shelters (Swedish Environmental Protection Agency, 2012). Park's users are allowed to collect edible mushrooms and wild berries (bilberry, crowberry, cloudberry, and lingonberry) which are also collected in the Abisko region for commercial purposes (Callaghan et al., 2013).

Regulating services include climate regulation, and water and nutrient regulation. Climate regulation, in particular, is extremely important in the subarctic ecosystems witnessing major temperature rise (from an average of -1°C in 1913-1922 period to a 0.6 °C in 2000-2009 period) over the past century (Van Bogaert et al., 2011). The consequences are alarming and transversal (Callaghan et al., 2013): snow melting, increased precipitation, permafrost thaw, among others.

Cultural services include tourism and recreation as well as aesthetic and spiritual values. Tourism in ANP increased steadily after the construction of the railway and road. While robust statistics on tourists in the Park are not available, their presence is estimated in about 40,000 tourists per year (Wall, 2003). Tourists visit the ANP because of the possibility of performing recreational outdoor activities in both summer and winter seasons.

Supporting services comprehend habitat and species diversity, net primary production, and soil formation. These services are vital for the maintenance of other ecosystem services.

Still, for the survey's purpose some ecosystem services from each category (provisioning, regulating, cultural and supporting) were selected following the guidelines of the Nordic TEEB report (Kettunen et al., 2012). These ES have been chosen based on their importance in the Arctic ecosystems, sensitivity to climate change and human-induced activities, and in order to have a comparable number of ES for each category considered.

2.3 Data collection

Tourists' perceptions on the importance of bundle of ES and the WTP for the maintenance of their provision under climate change scenario were assessed through a semi-structured questionnaire. The CV survey was pre-tested with volunteers visiting the ANP. The volunteers discussed their understanding of the climate change issue and ES concept and gave feedbacks on the clarity and flow of the questionnaire content, provision of sufficient information, and time needed to fill in the questionnaire. Modifications were made based on comments and suggestions given by tourists and researchers of the Abisko Scientific Research Station. Subsequently, the questionnaire was conducted face-to-face to 165 visitors in several spots of the ANP in the pe-

riod September – October 2013. For this purpose, it was used a convenience sampling, interviewing summer tourists above 18 years that have already visited the protected area during their stay. The refusal rate was 6.1% (11 people refused to respond to the questionnaire). The questionnaire was administered in three sampling places: the Abisko Tourist Station, the Nature Museum (Naturum) and in front of the entrance to the protected area. The survey lasted approximately 10 minutes per person. Careful description was provided upon requested clarification in order to avoid misunderstandings and, in the same time, any possible leading of the respondent towards passive acceptance (Blamey et al., 1999). In particular, upon request from the respondents, interviewers provided additional information regarding the different categories of ES and the impact of climate change. The additional information was provided as objectively as possible in order to avoid influencing the answers of respondents.

The questionnaire comprised 17 closed-form questions and 2 open-form questions subdivided in four thematic sections, following standard procedures described by Arrow et al. (1993). Section 1 focused on the tourists' motivations to visit the ANP, the length of their stay as well as previous visits in other Swedish parks. Section 2 assessed the tourists' opinions on the importance of the conservation practices in the Park and previously defined ES categories as well as the gravity of the potential climate change impact on the ecosystem services generated in the ANP.

The ES selected in the survey were divided in four categories namely: provisioning services (wood, food, water provision, and reindeer pasture), regulating services (climate, water and nutrient regulation), cultural services (tourism and aesthetic values), supporting services (habitat and species diversity) (Kettunen et al., 2012). Tourists' perceptions on the importance of each ES category in the ANP were investigated using a 5-point Likert scale (from 1 = not important to 5 = very important).

Section 3 assessed the tourist's WTP contingent on specifically defined hypothetical scenario highlighting the current threats on the Sub-Arctic ecosystems and their services and describing possible initial adaptation strategies needed as a response to the climate change. The respondents that confirmed their WTP were asked to first state their total WTP amount and distribute this amount among the four categories of ES.

An open-ended (OE) response format was adopted. This approach can provide a lower (conservative) WTP value than other methods. Donation (contribution) form was used as a way for determining tourists' WTP, as in Sweden, by law, all the parks are free (i.e., no entrance fee can be assessed as payment vehicle). Tax as a payment vehicle was not used because of the elevated number of foreign tourists visiting the ANP. The respondents were briefly introduced to the visible impacts of the climate change in the Arctic ecosystems and the ANP and to the preliminary activities that would be set in place by the Park's management (which is going to administer the collected findings) together with Abisko Research Station to adapt to these changes (long term monitoring, environmental assessment, awareness campaign at the initial phase, creation of buffer zones). In this stage of the survey, respondents were asked to state their WTP - a lump sum payment per person - for the adaptation programme. They were also reminded to consider both their budget constraints and the fact that ANP is only one of the national parks located in Northern Sweden in order to avoid overstating their WTP.

Section 4 requested personal information of the respondents such as gender, age, level of education, country of origin and income.

2.4 Statistical analysis

Tourists' perception on different categories of ES was investigated using non-parametric statistical tests. Since normal distribution could not be guaranteed and the number of observations was limited, the non-parametric tests of Kruskal-Wallis and Mann-Whitney were used for statistical analysis of this section ($\alpha = 0.05$).

A Tobit model was fitted to analyze the data and generate a predictive model of WTP (Tobin, 1958). It is a censored (or truncated) regression model in which the range of the dependent variable (WTP values) is constrained in one way: above or below. In this particular case the censoring was made from below with threshold set to zero, meaning that values below zero were constrained.

In cases of relatively large numbers of zero values, Tobit regression models using maximum likelihood es-

timation are preferred to linear models using ordinary least squares (OLS), as they predict only positive rational WTP values (Tobin, 1958; Maddala, 1983). In this case the OLS method has a specific distribution, having many data concentrated on zero value, and a continuous positive distribution of WTP amounts that includes those who were willing to pay. Hence, OLS estimates are downward biased.
The Tobit model can be written as:

$$Y_i = \begin{cases} X_i\beta + e_i & \text{if } Y_i > 0 \\ 0 & \text{otherwise} \end{cases}$$

where

Y_i is the Willingness-To-Pay;

X_i the vector of explanatory variables;

β is the regression coefficient;

e_i is a random disturbance term.

The Tobit model has been still widely employed in CV surveys using open-ended WTP questions and having relatively high percentage of zero values (Halstead et al., 1991; Martín-López et al., 2007a; Adams et al., 2008; Bowman et al., 2009). We used the LIMDEP statistical package and R Studio to run the Tobit regression model. Description of the selected set of predictor variables is included in Table 1.

Table 1 Explanatory variables used in the Tobit model

Variable name	Code	Description
Visits	Continuous variable	Number of visits in ANP
Climate Change	Ordinal data (5 point scale: -2 = quite negative, 2 = quite positive)	Climate change impact on the provision of goods and services of the ANP
Conserve	Ordinal data (5 point scale: 1 = not important, 5 = very important)	How important is the conservation of the environment in the ANP
Research	Ordinal data (5 point scale: 1 = not important, 5 = very important)	Importance of the research and education activities as motivation for visiting the ANP
Age	Age categories from 1 – 3	1 is referred as lowest age category (less than 30 years), 3 is the highest age category (more than 50 years)

3 Results

3.1 Tourists' profile

Results of the socio-demographic analysis showed that 50.9% of the respondents are male and 49.1% female. The majority of tourists are between 18 and 30 years old (38.8%), followed by the 31-50 year age category (34%), and more than 50 years age category (27.2%).

Sweden was indicated as Country of origin by 71 respondents (43% of the interviewed) out of which 44% come from Norrland county (where is located the ANP), 38% from Svealand county (38%), and 18% from Götaland county. European tourists (40%), mainly Germans, Dutch, Norwegians, and Belgians, dominated the foreign respondents, followed by Japanese (4%) and Australian (4%) tourists.

The respondents have relatively high levels of education: 37.3% of the respondents hold post-graduate degrees and 33.5% bachelor's degrees. About 25.5% of the respondents have a high school diploma and only

3.7% have elementary education.

About 26% of the respondents did not state their income category. As for the remaining respondents fairly similar percentages were obtained across the income categories: 34% of the interviewees stated an average monthly individual income of more than 3,500 €, 34% stated income of less than 1,500 € per month and 31% stated monthly income within the range of 1,501 - 3,500 €.

Regarding to the tourists' attitudes, nearly half of the respondents, mainly Swedish (68% of the repeated tourists) and Germans (12%), have previously visited the ANP. Major motivations to visit the Park included the possibility for outdoor recreation activities (mean=4.45, st.dev.=0.93) - like hiking, trekking, dogsledding, caving - followed by experiencing the nature (mean=4.37, st.dev.=0.93), also due to the aurora borealis (Northern Lights) phenomenon, an event that draws major attention especially to the overseas tourists. The unique landscape scenic beauty was the third most important driver for visiting the Park (mean=4.36, st.dev.=0.99), followed by the presence of wildlife (3.65, st.dev.=1.17), presence of lodging facilities (3.32, st.dev.=1.15) and possibility to conduct research, education or study activity (2.63, st.dev.=1.33). The minimum stay is one day while the maximum is 30 days (the average stay in the Park was 3.8 days).

3.2 Tourists' perception on ecosystem services

Respondents rated highly the importance of nature conservation in this protected area (mean=4.70, st.dev.= 0.63). However, around 20 tourists, mainly hikers, individuated littering as the most evident sign of tourists' pressure on the environment and as an issue to be properly addressed by the Park's management.

Tourists' opinion on climate change impact and its effect on the provision of goods and services in the ANP was assessed using 5-point Likert scale (from -2 = quite negative impact to +2 = quite positive impact). Results showed an average value of -0.55 (st.dev.= 1.09), meaning that most respondents recognized climate change as threat for the maintenance of ecosystem services.

In assessing the importance of the above listed categories of ES, relatively high values were attributed to all categories (Table 2). An average value of 4.26 was assigned to the supporting services, followed by 4.24 for the provisioning services, 4.21 for the regulating services and 3.99 for the cultural services.

Table 2 Importance of ecosystem services (ES) generated in the Abisko National Park.

	Provisioning services (N=157)	Regulating services (N=144)	Cultural services (N=158)	Supporting services (N=154)
Mean	4.24	4.21	3.99	4.26
Median	4	4	4	5
St.dev.	0.79	0.80	0.96	0.89

The non-parametric test of Kruskal-Wallis showed statistically significant differences among ES categories (K observed value=8.980, K critical value=7.815, p-value=0.030). In addition, the non-parametric test of Mann-Whitney showed statistically significant differences between provisioning services and cultural services (U=14005.0, Expected value=12403.0, p-value=0.034) and between supporting services and cultural services (U=10073.0, Expected value=12166.0, p-value=0.005). Therefore, tourists perceived supporting services as the most important and cultural services as the least important category of ES.

3.3 Willingness to pay (WTP)

The results of the Contingent Valuation showed that 61% of the respondents were willing to pay (contribute) for the implementation of adaptation strategies coping with the climate change issue. The WTP value of these respondents ranged from 2€ to 376€. About 48% of the respondents were willing to pay an amount in the range between 2€ and 30€, 33% an amount between 31€ and 60€, and 8% an amount between 61€ and 100€.

Only 11% stated an amount higher than 100€, with an upper limit of 376€.

The results of this survey showed that a relatively high percentage of respondents (around 40%) were not willing to pay for the development of adaptation strategies and many of these respondents motivated their choices in the follow-up questions.

The main reasons for not paying can be divided in zero values and protest bids (Figure 2 and 3). Zero value arises when respondents do not value the good and will always refuse to pay any positive amount for it. In this survey, zero values were given by respondents that did not earn relatively high income or put conservation practices in ANP as a low priority target. Protest bidders, on the other hand, state a zero WTP value not necessarily because they are indifferent to the public good being valued (in this case the Park's ecosystem services) but due to their disagreement with a particular feature of the survey, like the payment vehicle or the institutional framework in which the scenario is inserted (Halstead et al., 1992). This means that some of them might actually give a positive value for the good in question. Around 50% of the total bids were protest bids while 20% were zero values (the rest of the respondents did not provide an explanation). In the "Protest" category, over 60% were not willing to pay because believed that the State should provide financial resources to tackle the climate change issue; 16% objected the idea of contributing financially and 9% was related to the "*Allemansrätten*" (the every man's right of free access to and use of public and private land; Bostedt and Mattsson, 1995; Tolvanen et al., 2005); another 13% disagreed with the payment vehicle, arguing that by contributing for the implementation of adaptation strategy in terms of somewhat higher taxes (Boman and Mattsson, 2008), these kind of projects will have long term financing. These protest responses are common among Swedish surveys dealing with environmental issues (Söderqvist and Scharin, 2000; BalticSTERN, 2013). The protest bids were excluded from the Tobit model.

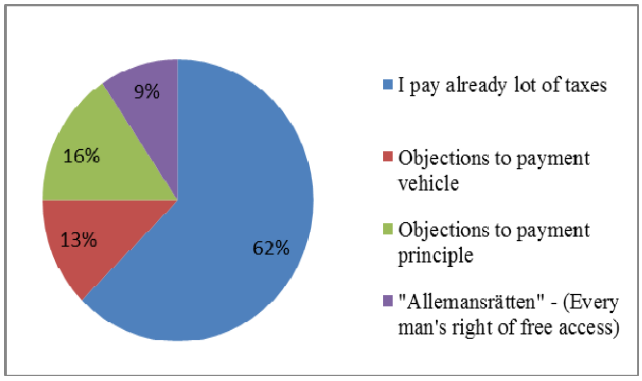

Fig. 2 Protest bids (50.6% of total refusals).

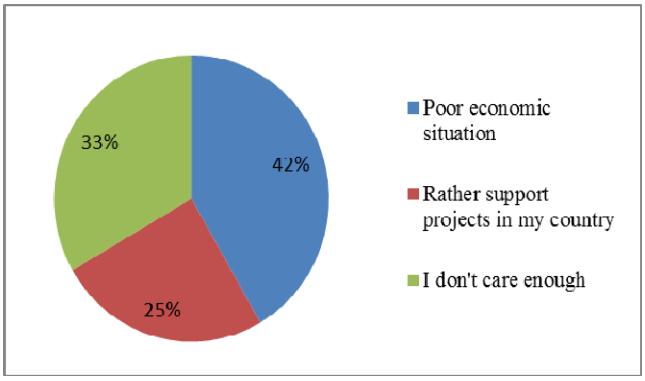

Fig. 3 Zero values (20% of the total refusals).

Among the zero values, major part of refusals of the WTP question was due to the poor economic situation (42%), followed by scarce interest in climate related projects (33%), and preference for contribution elsewhere (respondent's homeland 25%).

Table 3 summarizes the outcomes of the Tobit model having as dependent variable the individual WTP for each category of ES (continuous variable) and as explanatory variables the opinion on conservation and climate change (5 point Likert scale), age (three age group categories), research as motivation for visit (5 point Likert scale), previous visits in parks (continuous variable) (Table 3).

The mean individual WTP estimated by the Tobit model was found to be 6.20 (st.dev.=2.23) for the provisioning services, 5.69 (st.dev.=1.84) for the regulating services, 6.35 (st.dev.=1.97) for supporting services, 4.09 (st.dev.=1.21).

The positive coefficient for the variable "Conserve" indicates that those visitors who rated highly the conservation of the environment and typical landscape in protected areas are also more willing to contribute. This variable is statistically significant at 1% level across each category of the ES. Respondents who perceive adverse impact of climate change on the ecosystem services in the Park are willing to pay for the maintenance of each category of ES (variable "Climate change", 10% level of significance). The respondents who have not visited ANP frequently are willing to pay more for conservation of each ES in the Park (variable "Visit")

(Reynisdottir et al., 2008). People that perceived that ANP is important for research and educational purposes were willing to pay more for the maintenance of mainly provisional and regulating services. Older tourists were willing to pay more for the adaptation strategies in the Park (Variable "Age") in the case of the provisioning and regulating services. This outcome is opposite to the outcomes of other similar studies conducted in Northern Europe (Kriström, 1990; Pouta et al., 2000), likely due to the tourist socio-economic and attitudinal profile. In particular, younger tourists (less than 30 years) were associated to lower income while older tourists (more than 50 years) were those detaining higher income and more involved in environmental organizations. Membership in environmental organizations and income were expected to have positive sign, but they were not statistically significant in none of the Tobit models.

Table 3 Tobit model for each category of ES.

	WTP for provisioning services	**WTP for regulating services**	**WTP for supporting services**	**WTP for cultural services**
Variable	Coefficient (St.dev.)	Coefficient (St.dev.)	Coefficient (St.dev.)	Coefficient (St.dev.)
Constant	-61.12*** (17.06)	-49.08*** (15.24)	-57.86*** (16.72)	-43.87** (12.92)
Visits	-0.01** (0.04)	-0.01** (0.03)	-0.01** (0.00)	-0.005* (0.003)
Climate Change	-0.04* (0.02)	-0.03* (0.02)	-0.04* (0.02)	-0.03* (0.02)
Conserve	10.84*** (3.54)	8.65*** (3.16)	10.42*** (3.47)	7.85*** (2.67)
Research	0.02* (0.01)	0.01* (0.003)	0.00 (0.00)	0.00 (0.01)
Age	6.93** (3.66)	5.47* (3.32)	4.86 (3.66)	2.01 (2.72)
WTP	6.20 (2.23)	5.69 (1.84)	6.35 (1.97)	4.09 (1.21)
Log likelihood function	-421.66	-401.56	-428.70	-365.37
Info. Criterion: AIC	5.13	4.90	5.22	4.46

Note: *** p-value <0.01, significant at 1%. ** p-value < 0.05, significant at 5%. * p-value < 0.10, significant at 10%.

3.4 Correlation analysis between tourist's beliefs, attitudes and WTP

The Spearman's correlation was applied distinguishing between two groups of data. The first analyses the correlation between tourist profile (age, gender, and origin) and general attitudes and behavior (perceived importance of conservation programmes, motivations for visiting parks, and membership in an environmental organization). The second group analyses the relationships between general attitudes and behaviors and the willingness to contribute for a specific conservation programme in the ANP (here we used the WTP amount for each categories of ES).

In the first group, statistically significant correlations were found between age and environmental organization membership (R=0.221, p-value=0.005) and between origin and environmental organization membership (R=-0.231, p-value=0.003), meaning that the interviewed Swedes visiting the Park were more involved in environmental organization.

Statistically significant relationships were also found between education and perceived importance of conservation practices (R=0.183, p-value=0.020) and between age and outdoor activities (R=-0.188, p-value=0.018), meaning that relatively younger visitors choose this Park because of the possibility to do outdoor-related activities.

In the second group, statistically significant correlations were found between perceived importance of the ecosystem services and WTP amount for: provisioning services (R=0.215, p-value=0.007), regulating services (R=0.274, p-value=0.001), cultural services (R=0.212, p-value=0.008), and total WTP amount (R=0.224, p-value=0.005).

Finally, the perceived importance for conservation practices was found to be significantly correlated with the WTP amount for provisioning services (R=0.178, p-value=0.022), regulating services (R=0.172, p-value=0.027), supporting services (R=0.160, p-value=0.040), and cultural services (R=0.175, p-value=0.025).

4 Discussion

Since specific statistics on tourists in the ANP are not available, a comparison between the summer tourists' profile obtained from this survey and those obtained in other studies conducted in this Park were compared (Heberlein et al., 2002; Wall-Reinius and Bäck, 2011). Similarities were found in the gender representation, relatively high education background, tourists' origin (majority of Swedish tourists followed by north and central European tourists) and high share of repeated tourists.

According to the abovementioned studies, the main reasons for visiting the ANP included Park's landscape and scenic beauty, possibility of outdoor activities and availability of services, which were also confirmed in our survey.

4.1 Importance of ES in the Abisko National Park

Supporting services, particularly habitat and biodiversity, obtained the highest score in the survey. Further investigations on the reason for their importance suggested that many of the tourists perceived biodiversity as the presence of charismatic species in the Park (use value, Reyers et al., 2012). High importance of the use value of the biodiversity was also found in Martìn López et al. (2012) focusing on the opinion of tourists on the importance of selected ES categories.

Provisioning services were highly valued both in terms of importance and WTP. This is most probably due to the high density of non-wood forest products (edible mushrooms and berries) which have commercial value outside the ANP (Callaghan et al., 2013). Moreover, fodder availability for livestock is very important for the preservation of the Sami traditional reindeer husbandry.

Tourists, even though main users of the cultural ecosystem services, expressed lower average value for this category. This could be due to the fact that a great percentage of tourists (Dutch and Belgian) perceived a potential trade-off between cultural services (tourism) and conservation activities: the ongoing and increased littering over the years, for instance, was perceived as a first sign of human pressure on the Park.

Tourists perceived climate change as a potential risk for the maintenance of all ES. Climate change was also perceived as a current threat by a particularly vulnerable group - the Sami people. Furberg et al. (2011) interviewed 14 Sami people located in the northwest part of Sweden (Abisko included). The majority of the respondents perceived both daily and long term environmental changes (e.g., longer, wetter, and warmer autumns, late water freezing, vegetation change, treeline rising) and were worried about their potential adverse impact on reindeer husbandry.

4.2 Comparison with other WTP case studies

In order to give an individual WTP for implementing an adaptation programme in the Park we calculated two total WTP values: one is calculated as a sum of the values of the three categories of ES, namely provisioning,

regulating and cultural ES (to avoid issues of double counting) and the second WTP value was calculated as the sum of the values of all categories of ES. Although we are aware of the limits of this operation, the intent is to quantify the total individual WTP so that we can compare it with the outcomes of other similar case studies.

The average individual WTP amount ranged from 15.98€ (which is the sum of the value three ES categories) to 22.33€ (sum of the values of all ES categories), which lies within the range of about 6€ up to 37€ average individual WTP values obtained in previous studies on visitors' willingness to pay for conservation of European terrestrial protected areas located in boreal and temperate forest ecosystems (Table 4). Grilli et al. (2014) performed a meta-analysis of CV and Travel Cost Method (TCM) surveys that assessed the economic value of European protected areas and obtained a mean value of 17.02€, which is fairly close to our outcome.

Table 4 List of studies on the economic valuation of terrestrial protected areas and associated mean WTP amounts.

Authors (year)	Study area	Country	Surface (ha)	WTP/visit (original values)	2013 Prices (in Euro)
Füzyová et al. (2009)	Tatras National Park	Slovakia	73,800	329.7 SKK	12.2
Riera et al. (1994)	Alt Pirineu National Park	Spain	69,850	8.1 EUR	9.2
White and Lovett (1999)	North York Moors	United Kingdom	143,200	3.1 GBP	6.0
Hackl and Pruckner (1995)	Kalkalpen National Park (Oberösterreich)	Austria	20,825	10.5 EUR	13.8
Dumitras et al. (2011)	Piatra Craiului National Park	Romania	148,000	69.8 ROT	29.7
Pettenella et al. (2008)	Plitvice National Park	Croatia	29,482	18.5 EUR	21.7
Broberg (2007)	Protected old-growth forests	Northwest Sweden	660,000	300 SEK	36.7
Asciuto et al. (2005)	Nature riserve "Bosco San Pietro"	Italy	6,430	10.7 EUR	12.6
This study	*Abisko National Park*	*Sweden*	*7,700*		15.98-22.33

4.2 Relation between perception and WTP for ES categories

Statistically significant correlation between perception and WTP were found for provisioning, regulating, and cultural services. Results of the correlation test associated to the supporting services suggested that even though tourists rated them highly, they stated a lower WTP for their conservation. A possible explanation could stem from the relationship between the WTP for supporting services and other factors, e.g. degree of knowledge of the supporting services, not taken into consideration in this case study. Namely, in risk analysis surveys, correlations can be found between higher intrinsic values and knowledge gradients, and support of biodiversity conservation strategies coping with risks like climate change (McFarlane, 2005). Hence, one of the key message of our results could move in that direction, i.e. could address the potential impact that environmental education programmes could have on individuals' stated behaviours (Vierikko and Kohl, 2009) and the successive important implications for the Park's environmental policies. In fact, in the cases where respondents were asked to state the importance of provisioning, cultural and to some extent regulating during the interview, they had fairly good "picture" of the ES category, whereas for supporting services many struggled to relate this ES category to a notion other than presence of charismatic species. Palomo et al. (2011), in their study on the participatory planning and finding a common agreement in the management in a protected area in Spain, proposed and encouraged education programme, higher participation and communication to and for all stakeholders in order to conserve the habitat services in the protected area. This suggestion was

done also after taking in consideration their intensive research on the stakeholders' (including tourists) perception and their WTP for conserving the ES in the same protected area (Martín-López et al., 2007b).

In addition, the intent of exploring the relationship between the awareness and the WTP for each ES category could help to better understand the potential of using the ES concept in protected areas as an investigation tool in CV design, capable of detecting what could be the most suitable set of ES categories that respondents can relate to. In fact, respondents' personal information and experience with the ES and the presence of additional information in the hypothetical WTP scenario set – in our case information on the ES bundles in parks- could potentially increase the accuracy of the valuation (Bergstrom et al., 1990). While tourists are genuinely interested and have some basic information on each ES category and its importance, still lot should be done in terms of highlighting the existence of the wide range of ES in the protected areas in addition to those generally known to tourists (recreation, aesthetics and biodiversity values). We believe that this type of ES valuation in the CV design could also address the embedding issues related to the values of recreation services when explored as the only service or as part of a list of ecosystem services.

5 Concluding remarks

This study provides insights into tourists' perceptions and WTP for selected categories of ES in the ANP. About 60% of the interviewed tourists were willing to donate for the conservation practices, and an additional 13% of the protest bids stated that they would pay more taxes to ensure long term financing. This suggests that tourists perceived the ANP as a unique and pristine area, worthy of being preserved.

Uncertainties in the estimated values could be associated with the choice of using CV as stated preference method (Jones-Walters and Mulder, 2009) and the open-ended as WTP format - which leads to relatively high number of protest bids and conservative WTP – and the donation as payment vehicle that could underestimate the value of ES generated in the Park. Uncertainties can be higher in the case of valuing non-tangible ES (e.g., supporting services) which functions, flows, and interconnections with other ES are generally poorly understood. However, the respondents' general attitudes (fairly high share of repeated tourists, members of environmental organisation, and awareness of climate change risks) show that they hold enough information to provide overall good quality answers. Moreover, comparisons with other CV studies indicated that the WTP value obtained in this study falls within the range of economic values estimated for other European terrestrial national parks. We maintain that this study contributed to reduce the gap of knowledge between social perceptions and economic valuation of single category of ES in protected areas. We found a statistically significant correlation between what people perceive to be an important ES and what they state as monetary contribution for the same ES.

These outcomes could support local decision makers in charge for the implementation of climate change adaptation strategies in the Park. However, it is important to remark that for a comprehensive understanding of the importance and role played by ecosystem services in support of human well-being, the economic valuation should be integrated by a solid biophysical accounting.

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