

Protected Area Certificates: Gaining Ground for Better Ecosystem Protection?

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Abstract Protected areas are vital to sustain a number of ecosystem services. Yet, many protected areas are under-financed and lack management effectiveness. Protected area certificates have been suggested as a way to resolve these problems. This instrument would allow land managers to certify an area if it meets certain conservation criteria. The certificates could then be sold on an international market, for example to companies and any consumers that are interested in environmental protection. Some pilot initiatives have been launched, yet little is known about future demand and features of protected area certificates. To fill this knowledge gap, we conduct a choice experiment with close to 400 long-distance tourists from Germany as a potential group of buyers. Our results indicate that the respondents have the highest willingness to pay for certificates that conserve sensitive ecosystems and in addition to this lead to poverty reduction and safeguard water resources. For other attributes such as a greenhouse gas reduction, the preferences are less significant. Overall, the results are rather homogenous irrespective of where the protected areas are located. These insights are important for the future design and marketing of protected area certificates.

Keywords Protected areas · Certificates · Choice experiment · Biodiversity · Carbon offsets

Introduction

The establishment and effective management of protected areas (PAs) are indispensable measures to conserve biodiversity. In addition, PAs provide services that are essential for human well-being such as water purification, climate regulation, carbon sequestration, and cultural experiences. In low-income countries, many of these services also play a key role in reducing poverty and vulnerability to poverty (Andam et al. 2010; Millennium Ecosystem Assessment 2005). Today there are more than 200,000 PAs worldwide and the number is steadily increasing [World Database on Protected Areas (WDPA) 2013]. However, especially in developing countries, a substantial share of PAs faces problems in meeting their conservation targets. In particular, many authors have identified insufficient and unstable funds as obstacles (Oestreicher et al. 2009; Waldron et al. 2013; Beale et al. 2013).

Traditional financing of PAs has mainly relied on public funds and bilateral and multilateral aid (Hein et al. 2013). This study aims to explore a new, market-based approach to finance PAs: Protected area certificates (PACs). The idea behind PACs is to give individuals and companies the possibility to support PAs that provide specific ecosystem services (Earthmind 2012). A PAC would guarantee that a land unit, such as a hectare of rainforest or savannah, will be preserved. PA managers and communities that want to get their land certified have to provide an action plan where they define the conservation targets and quantify the ecosystem services that should be delivered. Regular third-party audits are then used to monitor that the conservation targets are met.

Even though each PA is unique and will have its own conservation targets and needs, the PAC approach opens

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up for a standardized certification procedure. Ideally, this should increase the transparency and give stakeholders the possibility to follow the conservation efforts closely (Hamrick 2014). Potential buyers could be private companies that depend on resources from the PAs such as seed companies and the tourist industry (compare Koellner et al. 2010; Meißner 2013). Companies might also buy PACs as part of a corporate social responsibility strategy or to meet regulatory requirements, for instance when mitigation for polluting activities is required. Individuals who are interested in the conservation of ecosystems constitute a strong potential group of buyers as well (Earthmind 2012).

The PACs development is in its initial phase and many issues are still unsolved. This analysis intends to fill some of the knowledge gaps by exploring potential demand. While doing so, a particular group of buyers is considered: long-distance tourists. The tourism sector has been highlighted as an industry where future demand for PACs might be especially large (Earthmind 2012). On the one hand, unique ecosystems are often drivers of tourist arrivals in developing countries (Naidoo and Adamowicz 2005; Freytag and Vietze 2009). On the other hand, tourism also puts increased pressure on already delicate environments (Gössling 2001; Phillips and Jones 2006; Geneletti and Dawa 2009; Nakamura and Nishida 2009; Almeida Cunha 2010; Yang et al. 2011; Cole 2012; Noronha Vaz et al. 2012). To protect the endowments that make the destination appealing, both tourist businesses and tourists may have an interest to help protecting it. In addition to this, similar certificates for carbon (carbon offsets) are already sold to air travelers. As one important driver of the PACs development has been carbon sequestration, it is interesting to explore how the tourists would respond to this broader product, which goes beyond pure reductions in greenhouse gases.

To analyze the demand for PACs among tourists we conduct a choice experiment. Given that the concept of PACs is new and there is a lack of knowledge about buyers' preferences, we are especially interested in how the respondents evaluate different aspects of PACs. In particular we want to discuss the following questions:

- (i) Which sustainability criteria do tourists find most important when considering buying a PAC?
- (ii) Do the tourists differ in their preferences depending on their socio-demographic characteristics?
- (iii) How do PACs compare with already established market-based instruments, such as voluntary carbon offsets and tourist charges related to PAs?

The findings can be used as input in the construction and marketing of PACs, to enhance the uptake among tourists and tourist enterprises, and to increase social welfare.

PA Funding Through Market-Based Instruments—Previous Findings

Little research has been conducted on the demand for PACs directly (Meißner 2013); however, it is possible to draw some insights from evidence on alternative sources of finance for PAs. We choose to focus on two such sources: (1) voluntary carbon offsets, which have worked as a base for the development of PACs, and (2) PA entrance fees and ecotourism, which already account for a substantial share of the PA funds.

Voluntary Carbon Offsets

Voluntary carbon offsets have existed on the market for about a decade and many of the PACs initiatives have been developed on the basis of carbon offsets. The probably most prominent example of PACs, the UN program REDD + (reduced emissions from deforestation and forest degradation) was initiated primarily as a carbon offsetting program. It aims to mitigate global warming by protecting forest areas in developing countries, but also attaches importance to the co-provision of other ecosystem services such as biodiversity, watershed protection, and community development (UN-REDD 2010). This is not the only case where the carbon offsets and PACs are overlapping. According to Peters-Stanley and Yin (2013), more than 30 % of the voluntary carbon offsets are related to land use and forestry. The other way around, virtually all PACs initiatives include carbon sequestration capacities or similar greenhouse gas reductions as important ecosystem service [CCBA (The Climate, Community and Biodiversity Alliance) 2012; Earthmind 2013; Plan Vivo 2013].

Carbon offsetting has attracted much attention, especially in the air travel sector (Kind et al. 2010). At least in theory, demand could be substantial. There are numerous studies suggesting that tourists are becoming increasingly aware of climate change and that many people feel troubled about their own carbon footprint (Becken 2004; Barr et al. 2010; Hares et al. 2010; Cohen et al. 2011). There are also various stated preferences studies confirming that many air travelers would be willing to pay for carbon offsets (Brouwer et al. 2008; Hooper et al. 2008; MacKerron et al. 2009; Lu and Shon 2012). In spite of this, the offset purchasing rates have remained rather low. Some estimates suggest that about 7–8 % of the German population have bought carbon offsets to compensate for their flights (TUIfly 2008; Lütters and Strasdas 2012). In some other countries and contexts, this number might be higher (Peterson et al. 2013; Blasch and Farsi 2014). On a global scale, however, the impact of voluntary carbon offsetting on the emissions caused by air travel is close to

negligible; Eijgelaar (2011) estimates that less than 1 % are compensated for literature provides many explanations for the poor purchasing rates. First, there are more practical reasons; people might not be aware of the possibility to offset (Gössling et al. 2009), and the purchasing process is not always straightforward. Segerstedt and Grote (2014) for example found that only about half of the largest travel carriers in Germany offered their clients the possibility to buy carbon offsets. When they did so, in most cases the traveler could not buy the offset upon reservation but had to search for the carbon offsetting homepage actively (see also Peters-Stanley and Yin 2013). Second, there are some inherent problems with carbon offsetting that are difficult to ignore. There is an ongoing debate on the issue of additionality (see e.g., Gössling et al. 2007; Schneider 2009; Dhanda and Hartman 2011).¹ Another problem, which is hard to avoid when environmental policies are voluntary, is the issue of free riding. In line with previous literature on public goods (see e.g., Ledyard 1994), many authors find that people are reluctant to compensate for their carbon emissions if they cannot be sure that everyone else will do so as well (Lütters and Strasdas 2012; Nakamura and Kato 2013).

Against this background, the question arises whether the PAC approach, which focuses on the ecosystem as a whole rather than merely on carbon emissions, could attract more buyers. A few studies estimating the willingness to buy carbon offsets do in fact suggest that the emissions reduction might not be the most important characteristic. For example, MacKerron et al. (2009) considered the potential demand for carbon offsets among young and well-educated citizens of the UK. In their choice experiment, the carbon offsets always included a one ton reduction in carbon emissions as well as other co-benefits such as positive impacts on biodiversity, human development, and on technical development through more renewable energy dissemination. Their results indicated that the respondents were willing to pay most for biodiversity followed by human development, which was both above the willingness to pay (WTP) of the carbon offset itself (£14.98 and £12.84 against the pure carbon offset price of £12.47 for a transatlantic trip). Also the surveys of Becken (2004) and Lütters and Strasdas (2012) suggest a higher potential of certificates that highlight more ecosystem services than only the carbon offsetting.

As for the general characteristics of the carbon offsetters, empirical evidence is mixed. Most studies find that the typical offsetters are young and active and feel a strong

responsibility for climate change (Hooper et al. 2008; Lütters and Strasdas 2012; Lu and Shon 2012; Blasch and Farsi 2014; Segerstedt and Grote 2014), although there are also studies finding a positive relationship between WTP and high age (Peterson et al. 2013; Nakamura and Kato 2013). In the same way, high income has a significantly positive impact in some studies (Brouwer et al. 2008; Nakamura and Kato 2013; Blasch and Farsi 2014) but not all (Hooper et al. 2008; MacKerron et al. 2009; Lütters and Strasdas 2012; Peterson et al. 2013). For a longer discussion, see Segerstedt and Grote (2014).

Tourist Charges

Apart from the carbon offsets, we can also obtain useful insights from more traditional instruments used to finance PAs. Tourist charges have existed for a long time. There are estimates suggesting that 50–75 % of the PA funding in developing countries stem from user and entrance fees related to PAs (Giongo et al. 1994; Bovarnick et al. 2010). Such fees have the advantage of connecting the payment directly to the PA experience. Those people who are profiting from the visit have to pay. Most tourists seem to perceive this as fair. In spite of this, entrance and user fees are often too low to match the WTP of visitors or even the costs of operation (Emerton et al. 2006). Accordingly, there is a large amount of literature suggesting that the funding potential from increased fees could be substantial (see e.g., Adams et al. 2008; Baral et al. 2008; Thur 2010; Casey et al. 2010; Pascoe et al. 2014). However, as is emphasized by Whitelaw et al. (2014), the WTP for park fees related to the PA visit depends on factors such as good accessibility and infrastructure, which may not always coincide with the PAs that are in most need of conservation. There are also some authors questioning if the fees are really reinvested in the PA management (Méral et al. 2011) and to what extent sustainability targets are effectively monitored and controlled (Leverington et al. 2010).

More holistic, targeted tourist programs might counteract these problems. Ecotourism and voluntary tourism are growing niche markets (Tomazos and Butler 2009). Many case studies show that such programs have the potential to raise both awareness and local funds (Lindsey et al. 2007; Brightsmith et al. 2008; Almeyda et al. 2010; Kirkby et al. 2011; Broadbent et al. 2012). They might also increase the incentive for policy makers to sharpen environmental regulation and for private stakeholders to reinvest some of the income generated through tourism in conservation (Gutman and Davidson 2007). However, also here thorough planning, local stakeholder participation and not least appropriate control measures are key for a sustainable outcome (Krüger 2005).

¹ Additionality means that the carbon offsets should be used to promote carbon reduction projects that would not have happened if it were not for the financial support. In practice, it is very difficult to verify the additionality as the project holder will always have more information than the investors.

In this context, it is interesting to consider which ecosystem services are most important to raise funds and attract tourists. In a review of 251 studies on ecotourism, Krüger (2005) observed that the use of flagship species was crucial to expand the market for ecotourism. His results correspond with many studies measuring conservation efforts in PAs in general, such as the one of Morse-Jones et al. (2012), who found that UK citizens are willing to pay much more for unique and charismatic species such as gorillas than for unique and non-charismatic species like frogs, toads, or birds (see also Richardson and Loomis 2009; Sitas et al. 2009). Yet, there are also studies indicating that the tourists might also appreciate unique landscapes and large quantities of species such as the one of Lindsey et al. (2007), Kontoleon and Swanson (2003) and Ressurreição et al. (2011). Hence, even though high-profile mammals are likely to increase the WTP they must not be a prerequisite for everyone. Preferences can also be traced back to socio-demographic characteristics. Di Minin et al. (2013) for example found that in particular people who were young, less wealthy, and had more experience in visiting PA were interested in biodiversity beyond the most charismatic species. Apart from plants and animals, tourists also seem to have a higher WTP for specific ecosystem services if they perceive a close connection to them; Cerda (2013) found that visitors of the Peñuelas National Reserve in Chile would prefer if the entrance fees were earmarked for protecting the watershed that supplied the area with drinking water. In the same way, social issues may play an important role. Rolfe et al. (2000) found that respondents in Australia had a comparatively high WTP for supporting communities connected with PAs. This is in line with research conducted on certified food produced in developing countries, where ethical aspects may be preferred over environmental characteristics (Loureiro and Lotade 2005; Onozaka and Mcfadden 2011).

Research Design

Choice Sets, Attributes, and Levels

When designing the choice experiment, we aimed to cover different aspects that have been discussed in the context of PACs. In the final version, we decided to include six attributes: biodiversity, carbon sequestration, water protection, poverty reduction, cooperation with a well-known international organization, as well as price.

All attributes had ordinal levels with a more or less clear hierarchy except for the attribute related to plants and animals where we used two nominal levels; the first one aimed to increase the number of species by the creation of

new PAs with minimal human interference. The second one aimed to prevent further reductions in plants and animals by adapting production in already existing PAs. When buying a certificate, one of the two levels was always present. For carbon sequestration, we included four levels: not specified, 2, 2.5, and 3 tons reduction. To make it easier to understand the implications of the different attributes, we attached more detailed information on a separate information sheet provided in Table 1. Regarding the carbon attribute, we compared the reduction levels with the greenhouse gases that the average German person emits while heating the home, while driving, and taking a long-distance trip. The attributes aiming to protect scarce water resources as well as better living conditions of the people in the vicinity of the area both had two levels: not specified and positive impact. In addition, we also wanted to test if it made a difference to have a cooperating partner whom the respondents know and trust. Different potential labels were discussed in focus groups beforehand [e.g., world wide fund for nature (WWF) and various labels for sustainable tourism]. However, we decided to include the United Nations (UN) as several of its sub-organizations are involved in projects focusing on both poverty reduction and environment. Moreover, participants of focus groups were well familiar with the UN symbol and perceived it as trustworthy.

We determined the price levels using carbon offset prices offered by airlines on their homepages as proxy (compare for example Atmosfair 2012; Carbon Catalog 2012; KLM 2012; Lufthansa 2012). Given that some air travelers are already willing to pay that amount for carbon sequestration, we considered that range of actual prices an appropriate starting point for offset prices. Focus group discussions further revealed that few would be willing to pay more than €55. Hence we took this price as the highest price level.

Before completing the choice experiment, the respondents obtained a small text as information, instructing them that the PACs would help to protect or restore an area the size of a football pitch in their last country of destination (i.e., if their last trip had been to Thailand, an area in Thailand would be protected or restored). The respondents were further told that the area would exist in a sensitive ecosystem such as a hectare of rainforest, savannah, or wetland, and that the certificate would be provided by an independent environmental organization. To increase the external validity, a so-called cheap talk script was provided in the instructions. It reminded the respondents that people tend to exaggerate their WTP and that they should answer as if it were money from their own pocket (see Appendix 1 for more the complete instructions). In Fig. 1, an example of a choice set is provided.

Table 1 Attributes and levels in the choice experiment

Attributes	Levels	Explanations
Plants and animals	Not specified	Only as opt out alternative
	Restore old area	Aims to adapt the production in the area and makes it more sustainable in order to prevent further reductions in plants and animals
	New area	Aims to increase the number of plants and animals by creating a new protected area with minimal human interference
Greenhouse gases	Not specified	–
	Reduction by 2 tons	Helps to reduce our greenhouse gas emissions by 2 tons; the same amount an average Northern European emits when heating his/her home during 1 year
	Reduction by 2.5 tons	Helps to reduce our greenhouse gas emissions by 2.5 tons; the same amount an average European emits in traffic during 1 year
	Reduction by 3 tons	Helps to reduce our greenhouse gas emissions by 3 tons; about the same amount that is emitted during a long-distance flight trip (e.g., from Germany to Thailand)
Water resources	Not specified	–
	Positive impact	A special emphasis is placed on actions that aim to protect scarce water resources
Poverty reduction	Not specified	–
	Positive impact	A special emphasis is placed on actions that also lead to better living conditions of the people living in the vicinity of the area
UN cooperation partner	Not specified	–
	Yes	In cooperation with the United Nations
Price	0€	Only as opt out alternative
	€25	
	€35	
	€45	
	€55	

The explanations were provided on a separate information sheet to the respondents

Data Collection

The questionnaire was tested and discussed in two rounds of focus groups. The focus groups were primarily used to make sure that the language was clear, that visual aids helped in the communication without distracting from the actual message, and that the workload (e.g., the number of choice sets together with other observational data) was not too high. In the last stage of the questionnaire development, we made a field test at the airport of Hannover.








While focusing on collecting experimental data, observational data on travel habits, environmental interest and demographic characteristics were elicited to further explain the variation in choice. We specifically targeted people who had made a leisure trip to Africa, Latin America, and/or Asia within the last 10 years. Data collection took place in the public areas of four German airports between February and May 2012 (see Table 2). As far as the airports allowed it, we selected the days and daytime of the data collection randomly. Later testing did not yield any significant difference between the cities or dates.

The response rate amounted to 27 %. The interviewers approached people randomly. Those people who were willing to participate were first asked if they had made a

leisure trip within the last 10 years to at least one of the regions that we were asking for (qualifying question). If that was the case they continued to fill out the questionnaire themselves. People rejected to answer because of lack of time and/or motivation (69 %), because they had not made a leisure trip to the destinations we were asking for (21 %), or because they did not speak German or English (10 %). In total, 405 tourists took part in the final survey. We excluded questionnaires where more than 25 % of the answers were lacking. After data cleaning 354 questionnaires remained.

Descriptive data are presented in Table 3. Slightly more men answered the questionnaire than women. The majority lived in small households with one or two household members and were 25–49 years old. Most of the respondents also had a relatively high net household income (>€3000 per month) and a university degree. We further collected data related to their last trips to Africa, Latin America, and/or Asia as well as donation habits. On average, the respondents had gone to these regions eight times in the last 10 years. Most of them had gone to Middle Eastern countries like Egypt and Turkey. About 29 % used to make regular donations to an environmental or social organization. 49 % had heard about the possibility to offset

Fig. 1 Example of a choice set

Sustainability targets	Certificate 1	Certificate 2
Greenhouse gases	Reduction of 2.5 tons 	Reduction of 2 tons 
Plants and animals	Increases the number of species 	Stops the loss of species 
Water resources	-	Positive impact 
Poverty reduction	-	Positive impact 
UN cooperation partners	Yes 	-
Price	35€	25€

I choose

Certificate 1 Certificate 2

I wouldn't buy any of these

Table 2 Traveler data and data shares of different German airports

Attribute	Hannover	Hamburg	Berlin tegel	Munich
Number of travelers per year (including transits), as of 2011 ^a	5.5 million	13.8 million	17.2 million	40.1 million
Respondents	223	46	65	67
Share in total (%)	56	11	16	17

^a Flughafenverband ADV Verkehrsstatistik, 2011

carbon when flying and 10 % had taken part in such program before. Almost 90 % thought it was important to protect the environment.

Model and Experimental Design

Choice Model

For the econometric estimations, we used a conditional logit and a random parameter logit (RPL) model. RPL is a generalization of the conditional logit, but has the advantage of not relying on the independency of irrelevant alternatives property and accounting for unobserved heterogeneity (Train 2003). The utility of individual *n* of choosing a PAC *j* out of *J* alternatives can be specified as

$$U_{nj} = \alpha_{nj} + \beta_{nj} + \varepsilon_{nj}$$

with x_{nj} being a vector of observable attributes. The intercept α_{nj} reflects the intrinsic utility of choosing a certificate with no further specifications of attributes. The parameter β_{nj} is an unobserved coefficient vector that varies over the population with a density $f(\theta)$, where θ represents the true parameters of the distribution. The person will choose certificate *i* over *j* if and only if $U_{ni} > U_{nj} \forall j \neq i$. Assuming that the unobservable error term ε_{nj} follows a type 1 iid extreme value distribution, we define the probability that individual *n* chooses *i* conditional on β_n as

$$L_{ni}(\beta_n) = \frac{e^{\alpha_{ni} + \beta_{ni}x_{ni}}}{\sum_j e^{\alpha_{nj} + \beta_{nj}x_{nj}}} \tag{1}$$

This is similar to the conditional logit specification, only β_n is allowed to vary depending on the preferences of the individuals. As β_n is unknown, the researcher has to integrate L_{ni} over all possible values of β_n

Table 3 Descriptive data ($n = 354$)

Variable	Frequency
Gender	
Female	47.4 %
Male	52.6 %
Age	
15–24	16.8 %
25–34	27.4 %
35–49	28.2 %
50–64	19.0 %
65 or more	8.7 %
Monthly household net-income	
€1000 or less	13.1 %
€1001–2000	17.2 %
€2001–3000	22.3 %
€3001–4000	19.6 %
€4001 or more	27.9 %
University degree	54.72 %
Household members	2.22 (s.d. 1.3)
Number of trips to Africa, Latin America, and/or Asia the last 10 years	8.33 (s.d. 5.83)
Region of last travel destination	
Middle East	25 %
Southeast Asia	21 %
Northeast Asia	11 %
South America	11 %
Maghreb	8 %
Southern Africa	8 %
Other	16 %
Regular donations	
Yes	29 %
No	71 %
Knew about the concept of carbon offsetting	
Yes	49 %
No	51 %
Had bought carbon offsets	
Yes	10 %
No	90 %
I think it is important to protect the environment	
Disagree	3.7 %
Tend to agree	9.2 %
Agree	87 %
I behave in an environmentally friendly way	
Disagree	6.7 %
Tend to agree	50.6 %
Agree	42.6 %

$$P_{ni} = \int \frac{e^{\alpha_{nj} + \beta'_{nj}x_{nj}}}{\sum_j e^{\alpha_{nj} + \beta'_{nj}x_{nj}}} f(\beta) d\beta. \quad (2)$$

As the integral in (2) does not have a closed-form solution, it has to be simulated. Here we chose a maximum likelihood simulation with 1000 Halton draws for each respondent.

The variance of the random parameters may follow any distribution, while the idiosyncratic component of the utility function is still assumed to be extreme value type 1. In the present analysis, we used a normal distribution for the intercept and a censored triangular distribution for the greenhouse gas attribute and the certificate price. The censored triangular distribution made it possible for us to limit the random coefficients to have the same sign. From a theoretical point of view, this was plausible since we assumed that all respondents would draw a positive utility from a greenhouse gas reduction and a negative utility from price. The censored triangular distribution further tends to be more stable than the log normal distribution and it provided the best fit in terms of log-likelihood ratio.

To facilitate the interpretation of the parameter values, the marginal WTP for the different attributes were also calculated. For the conditional logit model, this is straightforward as it is simply the ration of the attribute parameter and the price

$$WTP_{\text{attribute}} = \beta_{\text{attribute}} / \beta_{\text{price}}.$$

For the RPL model, however, the WTP will differ between individuals if either of the parameters does. We, therefore, have to simulate the distribution of the WTP. As we assumed a censored triangular distribution for the greenhouse gas attribute and the price, the distribution of the WTP will also be triangularly distributed (Hensher et al. 2005).

In order to decide which parameters should be treated as random, we considered the Lagrange multiplier test suggested by McFadden and Train (2000). In addition we analyzed the t-statistics of the coefficients and standard errors at different specifications of conditional and random parameters (see Train and Sonnier 2005; Hensher et al. 2005; Mariel Chladkova et al. 2010 for more details). The tests indicated heterogeneity in utility for the intercept as well as the attributes related to greenhouse gases and price. As for the greenhouse gas reduction, this did not come as a surprise as the attribute had more levels and was the most demanding both from a technical and cognitive perspective. While some people are well aware of their carbon footprint, others may find it hard to see the difference between 2 and 3 tons of CO₂ emissions. This outcome was confirmed by more in-depth interviews; a group of respondents wanted to compensate the actual carbon footprint of the trip (and hence chose the highest level); others expressed that they were satisfied as long as some reduction took place; and yet others stated that the difference

would be so small on a global level that they could just as well ignore this attribute. Similarly, we found it plausible that people have different perceptions of what a price reflects; while high prices are usually perceived as worse than low prices, everyone does not necessarily consider them equally bad. Using a random parameter estimate made it possible to incorporate this preference discrepancy.

Experimental Design

One of the most challenging parts of choice experiments is to construct a questionnaire which combines realistic and easy-to-understand options with adequate statistical properties. Regarding the statistical properties, the efficiency of the experimental design—how attributes vary both within the alternatives and between them—is crucial as it minimizes the errors around the estimated parameters.

To maximize the D-efficiency, an orthogonal main effects design for the first option was obtained by Street and Burgess (2007, p. 48) and modified to correspond to our needs. In total, 16 choice sets were constructed, which was divided into four blocks (i.e., 4 choice sets per respondent). The final design was further adapted using a fold-over technique to rule out too dominant alternatives (e.g., the choice between a certificate with the highest levels of each attribute to a very low price, and a certificate where the opposite was the case; for a technical elaboration see Street and Burgess, *ibid*). To create the second alternative, a generator $G = (111111)$ was used. Testing it with the discrete choice experiments software of Burgess (2007), the final D-efficiency of the design compared to an optimal design with two choice sets was satisfactory at 95.6 % (see Appendix 2 for the complete design). For the qualitative attributes, dummy-codes were used.

Econometric Findings

For our econometric analysis, we used a conditional logit and a random parameter logit (RPL) specification, as described in Model and experimental Design Section. The software Nlogit was used for the estimation of both specifications. Results are presented in Table 4. Coefficients and standard errors were quite similar, indicating that results were stable across the two specifications. However, the RPL model significantly improved the fit against the conditional logit. Hence we focus on reporting the results from the RPL specification. All attributes were significant at the 1 % level apart from the intercept and the cooperation with the UN, which was significant at the 5 % level. Except for the price, which had the expected negative sign, all coefficients were positive. Respondents had

higher preferences for greenhouse gas reductions, they preferred if the certificate contained explicit criteria to protect water resources, if it improved the situation for people living in the vicinity of the area, and if the UN was a partner of the project. Also the intercept was positive indicating that people draw utility from buying a certificate. The attribute *Restore old area* referred to the additional utility that respondents would have if the PA would already exist (as opposed to creating a new one) and the main goal would be to prevent further reductions in plants and animals.

Apart from the design attributes, we also interacted the intercept with four socio-demographic variables “Donations,” “Female,” “Age,” and “Carbon offset.” Results suggest that respondents making regular donations to an environmental or social organization were more likely to buy a certificate than others. The same is true for female respondents and those respondents who had heard about carbon offsetting before. As far as the age is concerned, old people had on average a lower utility from buying a certificate.

With respect to the random parameter estimates, the intercept, carbon and price all had significant coefficient standard deviations, which imply that preferences for these attributes are heterogeneous. The negative price coefficient for example indicates that respondents on average thought of a high price as something bad, but all respondents did not think it was equally bad. Similarly greenhouse gas savings were perceived as something positive, but some people considered it more important than others.

Except for sign and significance of the coefficient estimates, their relative size becomes more easily interpretable when considering the ratios of the attributes with respect to price (i.e., the marginal WTP of each attribute). As can be seen in Table 5, respondents were willing to pay about €4 for restoring an old protected area. Poverty reduction and water protection were associated with the highest marginal WTP. In contrast, the WTP for a greenhouse gas reductions was rather low at about €3, even though the highest level of reduction yielded a higher WTP ($€3 \times 3 = €9$). Finally, having the UN as cooperation partner increased the WTP by €3.20. In total, a PAC that would preserve an old PA and would cover the highest levels of greenhouse gas reductions, water protection, poverty reduction, and UN cooperation would cost €41.

Discussion

PACs are a new instrument to conserve sensitive ecosystems. Hence our first research question aimed at identifying sustainability criteria, which would attract

Table 4 Results on the determinants of the WTP for a PAC (conditional logit and RPL estimations)

	Cond. logit			RPL		
	Coeff.	SE	<i>t</i> value	Coeff.	SE	<i>t</i> value
Intercept	0.410	0.212	1.936*	0.918	0.378	2.431**
Restore old area	0.157	0.070	2.233**	0.208	0.757	2.746***
Water	0.540	0.071	7.560***	0.588	0.765	7.685***
Poverty	0.682	0.073	9.386***	0.748	0.803	9.311***
UN	0.126	0.071	1.781*	0.167	0.757	2.210**
Greenhouse gases	0.134	0.036	3.768***	0.156	0.039	3.988***
Price	-0.458	0.004	-11.657***	-0.053	0.005	-10.531***
Donations: intercept ^a	0.684	0.146	4.682***	1.195	0.395	3.025***
Female: intercept ^b	0.283	0.123	2.307**	0.491	0.251	1.955*
Age: intercept	-0.273	0.026	-4.359***	-0.472	0.161	-2.928***
Carbon offset: intercept ^c	0.351	0.154	2.280**	0.634	0.311	2.040**
				s.d.	SE	
Intercept				0.016	0.004	3.988***
Greenhouse gases				0.005	0.001	10.531***
Price				2.446	0.947	2.583***
Log likelihood	-1377			-1332		
Obs.	1414			1414		
AIC	1.963			1.934		
Adjusted R2	0.15			0.18		
Halton Repls	-			1000		
Hausman test for IIA. The excluded choice is alternative A.	$\chi^2[10] = 5.8622$, prob ($C > c$) = .826,701					

* Significant at $P < 0.10$ ** Significant at $P < 0.05$ *** Significant at $P < 0.01$ ^a Equals 1 if the respondent donates money to an environmental and/or human rights organization regularly, 0 if not^b Equals 1 if the respondent is female, 0 if not^c Equals 1 if the respondent had heard about carbon offsetting before, 0 if not**Table 5** Willingness to pay for a PAC (random parameter logit) at 95 % confidence level

Attributes	Mean conditional parameter estimates (€) (s.d)	Minimum (€)	Maximum (€)
Restore an old PA	3.945 (0.163)	3.59	4.37
Water protection	11.18 (0.461)	10.16	12.38
Poverty reduction	14.22 (0.587)	12.93	15.75
Greenhouse gas reduction	2.97 (0.060)	2.84	3.13
UN cooperation	3.18 (0.131)	2.89	3.52

most tourists when considering buying a PAC. Our results show that respondents perceived improved conditions for the communities living in the vicinity of the PA and better protection of water resources as most important. Furthermore, the preference for these two attributes seemed to be rather stable over different specifications. This was somewhat unexpected, since we did not specify

the location of the PA but rather told the respondent to imagine that they would help conserving a sensitive ecosystem in their last country of destination. The spread of countries turned out to be very large (ranging from typical sun resorts in Egypt and Turkey to less common destinations such as Bhutan and Ghana). To see if this would affect the preferences, we conducted a robustness

check splitting the sample in subgroups depending on the tourist activities (sun and beach holidays versus others) and destinations (Turkey and North Africa versus others) but always came to similar results. It also did not seem to matter if the respondent visited a PA during their last trip.

Another result that we found surprising was the comparatively low interest in reducing greenhouse gases. This is in line with what has been suggested in previous research (Becken 2004; MacKerron et al. 2009; Lütters and Strasdas 2012) but nevertheless it is notable, since carbon sequestration has been one of the most important drivers for the development of PACs. One possible explanation for this could be that respondents have closely experienced the conditions at their destination; the trip might have given them the opportunity to visit unique and beautiful landscapes, but might have also confronted them with poverty and water scarcity. Climate change on the other hand is generally perceived as something more abstract (compare also e.g. Gössling et al. 2009; Hares et al. 2010; Weaver 2011). Even though it was the only attribute, which allowed the respondents to make up for their own footprint (i.e., where they obtained the information that a 3 tons reduction would be equivalent to what an average tourist emits on a long-distance flight), it might be difficult to grasp the whole extent of the impact. More open-ended questions further indicated that the majority of our respondents preferred obligatory measures over voluntary offsets to deal with the problem.

This is an important result, as it helps to design a marketing strategy for PACs. Although a possible approach could be to sell them as a “carbon offset plus,” our study suggests that PACs providers should put more emphasis on other aspects. If for example biodiversity is highlighted instead, more people might find the concept interesting. This does not mean that the carbon sequestration objective should be ignored; in fact higher biodiversity and carbon sequestration are often complementary targets (Imai et al. 2009; Onaindia et al. 2013). However, if one ecosystem service should act as a ‘flagship’ for the PACs, it is probably better to choose one which has wide appeal.

The second question we wanted to answer was if some socio-demographic characteristics increase the probability of a person to buy a certificate. Results yield that young women and people who made regular donations to environmental and social organizations were more likely to buy a certificate. However, other typical characteristics such as income and education did not have a significant impact. What we can see is that high income earners and people with an academic degree were over represented in our

study compared to the German average (German Federal Bureau of Statistics 2012). This was expected as we targeted people who had made at least one long-distance trip before, and long-distance tourists often belong to the highest income strata (Aamaas et al. 2013; Reinhardt 2014). However, the descriptive results also indicated that a large group of our respondents thought that it was important to protect the environment. As the participation in the survey was voluntary, we cannot dismiss that we have a self-selection bias, because those who were most interested in social and environmental issues were more willing to participate in the survey. This is a reasonable assumption since the survey was announced to interested respondents as dealing with social and environmental issues. Furthermore, the sample of around 350 respondents was relatively small. However, in the absence of any population data available to compare it with, we argue that this sample is representative at least for German environmentally conscious long-distance tourists. How does it affect the final validity of the outcome?

In total, it is estimated that some five million Germans go on long-distance trips each year (DRV 2013). Transferring our results on the average WTP of €41 for a PAC to this group, a considerable amount of money would be raised. However, assuming that our sample is not representative for all long-distance tourists and that people might additionally exaggerate their WTP, the finance potential would be much lower. A more realistic assumption could be that only 5–10 % of the long-distance tourists who count as being more aware of environmental and social issues and who have bought carbon offsets before belong to the group of potential buyers (see chapter 2.1). Given a price of €41 it would then be possible to collect €10.25–€20.5 million. This is still more than the PA funds available in many Latin American countries today (Bovarnick et al. 2010). We, therefore, conclude that PACs sold to tourists could help financing PAs, in particular if they highlight the “right” co-benefits. Nonetheless, future studies with larger sample sizes and more pro-active sampling techniques would be useful to make a clear distinction between possible buyer groups and assess the potential volume of the market more thoroughly.

Our third question aimed to answer how PACs would compare with already established instruments to protect PAs. As mentioned above, we infer from our results that PACs have the potential to increase the popularity of carbon offsets. Regarding other instruments such as ecotourism and PA entrance fees, potential synergy effects are less obvious. One big difference as far as we see it is that tourist charges are connected with direct use values. If the

benefits to the visitor are large, e.g., because there is a possibility to see unique charismatic species or the visitor facilities are good, the WTP will generally be higher (compare Steckenreuter and Wolf 2013). As opposed to this, PACs sold on international markets do not guarantee a use value per se but rely on the buyers good-will and their eagerness to conserve the PA. Benefits are less tangible. One consequence of this could be that payment flows of PACs fluctuate stronger and are harder to predict. There is also evidence that entrance fees lead to a crowding out effect of donations (such as PACs), although it might not be complete (Alpizar et al. 2014). Therefore, we reckon that if there is a possibility to reach the same sustainability targets with tourist charges but without involving intermediaries, it might be a more straight-forward approach that requires less transaction costs. Another possibility could of course be to make a combination of both approaches and finance PACs through entrance fees. The advantage of this method would be to have well-defined objectives with third-party monitoring. This could increase the understanding of tourists why fees are levied and give them an assurance that the money will be reinvested. We also believe that PACs could complement tourist charges in areas that are not able to fully recover costs of operation, e.g., because they are too remote.

The introduction of PACs is also connected with costs. Pilot projects for forest conservation in Tanzania show that the direct costs related to implementation, verification and monitoring, as well as institutional support range between \$3.9 and \$8.9 per ha (UN-REDD 2012). In addition to this, the price would also have to reflect the cost of transaction between sellers and final buyers, which could be substantial if the buyers are dispersed (as would be the case with millions of tourists). Given a WTP of approximately €41 (or \$52), such transaction costs might undermine the functioning of a PAC market. In fact, evidence shows that carbon offsetting companies are increasingly targeting retailers such as manufacturers, energy producers, and logistic companies, in order to reduce transaction costs (Peters-Stanley and Yin 2013). This could become a real problem, since many respondents commented that they would make a contribution only if they would be sure that the money is earmarked for what it is said to be and not to a large extent for administration.

Against this background, one important question for future research is how to design the markets for PACs as efficiently as possible. From the point of view of the buyers, one critical step to make a real difference will be to involve also companies to increase the volume of the market. Tourist companies might have a proper interest in

making the destination as attractive as possible for their clients and thus could see the contribution both as an investment and as a way to show corporate social responsibility. A possible way of commercialization could also be to share the costs between individuals and tourist businesses (Gössling et al. 2009). Another important issue for future research is how the PACs should be sold. Experience from the voluntary carbon offset market shows that the purchasing process has to be very straightforward. If not, there is a considerable risk that people who are generally positive about the concept never take the step to buy a PAC (Segerstedt and Grote 2014). One possible platform could be to sell the PACs through tourist businesses, although this method may raise new concerns related to trust (a few of our respondents objected that the direct supply through tourist businesses would be used by them as an “eyewash to obtain more clients”). It is also possible to think of vending points at airports, hotels, or directly at the PAs. Another approach could be to sell them on separate crowd-funding platforms, with the downside that it would require more activity from the buyer. There are also many challenges on the production side concerning governance, competing land uses, unclear land use rights, or stakeholder participation, which deserve attention but have been left completely aside in this paper (for more information, see e.g., Bullock et al. 2011; Visseren-Hamakers et al. 2011; Huettner 2012). Finally for the PACs initiatives to succeed, it will be essential to investigate more in detail how interactions between buyers and sellers work and how transaction costs can be kept at a minimum.

Conclusion

Our results suggest that German long-distance tourists have the potential to become buyers of PACs that conserve sensitive ecosystems such as tropical forests, savannahs, and wetlands. In particular, this will be the case if the PACs also aim to reduce poverty and safeguard water resources. We found that the WTP for greenhouse gas reductions was lower than for the before-mentioned attributes. Therefore, we conclude that the greenhouse gas reduction should probably not be used as the major selling point, even though carbon sequestration has been important for the design of the PACs initiatives. Those who were most interested in participating in the PACs scheme were young women who used to make regular donations to environmental and social organizations. The results indicate that PACs have the potential to become an interesting instrument to improve the

management of PAs. If tourists have the possibility to buy certificates for an area in the country of destination, the interest may increase even more. However, there are still many challenges that need to be analyzed further. As first experiences are being made by certificate providers, a natural sequel is to compare stated preference data with revealed preferences. Above all, it is necessary to match results on buyers and their WTP with supply in order to see what ecosystem services should be included in the design of a PAC and how PAC prices will develop.

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Appendix 1

Information text provided to the respondents before filling out the choice experiment

Imagine that you would book a trip again to the same destination as the last time.² Upon payment, you have the possibility to buy a “green certificate” from an independent environmental organization:

- When you buy a certificate, the organization guarantees to protect or restore an area the size of a football pitch in your country of destination (for example, if you go to Thailand, you would buy a certificate to protect an area in Thailand.)
- The area always consists in a sensitive ecosystem such as a rainforest, savannah, or wetland.

However, different certificates have different focus and prices. We will ask you to repeat the choice between the purchase of two different certificates or not to buy any certificate four times.

A few things to note before making your decisions:

Experiences from similar studies have found that people frequently declare that they are willing to pay more than they are willing to do in reality. Imagine that you are making the contributions out of your own pocket.

² We had asked the respondents to answer some questions related to their last trip to Africa, Asia, or Latin America before.

Appendix 2

Experimental design Each cell represents a choice set and the numbers indicate the attribute level.

Alternative 1	Alternative 2
0 1 1 0 2 2 2	1 0 0 1 3 3 3
1 1 0 1 2 0 1	0 0 1 0 3 1 2
0 0 0 1 2 1 3	1 1 1 0 3 2 0
1 1 1 0 1 0 3	0 0 0 1 2 1 0
1 0 0 1 1 3 2	0 1 1 0 2 0 3
1 0 1 0 2 3 0	0 1 0 1 3 0 1
1 1 1 1 3 1 0	0 0 0 0 0 2 1
1 0 0 0 3 2 1	0 1 1 1 0 3 2
0 0 0 0 0 0 0	1 1 1 1 1 1 1
1 0 1 1 0 2 3	0 1 0 0 1 3 0
0 1 0 0 3 3 3	1 0 1 1 0 0 0
0 1 0 1 1 2 0	1 0 1 0 2 3 1
0 0 1 1 3 0 2	1 1 0 0 0 1 3
0 0 1 0 1 1 1	1 1 0 1 2 2 2
1 1 0 0 0 1 2	0 0 1 1 1 2 3
0 1 1 1 0 3 1	1 0 0 0 1 0 2

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