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Valuing cultural ecosystem services: Agricultural heritage in Chiloé island, southern Chile

José Barrena [a,b,d], Laura Nahuelhual [a,c,d,*], Andrea Báez [e], Ignacio Schiappacasse [f], Claudia Cerda [g]

[a] Instituto de Economía Agraria, Universidad Austral de Chile, Casilla #567, Valdivia, Chile
[b] Escuela de Graduados, Facultad de Ciencias Agrarias, Universidad Austral de Chile, Casilla #567, Valdivia, Chile
[c] Fundación Centro de los Bosques Nativos FORECOS, Casilla #567, Valdivia, Chile
[d] Center for Climate and Resilience Research (CR^2), Chile
[e] Instituto de Estadística, Universidad Austral de Chile, Casilla #567, Valdivia, Chile
[f] Departamento de Economía, Facultad de Ciencias Económicas y Administrativas, Universidad de Concepción, Casilla 160-C, Concepción, Chile
[g] Departamento de Gestión Forestal y su Medio Ambiente. Facultad de Ciencias Forestales y Conservación de la Naturaleza, Universidad de Chile, Santa Rosa #11315, La Pintana, Santiago, Chile

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ABSTRACT

Valuation of cultural ecosystem services (CES) remains one of the most difficult and least accomplished tasks in ecosystem services research. In this study the Contingent Valuation Method with the double bounded dichotomous choice format was used to elicit WTP for agricultural heritage (AH) conservation, which was modeled using a Bivariate Probit specification. The hypothesis tested was that WTP decreased with distance from the site of provision of AH. Results show no significant differences in WTP across locations with equivalent means of US$50.8, US$36.2 and US$52.5 for Chiloé (site of AH provision), Valdivia (at 379 km from Chiloé), and Santiago (at 1198 km from Chiloé), respectively, suggesting that non-use values can be equally important for local as well as distant populations, particularly when the CES can be ascribed to emblematic cultural landscapes such as Chiloé. Aggregation of individual WTP demonstrates the importance of AH as a highly valued CES and sustains the recent designation of Chiloé as a Global Importance Agricultural Heritage System (GIAHS) pilot site. The study might prompt authorities to generate the proper incentives to move from just a GIAHS label to a real conservation initiative in Chiloé Island.

1. Introduction

While the provision of food, fiber, and fuel is the dominant aim of agriculture (MEA, 2005; Zhang et al., 2007), agricultural lands play unique roles in supplying other ecosystem services (Zhang et al., 2007). A growing amount of literature recognizes the critical importance of cultural ecosystem services (CES) provided by agricultural landscapes, such as the case of cultural heritage (Chan et al., 2012; Daugstad et al., 2002, 2006; MEA, 2005; Poudel and Johnsen, 2009; Swinton et al., 2007).

The Millennium Ecosystem Assessment (MEA) defined cultural ecosystem services (CES) as "the non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and esthetic experience, including knowledge systems, social relations, and esthetic values" (MEA, 2005). Expressed alternately to differentiate explicitly among services, benefits, and values, CES can be considered as "ecosystems' contribution to the non-material benefits (e.g. experiences, capabilities) that people derive from human–ecological relations" (Chan et al., 2012).

It has been argued that CES represent one of the strongest incentives for people to become involved in natural capital conservation (Daniel et al., 2012; Milcu et al., 2013; Philips, 1998) and they have gained importance in a wide range of settings. In fact, industrialized societies often value CES ahead of other services (Palomo et al., 2011; Quétier et al., 2010; Tielbörger et al., 2010). However, CES remain largely under-appreciated and under-valued (Swinton et al., 2007) and have been little assessed in the literature as compared to other services (Bostedt and Lundgren, 2010; Chan et al., 2012; Daniel et al., 2012; Gee and

Abbreviations: AH, Agricultural heritage; BP, Bivariate probit; CES, Cultural ecosystem services; CVM, Contingent valuation method; ES, Ecosystem services; GIAHS, Global Importance Agricultural Heritage System; KR, Krinsky and Robb method; WTP, Willingness to pay

* Corresponding author at: Instituto de Economía Agraria, Universidad Austral de Chile, Casilla #567, Valdivia, Chile. Tel./fax: +56 63 221235.
E-mail address: lauranahuel@uach.cl (L. Nahuelhual).

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Burkhard, 2010; Milcu et al., 2013). This can be attributed to the fact that CES are generally less tangible than other services, holding almost exclusively non-use values, which are difficult to estimate (Carson et al., 2003; Edwards, 1986; Milcu et al., 2013). As a result, their incorporation into decision-making remains far behind that associated with more tangible services. Hence, being able to place values on these services is fundamental to encourage agricultural land managers to provide and maintain CES at levels that are desirable to society.

As stated by Ruhl and Chapin (2012) "ecosystem services theory is fundamentally anthropocentric in focus—It is about how ecological systems provide economic value to humans". The value of ecosystem services reflects society's willingness to pay and to trade off to preserve these services (Ruhl and Chapin, 2012). In this context, the role of economic valuation is to make explicit to society and policy makers, that ecosystem services are scarce and that their degradation involves costs that society will have to bear. If these costs are not assigned, then policy would be ill-advised and society would be worse off due to misallocation of resources (Pascual and Muradian, 2012).

Knowledge about ecosystem service benefits will certainly lead to more economically efficient decisions regarding land use and is a crucial input into decision methods such as cost-benefit analysis and environmental impact assessment. This knowledge can also enhance the information available to voluntary and regulatory markets and other market-based instruments (Ruhl et al., 2009). However it is not just at a 'micro' level that monetary valuation of ecosystem services can be relevant. By monetizing changes in the flows of benefits arising from natural capital, valuation could also support a more explicit and complete inclusion of the value of this capital within wealth accounting methods, thus supporting an assessment of the sustainability of economic growth paths.

Given the importance of economic valuation in informing policy, environmental economists have made significant progress in developing valuation methods, particularly stated preference methods, which deal with intangible ecosystem services (Pascual and Muradian, 2012). There are many economic valuation studies on CES such as recreation (e.g. Cisneros-Montemayor and Sumaila, 2010) and scenic beauty (e.g. Daniel et al., 2012; Grêt-Regamey et al., 2008), but beyond these two types of services, CES holding non-use values have not generally been assessed in this manner—for instance, those associated with spiritual values, cultural identity, social cohesion, and heritage values (Milcu et al., 2013). These CES are especially difficult to value in monetary terms and have consequently been rendered invisible in planning and management.

In this study the Contingent Valuation Method (CVM) was used to estimate the willingness to pay (WTP) of stakeholders[1] from nearby and more distant locations for the maintenance of agricultural heritage (hereafter AH) in Chiloé Island, southern Chile. Agricultural heritage was understood as "a specific type of inheritance composed of the farmers' way of life, production and agricultural activities" (Casanelles, 1994). Other authors have identified this CES as "cultural heritage of rural lifestyles" (Swinton et al., 2007). These definitions suggest that AH can be taken as a non-divisible combination of three cultural services: the heritage value associated to a culturally significant species (i.e. Chiloé native potato); the traditional systems of knowledge of the heritage keepers; and the social relations established by them (MEA, 2005).

[1] In this paper, we follow the definition by Hein et al. (2006): "Any group or individual who can affect or is affected by the ecosystem's services", understanding the existence of a dynamic bidirectional relationship between the ecosystem services and the stakeholders.

Chiloé Island, in southern Chile was chosen as a case study, given that in 2008 it was proposed by FAO as a Global Importance Agricultural Heritage System (GIAHS) pilot site (FAO, 2008). GIAHS are selected based on their importance for the provision of local food security, high levels of agrobiodiversity and associated biological diversity, storage of indigenous knowledge and ingenuity of management systems (FAO, 2003).

The study focuses on the conservation of Chiloé native potato, which continues to be cultivated by small and medium farmers following traditional agricultural practices. It is expected that WTP for its conservation decreases as stakeholders change from nearby to more distant locations reflecting both less information regarding the CES being valued and a less significant attachment to the agricultural landscape that provides the service (see Pate and Loomis (1997) and Sutherland and Walsh (1985)).

Understanding how people perceive and value ecosystem services is fundamental to management. This type of information is required both to design cost-effective incentives to provide ecosystem services and to measure which kinds of services deliver the greatest overall welfare benefits to society (Swinton et al., 2007). At the national level, this study is of clear interest given the GIAHS designation of Chiloé, which is based on the recognized importance of AH. Hence, the results obtained can be useful to ensure that the current decisions about the level of funding of traditional agriculture conservation are indeed informed decisions.

Finally, this line of work is relevant in developing countries such as Chile where there are few studies exploring economic values of CES from traditional agriculture, which is threatened by agricultural abandonment (Carmona et al., 2010; Díaz et al., 2011) and social transformations (Amtmann and Blanco 2001; Salières et al., 2005).

2. Study case: Chiloé GIAHS pilot site

The Chiloé Archipelago is composed of the main Island of Chiloé and a group of 40 smaller islands in southern Chile (41–43 °S) (Fig. 1). Administratively, Chiloé is made up of 10 municipalities, comprising an area of 9182 km^2 (INE, 2007). A large part of the Archipelago is covered by native forests (66.9%), while the remaining area (27.4%) corresponds to agricultural lands (mostly pastureland) and shrubland (CONAF et al., 1999). An important part of these forests are protected under Chiloé National Park (43,057 ha) and privately owned conservation areas, such as Tepuheico Park (20,000 ha) and the Tantauco Park (118,000 ha).

The predominant farm structure in Chiloé is a peasant agriculture. These small properties continue to experience farm subdivision, leading to their increasing atomization which compromises their sustainability (CET, 2011; Díaz et al., 2010; Salières et al., 2005). Within the agricultural activity, the Chiloé native potato is crucial to food security and sovereignty of Chiloé's inhabitants (CET, 2011). Around 200 documented varieties of native potato would be still managed today which are highly adapted to the range of ecological conditions found in Chiloé (CET, 2011). The conservation of this species in small farms has been possible through the oral transmission of traditional knowledge among generations of peasant families. However, in last decades, the influx of new economic activities (forestry and fish-farming), urban expansion, migration of young people, and the increasing use of commercial potato varieties have threatened the conservation of this species and produced deep changes in the socio-economic structure of the territory (CET, 2011; FAO, 2012; Salières et al., 2005).

Chiloé is considered as a valuable geographical location both nationally and internationally, for its outstanding natural landscapes, its local communities which hold unique customs and

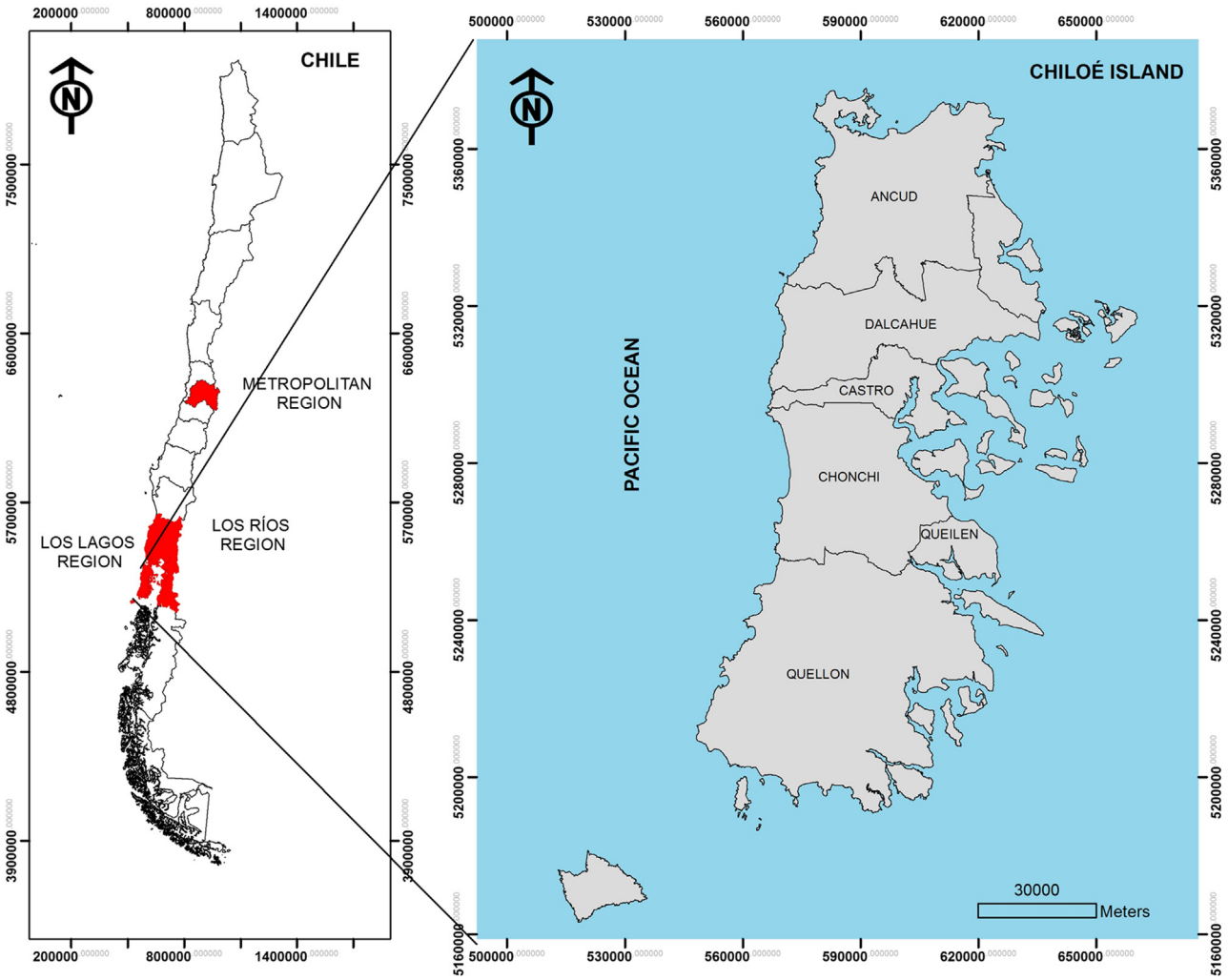

Fig. 1. Map of Chile showing Chiloé Archipelago and the administrative regions where the survey was taken.

traditions, its rich architectural heritage, and its agricultural heritage (FAO, 2012; UNESCO, 2012). For these reasons, over the years numerous conservation efforts have been developed to protect the natural, social and physical capital of Chiloé. In this context, World Wildlife Fund (WWF) designated Chiloé as one of the 25 priority areas for ecosystem conservation in the world (FAO, 2012). Also, in 2000, UNESCO declared some of Chiloé's wooden churches human patrimony (UNESCO, 2012). Finally, the GIAHS designation recognizes the relevancy of Chiloé Island as a center of culture, tradition, and genetic biodiversity (i.e. Vavilov center of origin of potato, *Solanum tuberosum*) (FAO, 2012).

3. Methods and data

3.1. CVM survey design and application

For most CES, stated preference methods are thought to be the only economic valuation techniques capable of measuring non-use values (Cameron, 1992; Harrison, 1995; Larson, 1992). In this study, CVM was applied, which has become the main tool for economic valuation of non-market goods (Arrow et al., 1993; Haab and McConnell, 2002; Martín-López et al., 2011; Poudel and Johnsen, 2009).

Following Portney (1994), the CVM questionnaire consisted of three sections. The first section explained to respondents the worldwide relevancy of Chiloé native potato as a cultivated genetic resource, its traditional form of cultivation, and the threats to its conservation. This description was supported with extensive photographic material. This section also asked respondents their previous knowledge on native potato and related conservation initiatives and required them to rank the most outstanding feature of Chiloé, namely (i) site of natural beauty; (ii) site of architectural heritage; (iii) a site of agricultural heritage; and (iv) a site of customs and traditions.

The second section contained the presentation of the market, the payment vehicle and the WTP question. During the description of the hypothetical market, emphasis was given to Chiloé native potato as a culturally significant species. This description also aimed at preventing the respondent from valuing native potato as a consumption good (direct use market value). It was explained that the traditional cultivation of the native potato has been central to its conservation, which in turn has been possible thanks to the oral transmission of traditional agricultural practices through farmers' generations. The respondents were informed that a Foundation would be created, which would operate with voluntary donations from across the country to carry out a native potato conservation program.

After describing the market, the respondent was asked a screening question, which was worded as follows: *When this Foundation begins to operate, it will solicit funds from yourself and from other citizens on a voluntary basis. Taking into account your*

Table 1
Price vectors expressed in Chilean pesos and US dollars in parenthesis, offered to respondents for the double bounded dichotomous choice format.

First price	Second price	
	No to the first price	Yes to the first price
2000 (4)	1000 (2)	4000 (8)
4000 (8)	2000 (4)	6000 (12)
6000 (12)	4000 (8)	8000 (16)
8000 (16)	6000 (12)	10,000 (20)
10,000 (20)	8000 (16)	12,000 (24)
12,000 (24)	10,000 (20)	15,000 (30)
15,000 (30)	12,000 (24)	20,000 (40)
20,000 (40)	15,000 (30)	30,000 (60)
30,000 (60)	20,000 (40)	50,000 (100)
50,000 (100)	30,000 (60)	70,000 (140)

1 US$ = 500 Chilean pesos.

individual income and your expenses in other activities, would you be willing to make this contribution?

People who answered that they would not make this contribution were asked the reasons, but were finally excluded from the sample. Possible reasons for a negative answer to this screening question were the following: (1) I already contribute to such purposes with my taxes and this is a Government's responsibility; (2) I would need more information regarding the Foundation and its functions; (3) I prefer to contribute to other initiatives; (4) I do not believe in this type of contributions; (5) I believe that there are already Foundations that carry on this function; (6) At the moment, I am not in an economic situation to contribute.

For those people who answered that they would contribute to the conservation program, the valuation question was worded as follows: *Would you be willing to pay $xx* (*Bid amount*) *for one year to the Foundation*? If the answer to the first proposed price was negative, a lower amount was presented to the respondent and in the case of a positive answer, a higher amount was presented. The vector of prices faced by respondents is showed in Table 1. These prices were obtained from a pre-pilot survey that relied on an open-ended question (i.e. how much would you be willing to pay?) which was applied in person to 75 people in the city of Valdivia. Using an open question in a first version of a CVM questionnaire is a common procedure in contingent valuation studies that aim at valuing public goods for which no previous knowledge of people preferences exists.

For the final survey, the double-bounded dichotomous choice question format was selected (Carson et al., 2003), which has the advantage of being less susceptible to strategic behavior and easier for interviewees, thus reducing the number of non-responses or protest responses (Haab and McConnell, 2002).

In turn, the selection of a voluntary donation as a payment vehicle was based on the fact that in Chile taxes are centralized, in which case their distribution towards regional needs cannot be ensured. Other payment vehicles such as environmental bonds, fines, and rewards have been proved more difficult for respondents to understand in a survey setting. The literature presents several other studies that have used voluntary contributions rather than other mechanisms (Bedate et al., 2009; Sanz, 2004).

The second section also asked the respondent to prioritize the most important role of the Foundation, namely (i) to conserve native potato genetic resources for strategic reasons such as food security; (ii) to conserve traditional farming styles; and (iii) to conserve the native potato because is part of Chiloé's identity and tradition, roles that were closely related to the three CES comprised in AH. Finally, the third section included questions concerning demographic characteristics of respondents, such as gender, age, monthly income, education level, and occupation.

After an extensive pre-testing in November and December of 2011 in the city of Valdivia (75 people in the pre-pilot survey and 150 people in the pilot survey), the final questionnaire was applied in person in the cities of Castro and Ancud in the Los Lagos administrative region (350 people), the city of Valdivia (350 people) which is the capital of the Los Ríos administrative region (379 km distance from Chiloé) and Santiago Metropolitan region (350 people), which is the country's capital (1198 km distance from Chiloé), obtaining a total of 1049 complete surveys.

Respondents surveyed in Castro and Ancud (henceforth Chiloé sub-sample) represented the nearby population and they were assumed to be the most knowledgeable and directly involved in protecting AH. Respondents interviewed in Valdivia (henceforth Valdivia sub-sample), located further away from the CES provision center, were assumed to have partial knowledge of the CES being valued. Finally, interviewees from Santiago (henceforth Santiago sub-sample), represented the most distant population and were assumed to be the least knowledgeable of the CES under valuation.

An initial question ruled out underage persons and therefore the CVM questionnaire was applied only to people 18 years old and above. The age question was followed by two other questions that aimed at excluding people who were non-residents or did not have a permanent job (e.g. housewives and retired people). People who were temporarily unemployed and in search of a job, were included in the sample.

Interviews took place in high traffic places such as malls and plazas. If a person refused to be interviewed or did not meet the requisites for being surveyed, another person was chosen randomly. The final survey was conducted by well-trained surveyors, male and female, in the four cities previously mentioned, during mornings and evenings of working days and weekends during January of 2012.

3.2. Theoretical and empirical model specification

The random utility model provides the theoretical basis for CVM analysis. In this model and in the case at hand, an individual would choose to pay the donation fee for AH conservation over not paying the donation under the following condition (Hanemann, 1984):

$$v(1, Y-A; s)+\varepsilon_1 \geq v(0, Y; s)+\varepsilon_0 \quad (1)$$

where v is the indirect utility function, 1 represents paying the donation and 0 not paying it, Y is the person's individual income, A is the bid amount, s represents other socioeconomic characteristics affecting individual preferences, and ε_0 and ε_1 are the identically, independently distributed random variables with zero means. Paying the donation for conservation or not paying it, is determined by the utility difference Δv:

$$\Delta v = v(1, Y-A; s)-v(0, Y; s)+(\varepsilon_1-\varepsilon_0) \quad (2)$$

The dichotomous choice format of the CVM requires a qualitative choice model. Consistent with many previous studies, a linear distribution of WTP and a Bivariate Probit (BP) were used, based on the one developed by Cameron and Quiggin (1994). This model specification assumes that the error of the second dichotomous question is correlated with the error of the first. The possibility of imperfect correlation between the error terms of both equations of WTP make the BP model be the correct specification (Alberini, 1995), given that the normal bivariate distribution permits the existence of a distinct correlation of zero between the terms of error, while the logistic distribution does not permit the same distinct correlation (Cameron and Quiggin, 1994; Jeanty et al., 2007).

Cameron and Quiggin (1994) propose to use a normal bivariate distribution of the form $BVN=(x_{1j}'\beta_1, x_{2j}'\beta_2, \sigma_1^2, \sigma_2^2, \rho)$ where x_{1j}' is a

Table 2
Description of the variables used in the BP model.

Variable	Description
Price 1	First bid amount proposed to the respondent as annual contribution ($)
Price 2	Second bid amount proposed to the respondent as annual contribution ($)
Hiedu	Binary variable equal to 1 if the respondent had a higher education level (over 12 years) and 0 otherwise
Inc	Individual net monthly income ($)
Kpot	Binary variable equal to 1 if the respondent had previous knowledge of Chiloé native potato and 0 otherwise
Kinit	Binary variable equal to 1 if respondent knew about initiatives related to the protection of Chiloé native potato and 0 otherwise
Custr	Binary variable equal to 1 if the respondent considered that the most relevant characteristic of Chiloé was as a site of customs and traditions and 0 otherwise
Agrhe	Binary variable equal to 1 if the respondent considered that the most relevant characteristic of Chiloé was as a reserve of agricultural heritage and 0 otherwise
Nabea	Binary variable equal to 1 if the respondent considered that the most relevant characteristic of Chiloé was as a site of natural and scenic beauty and 0 otherwise
Geres	Binary variable equal to 1 if respondent considered that conserving genetic resources for strategic reasons was the most important role of the Foundation and 0 otherwise
Rlife	Binary variable equal to 1 if respondent considered that conserving rural traditional lifestyle was the most important role of the Foundation and 0 otherwise

vector of explanatory variables and β_1 the vector of parameters corresponding to the first equation; x_{2j}' corresponds to the vector of variables and β_2 to the vector of parameters of the second equation; ${\sigma_1}^2$ and ${\sigma_2}^2$ correspond to the variances of the error term of the first and second equation, respectively; and ρ is the correlation coefficient between the two equations.

Modeling data generated by the double-bounded question format relies on the formulation given by

$$WTP_{ij} = x_{ij}'\beta_i + e_{ij} \tag{3}$$

where WTP_{ij} represents the jth respondent's willingness to pay and $i=1,2$ denotes the first and the second question, respectively. In this way, *WTP* depends on a systematic component given by the observed characteristics of the respondent ($x_{ij}'\beta_i$) as well as on a non-observable random component ($e_{ij} \sim N(0,\sigma^2)$).

Following Haab and McConnell (2002), the jth contribution to the likelihood function becomes

$$\begin{aligned} L_j = {} & \Pr(x_{1j}'\beta_1 + e_{1j} > A, x_{2j}'\beta_2 + e_{2j} < A_u)^{YN} \\ & \times \Pr(x_{1j}'\beta_1 + e_{1j} > A, x_{2j}'\beta_2 + e_{2j} > A_u)^{YY} \\ & \times \Pr(x_{1j}'\beta_1 + e_{1j} < A, x_{2j}'\beta_2 + e_{2j} < A_l)^{NN} \\ & \times \Pr(x_{1j}\beta_1 + e_{1j} < A, x_{2j}\beta_2 + e_{2j} > A_l)^{NY} \end{aligned} \tag{4}$$

where $YN=1$ for a yes–no answer and 0 otherwise; $YY=1$ for a yes–yes answer and 0 otherwise; $NN=1$ for no–no answer and 0 otherwise; and $NY=1$ for a no–yes answer and 0 otherwise. Specifically, A is the amount offered in the first question of the double bounded model; faced with this question respondents decide whether they accept the amount or not. A_u is the amount offered in the second question of the double-bounded model dependent upon a positive answer to the first question and therefore it is a value larger than A. In turn, A_l is the amount offered in the second question of the double-bounded model in case the answer to the first question had been negative and therefore it is a value smaller than A.

Applying the natural logarithm to Eq. (4), the following function is obtained:

$$\begin{aligned} \ln L_j = {} & YN \ln \Pr(x_{1j}'\beta_1 + e_{1j} > A, x_{2j}'\beta_2 + e_{2j} < A_u) \\ & + YY \ln \Pr(x_{1j}'\beta_1 + e_{1j} > A, x_{2j}'\beta_2 + e_{2j} > A_u) \\ & + NN \ln \Pr(x_{1j}'\beta_1 + e_{1j} < A, x_{2j}'\beta_2 + e_{2j} < A_l) \\ & + NY \ln \Pr(x_{1j}\beta_1 + e_{1j} < A, x_{2j}\beta_2 + e_{2j} > A_l) \end{aligned} \tag{5}$$

Once the BP regression is estimated, the WTP is calculated as $\overline{\chi}\beta'/\beta_0$ using the Krinsky and Robb (KR) method (Krinsky and Robb, 1986), where $\overline{\chi}$ is the mean of the explanatory variables, β' is the vector of the estimated coefficients of the explanatories variables, and β_0 is the estimated coefficient for the bid.

The BP model was estimated using the econometric software STATA 10, which facilitates the manageability of large databases. In addition, the KR confidence intervals for mean and median WTP can be easily constructed using this program (see Cameron and Trivedi (2005)). The description of the variables used in the BP model is presented in Table 2.

Price and income are the basic variables determining demand. Education is also included in most valuation studies as a predictor of WTP. In this study, education was incorporated as a dummy variable that accounted for higher education level which in the case of Chile ranges between 14 and 20 years. The remaining variables were chosen as they accounted for knowledge of the Chiloé native potato (*Kpot and Knit*), perceptions regarding Chiloé (*Custr, Arghe, Nabea*), and the main role assigned to the Foundation (*Geres, Rlife*).

4. Results

4.1. Respondent's socio-demographic characteristics and knowledge of AH

Of the total number of surveys applied and completed (1049), an important percentage contained negative answers to the screening question that asked the respondent if she/he would be willing to contribute to the Foundation to carry a native potato conservation program. Specifically, 30.6% of respondents in Chiloé, 48.4% in Valdivia, and 41.7% in Santiago gave negative answers, which resulted in a total number of 627 usable questionnaires (59.8% of the sample) for analysis and estimation.

Table 3 provides frequencies and mean values associated to each sub-sample and the general sample for the interviewees who were willing to contribute to the Foundation.

Most respondents (over 88% in all cases) were employed at the time of the survey. The proportion of respondents with higher education (*Hiedu*) and the respondent's' average monthly income (*Inc*) was lowest in Chiloé (less than the general sample) and highest in Valdivia (more than the general sample). In Chiloé practically 100% of the respondents stated that they knew Chiloé native potato (*Kpot*), and more than 35% identified existing protection initiatives (*Kinit*), whereas in Valdivia and Santiago those percentages fell to 66% and 12% and to 54% and 3%, respectively. Yet, an ANOVA with a Tukey test for the numerical variables and a Pearson χ^2-squared test for the binary variables, showed no statistical differences across sub-samples for the means of monthly income (*Inc*) and frequency of higher education (*Hiedu*), previous knowledge of native potato (*Kpot*) and the knowledge of initiatives related to the protection of native potato (*Kinit*).

In relation to what the respondents considered the most outstanding feature of Chiloé, the quality of the site's customs and traditions (*Custr*) was ranked highest by over 40% of respondents

Table 3
General characteristics of the sub-samples and general sample indicating percentages of people in the case of binary variables (for value 1) and mean values of each group of respondents for numerical variables.

Variable	Category	Sub-samples			General sample $n=627$
		Chiloé $n=243$	Valdivia $n=180$	Santiago $n=204$	
Sector (*Sec*)	Urban	89%	98%	100%	95%
Gender (*Gend*)	Male	54%	51%	39%	48%
Age (*Age*)	Years	39	40	38	39
Currently working (*Cwor*)	Yes	97%	98%	88%	94%
Higher education (*Hiedu*)[a]	Yes	44%	70%	69%	59%
Knew about the native potato of Chiloé (*Kpot*)[a]	Yes	99%	66%	54%	75%
Knew about initiatives relating to the protection of the native potato of Chiloé (*Kinit*)[a]	Yes	35%	12%	3%	18%
Considered that the most relevant characteristic of Chiloé is:					
As a site of architectural patrimony (*Arche*)[b]	Yes	12%	22%	19%	17%
As a site of customs and traditions (*Custr*)[a]	Yes	43%	42%	33%	40%
As a reserve of agricultural heritage (*Agrhe*)[a]	Yes	24%	18%	17%	20%
As a site of natural and scenic beauty (*Nabea*)[a]	Yes	21%	18%	31%	23%
The most important role of Foundation is					
Conserving genetic resources for strategic reasons (*Geres*)[a]	Yes	22%	23%	23%	23%
Conserving rural traditional lifestyle (*Rlife*)[a]	Yes	32%	42%	23%	32%
Conserving native potato because it is part of the culture of Chiloé island (*Cult*) [b]	Yes	46%	35%	55%	46%
Monthly Incomes (*Inc*)[a]	US$	776	1083	1025	945

[a] Used in BP estimation as independent variables besides donation amount (Price 1 for Eq. (1) and Price 2 for Eq. (2) as described in Table 2).
[b] These variables were excluded from the estimation to avoid perfect collinearity with *Custr, Agrhe, Nabea* and *Geres* and *Rlife*.

in Chiloé and Valdivia, and over 30% in Santiago. Regarding what people considered to be the most important role of the native potato conservation program, in Chiloé and Santiago conserving native potato as part of the identity was the most frequent answer (46% and 55%, respectively), while in Valdivia the predominant reason was conserving rural traditional lifestyles (42%) (See Table 3).

4.2. Bivariate probit estimation results

The results from the four BP regressions for the three sub-samples and the general sample are shown in Table 4. The upper part of the Table 4 shows the estimation for Eq. (1), and the lower part, the estimation for Eq. (2). Eq. (1) represents the probability that WTP be equal or higher to the first bid amount presented to the respondent (Price 1), whereas Eq. (2) represents the same probability for the second bid amount (Price 2). In both equations this probability is also influenced by respondent's own characteristics and by a series of independent variables that reflect her/his preferences for the CES being valued (Table 4). As expected, in the four BP regressions the coefficient on price was negative and significant in both equations, indicating that as the price increased the probability of a positive answer to the WTP question decreased.

The results for the general sample indicate that WTP was influenced positively by the knowledge of AH protection initiatives (*Kinit*), the level of education (*Hiedu*) and the net monthly income (*Inc*). However, in the case of the sub-samples, these variables were not simultaneously significant. In the case of Chiloé, *Kinit* resulted significant, showing a positive influence on the WTP in both equations. In Valdivia, *Hiedu* positively influenced the probability of accepting the proposed price in both equations. In the Santiago sub-sample previous knowledge about native potato (*Kpot*) was significant in both equations, negatively influencing the probability of accepting each of the proposed prices. Fig. 2a shows how the probability of a positive response to the WTP question decreases as the bid amount increases, when holding all the explanatory variables at their mean values. In turn, Fig. 2b and c shows respectively that people who knew initiatives related to the protection of Chiloé native potato (*Knit*=1) and held a higher education level (*Hiedu*=1) had a higher WTP for conserving AH.

Other variables also influenced WTP in each of the sub-samples, but with statistical significance in only one of the two equations. This suggests the possibility that the answers to the first and second question were influenced by different variables. For example *Inc* resulted significant in Chiloé and Santiago only in Eq. (1); *Custr*, *Agrhe*, and *Nabea*, were significant and negative only for Chiloé in Eq. (1). In turn, *Custr* was significant and negative only in Eq. (1) of Valdivia, whereas *Agrhe* and *Nabea* were significant and negative only in Eq. (2) of Valdivia. Finally none of these three variables was significant in either equation of Santiago.

For the group of variables that accounted for the most important role of the Foundation, the parameter associated with the variable *Geres* was positive and significant for Santiago and the general sample in Eq. (1). Meanwhile, the parameter associated with the variable *Rlife* resulted negative and significant for Valdivia only in Eq. (1). Contrarily, none of these variables presented statistical significance in Eq. (2) for any of the sub-samples.

It is important to remark that Valdivia was the only sub-sample where the value of ρ did not allow the rejection of the null hypothesis of independence among the errors of both equations (H_0: $\rho=0$), which theoretically admits the existence of two functions of WTP associated with the two phases of the interview. On the contrary, in the case of Chiloé, Santiago, and in the general sample ρ resulted significant, which suggests that the behavior of the respondents is guided under the same WTP function in the different phases of the interview.

Table 5 shows mean WTP estimates obtained by the KR method for each sub-sample and the general sample. In Chiloé and Santiago, the mean annual WTP (US$50.8/person and US$52.5/person, respectively)) were slightly superior to the value that was obtained in the general sample (US$50.5/person), while in Valdivia WTP (US$36.2/person) was 30% inferior to the value of the general sample. However, the overlapping KR confidence intervals for

Table 4
Bivariate probit regression results: coefficients and standard errors for each sub-sample and the general sample.

Eq. (1)								
Variable	Chiloé		Valdivia		Santiago		General	
	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
Constant	1.4414	(0.8981)	2.2828	(0.6213)***	0.7510	(0.3278)**	1.1955	(0.2234)***
Price 1	−0.0319	(0.0041)***	−0.0676	(0.0106)***	−0.0197	(0.0036)***	−0.0283	(0.0023)***
Kpot	0.1117	(0.8121)	0.0359	(0.3161)	−0.3932	(0.2083)*	−0.1731	(0.1443)
Kinit	0.3989	(0.2304)*	1.0518	(0.5939)*	−0.5446	(0.7051)	0.3747	(0.1757)**
Custr	−0.7051	(0.3508)**	−0.8590	(0.4413)*	0.0214	(0.3069)	−0.3237	(0.1827)*
Agrhe	−0.6576	(0.3780)*	−0.6977	(0.4793)	−0.1250	(0.3335)	−0.2982	(0.2022)
Nabea	−0.8636	(0.3946)**	−0.6363	(0.5112)	0.0973	(0.3087)	−0.2994	(0.1991)
Geres	0.3840	(0.2684)	0.1884	(0.4219)	0.4940	(0.2759)*	0.3918	(0.1665)**
Rlife	0.1499	(0.2311)	−0.8071	(0.3569)**	0.2568	(0.2516)	0.0260	(0.1368)
Hiedu	0.2512	(0.2210)	1.2380	(0.3342)***	0.0568	(0.2349)	0.3201	(0.1323)**
Inc	0.0004	(0.0002)*	0.0001	(0.0002)	0.0005	(0.0001)**	0.0003	(0.0001)***
Eq. (2)								
Constant	−0.0540	(0.8510)	0.8620	(0.4524)*	−0.2805	(0.2966)	0.2046	(0.1915)
Price 2	−0.0155	(0.0042)***	−0.0290	(0.0070)***	−0.0107	(0.0030)***	−0.0156	(0.0022)***
Kpot	0.3412	(0.7864)	0.4662	(0.2489)*	−0.4529	(0.1903)**	−0.0070	(0.1251)
Kinit	0.5527	(0.1906)***	0.2679	(0.3648)	−0.2793	(0.6004)	0.4890	(0.1474)***
Custr	−0.0554	(0.2887)	−0.5164	(0.3541)	0.0325	(0.2734)	−0.1140	(0.1558)
Agrhe	−0.0135	(0.3091)	−1.0576	(0.3717)***	0.2872	(0.3048)	−0.1558	(0.1730)
Nabea	−0.3773	(0.3263)	−1.0923	(0.3839)***	0.2853	(0.2729)	−0.3353	(0.1694)**
Geres	−0.0077	(0.2282)	−0.0573	(0.2972)	0.0522	(0.2405)	0.0171	(0.1391)
Rlife	−0.1829	(0.2024)	0.1256	(0.2690)	−0.0115	(0.2316)	0.0959	(0.1230)
Hiedu	0.2424	(0.1926)	0.9037	(0.2624)***	0.4211	(0.2216)*	0.4300	(0.1178)***
Inc	0.0002	(0.0001)	0.0000	(0.0001)	0.0002	(0.0001)	0.0001	(0.0001)*
N	243		180		204		627	
Log likelihood	−247.59		−138.01		−222.53		−674.09	
Chi-square (20)	102.10***		96.020***		55.45***		235.58***	
ρ (1, 2)	−0.3071**		−0.0172		0.5583***		0.1634**	

* p-Value < 0.10.
** p-Value < 0.05.
*** p-Value < 0.01.

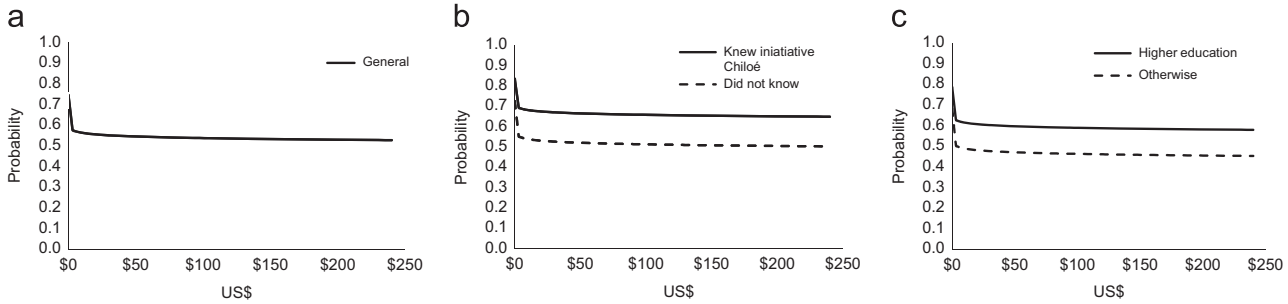

Fig. 2. (a) Probability of a positive response to the WTP question as a function of the bid amount, holding the remaining covariates at their mean values; (b) WTP for *Kinit* = 1 and *Kinit* = 0; and (c) WTP for *Hiedu* = 1 and *Hiedu* = 0.

Table 5
Willingness to pay estimates for each sub-sample and the general sample.

	Mean annual WTP (US$)	Lower bound	Upper bound	ASL*	CI/ MEAN
Chiloé	50.8	37.3	66.9	0.000	0.6
Valdivia	36.2	31.6	41.8	0.000	0.3
Santiago	52.5	36.8	73.1	0.000	0.7
General sample	50.5	45.8	56.0	0.000	0.2

Krinsky and Robb (95%) confidence interval for WTP measures.
* Achieved significance level for testing H0: WTP < = 0 vs. H1: WTP > 0.

the sub-samples suggest that WTP was not statistically different across sub-samples, which leads to the rejection of the hypothesis that WTP would be negatively correlated with distance from the place of provision of the ecosystem service.

Mean WTP values were projected over the work force (employed and momentarily out of job) according to the proportions of respondents that agreed to contribute to the Foundation (i.e. answered yes to the screening question and were the relevant sample for estimation purposes). These proportions were 69.4% in Chiloé, 51.6% in Valdivia and 58.3% in Santiago. The aggregate values obtained were divided by three, a procedure that has been recommended by several authors for reducing hypothetical bias (NOAA, 1994; Harrison and Rutström, 2005; Harrison, 2006; Bedate et al., 2009). Hypothetical bias may be defined as the potential error arising from an individual not being faced with a real situation (Schulze et al., 1981) and is a common problem in contingent valuation studies, leading to an overestimation of WTP (Bedate et al., 2009). Several solutions have been proposed to correct hypothetical bias in CVM. Amongst ex-post solutions, one approach used in the field of experimental economics consists of identifying calibration factors. According to the works of List and

Gallet (2001), Murphy et al. (2005) and Harrison and Rutström (2005), the mean hypothetical values are 2.5–3 times higher than real values.

Given this adjustment, and taking official data on work force for each region obtained from INE (2012), the final aggregated values reached US$4,409,491 in Los Lagos region (Chiloé sub-sample), US$1,086,326 in Los Ríos region (Valdivia sub-sample) and US$34,865,303 in the Metropolitan region (Santiago sub-sample), totaling US$40,361,120 which represent the social benefits of AH conservation in Chiloé Island.

5. Discussion and conclusions

Contrarily to what it was expected, the results showed no significant differences in WTP for the conservation of AH, when respondents were segmented by distance. This in spite of the fact that previous knowledge of native potato decreased as the distance from Chiloé increased (see *Kpot* and *Kinit* variables in Table 3). Previous studies have found heterogeneous results regarding the relation between WTP and distance to the good or service being valued. Pate and Loomis (1997) analyzed the effects of distance on WTP for the implementation of three programs designed to reduce various environmental problems, finding that in two of them (pollution control and a wetland improvement program) WTP declined as the distance increased, while in the third (salmon improvement program), WTP did not have significant variations with distance. Kim et al. (2012) established that WTP for the preservation of the spotted seal of Baengnyeong Island in South Korea was higher for residents than for non-residents. Duffield et al. (1992), Lockwood (1996) and Kniivilä (2006) found that local respondents' WTP was smaller than that of non-residents. Blaine and Lichtkoppler (2004) found no statistical differences between mean WTP for conservation programs in Cuyahoga County Ohio, between soil and water district clientele and the voting public. Ponce et al. (2011) economically quantified the impacts of a hydropower project on the landscape in a southern region of Chile. They showed that the cities' distance from dams significantly affected citizens' WTP for landscape protection.

These results reveal that for certain ecosystem services, distance does play a role in the determination of WTP, while for others it does not, suggesting that the particular characteristics of the service being valued as well as those of the stakeholders involved will determine the magnitude and direction in which distance can influence WTP.

In the case of valuation of CES (economic or social), the determination of the relevant stakeholders to value the service represents a complex challenge. The benefits that people obtain from CES are subject to permanent cultural and moral considerations (Aldred, 1994; Pascual and Muradian, 2012) and originate from non-use values, unlike provisioning and regulating services where the benefits arise from direct and indirect use values (Hein et al., 2006). Agricultural heritage in particular exists first from the inherent characteristics of the agricultural landscape of Chiloé and its benefits are derived from its non-use value in an ample spatial scale. Distinct stakeholders can value AH for its existence (based on the utility that it generates for them just because it exists), its altruistic value (based on the utility for someone else who benefits), and/or in terms of its legacy value (based on the utility that it generates to know that future generations will benefit from this CES) (Kolstad, 2000). This makes it possible that stakeholders, regardless the distance from the ecosystem service, have similar WTP since their valuation criteria are not influenced by "use" (direct or indirect), and can be an explanation for the results obtained. On the other hand, the special characteristics of Chiloé grant this place worldwide importance, which could positively influence the valuation that people from far away and with less knowledge of AH have for this cultural service. The spatial discounting literature suggests that non-use values should have much lower spatial discount rates than use values (Brown et al., 2002). In some cases, non-use values may not decline at all with distance, which implies that the rate of spatial discounting is zero (Pascual and Muradian, 2012).

Whereas distance did not influence respondents' preferences and values for AH, WTP was significantly determined by other variables. In particular, *Kinit* positively influenced WTP in Chiloé, *Hiedu* positively influenced WTP in Valdivia and *Kpot* had a negative influence on WTP in Santiago. This last result is somehow unexpected, but could in part reflect the fact that people from more distant regions might obtain their knowledge of the Chiloé native potato in a decontextualized manner (i.e. through sales in supermarkets or in food festivals), unconnected from the rest of the cultural aspects that define AH (i.e. traditional systems of knowledge, farmers social networks).

The aggregated benefits obtained (US$40,361,120) reflect the importance that society places on AH conservation (see Section 4.2) and is considerably high compared for example to government subsidies directed to small and medium farmers. The main division of the Chilean Ministry of Agriculture (the Institute for Agricultural Development) handles at least eight nation-wide programs to support family agriculture (including indigenous farmers), whose 2012 budget for the Los Lagos region was US $13,300,350 (INDAP, 2012).

It is important to highlight efforts to value complex CES from agricultural landscapes. The information that such studies provide can assist the design and implementation of public policies oriented towards their conservation. In the case of AH in Chiloé Island and other relevant heritage conservation sites, such policies concern both providers and beneficiaries of AH. In the case of providers, policy makers should take into consideration that in order to maintain cultural landscapes, farmers must have the possibility of making a living without intensifying their management practices. This is only possible if they are made aware of their role in the provision of other ecosystem services beyond food, such as the case of AH. In this sense, the results from valuation studies might help design specific incentives or compensation initiatives. This is particularly important in the case analyzed here where AH conservation is menaced by the decreasing number of native potato producers, given the lack of incentives, among other external drivers. It is estimated that at present time only near 40% of Chiloé farmers (about 1600 farmers) cultivate some native potato varieties, but in small amounts, and of this total less than 10% (160) would do it for commercial purposes—cultivating no more than six varieties (A. Contreras Pers. Comm). As in other countries, the absence of the appropriate recognition of agricultural heritage, has led to its underestimation and a lack of consideration in public policy as well as social consciousness. This lack of consideration strongly contrasts with the objective importance of agricultural heritage for humanity—its subsistence value, its contribution to sustainable development and respect for the landscape, its role in the quality of life and the preservation of cultural and biological diversity, and the relevance of the values and types of properties associated with it.

With regard to beneficiaries, it is important to recognize that AH conservation influences the welfare not only of local populations where this CES is generated, but also of distant stakeholders. In fact, for CES, the inherent value of an ecosystem will often draw stakeholders to an area (Costanza, 2008; Fagerholm et al., 2012). Also the designation of Chiloé as a pilot GIAHS site implies that the benefits of AH conservation are global in nature, accruing to humanity's present and future generations. Therefore, the precise

determination of beneficiaries and the importance they give to AH should be important criteria in land use planning and management policies.

Not withstanding the anthropocentric focus of economic valuation in particular—and ecosystem service theory in general—it does not intend to displace other reasons for managing and protecting ecological integrity, such as the intrinsic value of species or ethical beliefs about human responsibilities towards conservation (Costanza et al., 1989). Adding other valuation criteria is especially relevant in cases where important critical thresholds might be approaching or ecosystem change is irreversible or reversible only at prohibitive costs, situations in which the assumptions of economic valuation might no longer hold. Under conditions of high or radical uncertainty and existence of ecological thresholds, policy should be guided by the "safe-minimum-standard" and "precautionary approach" principles (Pascual and Muradian, 2012).

Progress is needed in the development of a transdisciplinary view on CES valuing, which can address the challenges of analyzing and assessing ecosystems in a comprehensive manner, despite the methodological complications that this might entail. Exploring new theoretical frameworks and methodologies in the valuation of CES could provide better approaches that recognize the importance that different stakeholders give to these services. Authors such as Chan et al. (2012), Daniel et al. (2012), and Martín-López et al. (2009,2011) have made important contributions in this area.

While recognizing that monetary valuation methods, particularly those aimed at estimating non-use values, are subject to several complications, demonstrating the approximate contribution of ecosystems to the economy remains urgently needed and the contribution of valuation studies should be understood in this context. Valuation exercises can still deliver information that is a crucial component of environmental policy in general. As Kontoleon and Pascual (2007) assert, "ignoring information from preference-based valuation methods is thus neither a realistic nor a desirable option". Instead, policy-makers should interpret and use the valuable information provided by these techniques while acknowledging the limitations of this information (Pascual and Muradian, 2012).

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