Capítulo 3

Valuation of the services provided by the Forest Recreational Reserve of Valverde, Santa Maria, Azores

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ABSTRACT

The valuation of the recreation services without market value provided by forest spaces managed for this purpose is a good reference for future conservation policies, at least as a "budget ceiling" for annual costs supporting conservation policies. Benefit and cost analysis can be based on these values against conservation cost policies. In the case of the Forest Recreation Reserve (FFR) of Valverde (Santa Maria, Azores) a Contingent Valuation Method (CVM) in a Discrete-Choice (DC) format survey was developed and undertake to estimate the mean Willingness To pay (WTP) among the visitors. CVM surveys whose results are to be aggregated for policy evaluation purposes need two important complementary definitions: (1) the definition of the population and (2) the definition of the sample of that population. The survey population, which should include by definition all the individuals affected by the policy-induced "conservation of forest spaces for recreational purposes", was defined

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as the set of all visitors over the last 12 months. As the chosen bid form is an individual access ticket, the relevant population are individuals and not households.

From 150 usable questionnaires, 115 respondents gave "no" answers to the proposed bids, and invoked a "protest" reason for these answers, which corresponds to about 77% of the usable sample. Those answers were considered "protest-no", and were not considered when estimating mean WTP. Considering the available data, the estimated population for the purpose of this study will be just over 6.000 visitors per year.

Taking the obtained aggregate values as a public "annual income", in other words, as an annual series of constant payments, and considering an annual real rate of return of 1,5% normally accepted for institutional investments, we can estimate both the "budget ceiling" for the annual conservation of the area and the present value of the Valverde FRR.

INTRODUCTION

The construction, conservation and management of spaces in a forest environment with recreational purposes is, in many aspects, one of the most characteristic creation of the 20th century landscaping in the Azores (Albergaria, 2012). Created in the last half of the past century, 27 Forest Recreational Reserves (FRR) are nowadays spread in 8 of the 9 islands of the archipelago, serving a huge amount of activities and hosting a significant number of visitors. Since 2010 that periodic surveys are maintained to evaluate the satisfaction of the visitors in these FRR, based in two main parameters: (1) *services displayed* and (2) *infrastructures*.

From the survey of 2012 (DRRF/DCPP, 2012), it can be derived a high level of satisfaction of the visitors towards the FRR´s of Azores, with a global "satisfaction/ high satisfaction" of 84.8%, as it can be observed in Table 1.

Beyond the initial investment, the maintenance and the management of these FRR spaces (with areas from 1.4 up to 80.0 ha) represent an important annual budget. The optimization of the use of this budget can be approached if the criteria of allocation are supported by the value that visitors (population) accord to the use of these different spaces – their willingness to pay for the recreation services.

Table 1. Results of the survey on the FRR services 2012

Item considered for evaluation	Satisfaction/high satisfaction	
	Mean FRR´s	Valverde FRR
Open schedulle	87,0%	94,0%
Kindness of the staff	94,0%	100,0%
Cleaning and general maintenance	62,0%	100,0%
Cleaning and maintenance of the WC	92,0%	87,0%
Cleaning and maintenance of other infrastructures	56,0%	100,0%
Cleaning and maintenance of green spaces	96,0%	100,0%
Security	94,0%	100,0%
Walking pathways	80,0%	84,0%
Area for physical exercice	70,0%	97,0%
Kids park	88,0%	100,0%
Area for picnics	95,0%	100,0%
Barbecues	88,0%	100,0%
Sightseeing places	73,0%	92,0%
Animal hences	81,0%	97,0%
Quality of supporting services	90,0%	90,0%
Parking area	92,0%	100,0%
Visual information	86,0%	87,0%
Centres for forest interpretantion and	69,0%	80,0%
Inoformation panels	89,0%	97,0%
Classification of the visit	99,0%	100,0%
Repeat intention	99,0%	100,0%
Global classification	**84,8%**	**95,5%**

So, the estimation of the value of the services displayed by the different FRR in Azores is a challenge that must be faced, to serve as a guide in the future allocation of the budget available for this purpose.

An initial study about the valuation of the recreational use of the FRR of Pinhal da Paz, in S. Miguel island (Lopes *et al.*, 2012), has been noticed in 2012, and the need for additional information on the value of other FRR has been identified in the discussion of this paper in the VI Jornadas Florestais Insulares.

Based on a questionnaire developed by the end of 2012, and a survey realized in the summer of 2013, a new approach has been done aiming at the valuation of recreation services delivered by the Valverde FRR, in the island of Santa Maria.

The Valverde FRR, with an area of 4,0ha and altitudes between 60 and 130 metres, "*could almost be described as the town park of Vila do Porto, given its close proximity to the town and its more structured characteristics*" (Albergaria, 2012). The origin of this forest space date back to 1955, it became a forest park at the beginning on the 60´s and joined the classified FRR later in 1989, through the Regional Legislative Decree nº 16/89/A of the 30th August. The visitors can explore an excellent network of pathways leading to a picnic area and two children playgrounds, a fitness circuit adapted to senior and people with reduced mobility, a deer enclosure, display of birds and a "belvedere" situated at the edge of the FRR with wide views over the valley of S. Francisco river having the sea in the distance.

Taking into account the results of the survey of 2012 summarized in table 1, and considering the same items for the general survey, the Valverde FRR collects a better qualification from its visitors, with a global classification of 95.5% of satisfaction/ high satisfaction and deserving eleven 100% classifications in the whole of twenty considered items.

METHODOLOGY

A) The questionnaire, the survey

The questionnaire used in the Valverde FRR survey was a simplified form of the methodology developed by Santos (1997, 1998) in the Pennine Dales and Peneda-Gerês, and Páscoa and Pinto (2005) in the Serra do Açor. The survey was organized into 2 distinct sections, which are described and discussed below.

- (a) Attitudes towards the Valverde FRR, where questions were prepared to get the respondent willingness to pay (WTP) for the maintenance and management of the FRR. The WTP amounts were defined previously to the survey as a set of 5 different bid amounts, ranging from €2.0 to €10.0. Each survey did only consider one single bid level, and each new respondent would consider the nest bid level. Starting from the lower bid level (2,0€), when the higher bid level (10,0€) was reached, the bid level would start again from the lower one. The questions were formulated as "Suppose that the continuation of the maintenance and management of this FRR would imply the payment of (the amount bid) per visit, as an individual entrance ticket. Would you be willing to pay that entrance ticket to maintain the infrastructures and the management of the area?";

- (b) Socio-economic information, aimed at gathering information related to the education, professional and economic situation of the respondents;

The Discrete-Choice (DC) format was adopted for the valuation questions, based on Santos (1997) and Páscoa & Pinto (2005) works. In each valuation question, respondents were asked whether they would be prepared to pay a daily given ticket cost (the offered bid amount) for the maintenance and management of the area. Bid amounts differed across respondents, so that mean WTP could be estimated from the yes/no answers.

B) The questionnaire administration

The survey has been used on-site in-person interviews. This option, although costly, is generally adopted to carry out questionnaires in this field of CVM studies, and its advantages are recognized by different authors in comparison with self-administered questionnaires (Mitchell and Carson, 1989; Santos, 1997 and 1998; Páscoa and Pinto, 2005).

Usually, a pilot survey should be carried before the main survey, to assess if the questions were understandable and plausible for respondents, and if bid sets were acceptable. The decision to start directly with this questionnaire in the survey on the Valverde FRR was based on the simplicity of the questions, and on the results previously obtained in the initial study for the Pinhal da Paz FRR (Lopes, F. *et al.*, 2012). Fortunately, the progressive evaluation of these aspects revealed an increase in the proportion of "no" answers with the bid rising, and the highest bid amounts deserved only one "yes". These results confirmed that bid sets were performing acceptably.

C) Population, sampling frame and non-response.

CVM surveys whose results are to be aggregated for policy evaluation purposes need two important complementary definitions: the definition of the population, and the definition of the sample of that population. Survey population should include, by definition, all the individuals affected by the policy-induced landscape change (residents, visitors, non-users).

Very often, non-users WTP for landscape conservation represent a significant share of the aggregated benefits of policy schemes (Willis *et al.*, 1993). However, in our case, non-users were not interviewed, conceding that only visitors or residents hold

the required familiarity with the FRR in study to allow the intended valuation tasks. Residents were also not surveyed but in this case due to the understanding that visitors and residents share the aggregated benefit of policy schemes, given that the Valverde FRR is considered a kind of urban park of Vila do Porto, the origin town of a significant part of the visitors (Willis and Garrod, 1991; Willis *et al*., 1993).

Having sampled only visitors, the CVM results can only be aggregated to the visitor population, and thus aggregated benefit estimates presented are to be interpreted as a lower-bound estimates. The survey population was defined as the set of all visitors of the Valverde FRR, over the 12 months of the year of the survey. In our case, individual visitors rather than households are the relevant population for the survey, due to the fact that the chosen payment form is an individual ticket.

The survey has been assessed during two months, between the 24th July and the 17th September 2013, in week days and with no more than two sets of bids each day. Interviewees were selected on a "next person to walk past" basis, with only one person being interviewed each time. At the end of the period of about two months, 150 interviews had been conducted. No one refused to participate. However, from those 150 interviews, it has been not possible to obtain 112 answers to the question about "the monthly income of the household".

From the 150 usable questionnaires for valuation purposes, 115 respondents gave "no" answers to all valuation questions and invoked a "protest" reason for these answers, which correspond to almost 77% of the sample. Those answers were considered "protest-no" and were not considered when estimating mean WTP. The main reasons to justify the "no" response were: (1) I couldn´t pay that price (26.96%); (2) This is a responsibility of the government (26.09%) and (3) I already pay too much taxes.

A "false yes" response, where no thought has been given to answering, is an important source of bias well known and discussed in DC-CVM analysis (Willis and Garrods, 1991; Santos 1997 and 1998; Ressurreição *et al.* 2007). A 'false yes' is a trend usually shared by many respondents, which give unconsidered "yes" answers even when a "no" would better correspond to the respondents´ opinion, attitude or income situation. Many respondents may view as unethical or anti-public-spirited to reject the conservation option, regardless of cost implications for their households. To offset at least a part of the false yes bias, the questionnaire included a "checklist of reasons" for 'yes' answers that could allow their identification. The subsequent analysis of the pairs "yes" and "checklist of reasons", and the lack of information about the "monthly income of the households" didn´t reveal any clear "false yes" answers, reason why all the 35 "yes" answers has been considered.

The main reasons to justify the "yes" response were: (1) Infrastructures must be maintained to be used by the population (42.86%); (2) The satisfaction collected is a good retribution for the price paid (28.57%) and (3) This FRR have nice landscapes and deserves the maintenance.

Taking into account the answers about the level of education of the visitors (Table 2), the higher presence is verified for the visitors that: (1) completed a high school or a professional degree (56.67%); (2) abandoned their studies before the 15 years (25.33%) and (3) frequented and or finished their university studies (18.0%).

Table 2. Visitors by level of education and willingness to pay or not to pay

Education level	Sample		Willing to pay		Not willing to pay	
	N	%	N	%	N	%
Abandoned the school before 15 years age	38	25,33%	3	8,57%	35	30,43%
High School degree	60	40,00%	12	34,29%	48	41,74%
Professional degree	25	16,67%	7	20,00%	18	15,65%
Frequence of university courses	6	4,00%	2	5,71%	4	3,48%
University degree	19	12,67%	11	31,43%	8	6,96%
Frequence of a MSc Course	1	0,67%		0,00%	1	0,87%
Holding a MSC degree	1	0,67%		0,00%	1	0,87%
Holding higher degrees than MSC	0	0,00%		0,00%		0,00%
Total	**150**	**100,00%**	**35**	**100,00%**	**115**	**100,00%**

Considering the answers to the level of the monthly income of the households of the visitors responding the questionnaire (38 positive answers), the obtained stratification is stated in Table 3.

Table 3. Levels of monthly income of the households of the visitors

Level of monthly net household income (€)	N	%
< 500	7	18,42%
]500-600]	6	15,79%
]600-750]	7	18,42%
]750-1000]	9	23,68%
]1,000-1,500]	9	23,68%
]1500-2000]		
]2000-2500]		
]2500-3000]		
> 3000		
Level of answers	*38*	*25,33%*
Lever of no answers	*112*	*74,67%*
Total	**150**	**100,00%**

The number of visitors to Valverde FRR has no previous accurate studies, and hence the estimation is just based in elements provided by the staff of the FRR, as an average of 25 visitors per day in week-days and 50 visitors per day in week-end and feast days. Considering that the months with more demand are the months of spring and summer, the total amount of visitors during these six months is estimated on 6.000.

D) Estimating mean and median WTP

When the objective is just to estimate the *mean* and *median* values of the WTP, a non-parametric estimation procedure can be used. Non-parametric techniques provide a purely empirical approach to estimating the *survivor function* of WTP responses. This *survivor function* is, in this case, a decreasing untidy-looking step function, rather than the continuous curve defined by parametric specifications. This fact does not prevent the use of the non-parametric survivor function to estimate mean and median WTP values, which do not depend on an *ad hoc* parametric assumption (Bateman *et al.*, 2002).

The mean and median estimates obtained by these processes can be taken as lower bounds for these statistics, which really means that they give the minimum values for mean and the median that are consistent with the sample data (Bateman *et al*., 2002), and at the same time consistent with the decision of considering only visitors in the questionnaire.

Non–parametric estimators can also be worked through maximum likelihood procedures. Indeed, the value of the maximized log-likelihood function derived from non-parametric estimation is the lowest value that can be derived for the log-likelihood function of the available data. This lower bound value for the log-likelihood can guide analysts in their choice of a parametric specification that might be used to obtain best estimates for the mean and median WTP of the sample (Bateman *et al*., 2002).

The form of the non-parametric estimator depends on the type of data that has been collected in the CV survey. In our case, and as previously stated, the discrete-choice (DC) format was adopted for the valuation questions (single bounded WTP questions). In designing DC-CVM surveys, the analyst decides upon a series of positive bid levels (denoted *Bj*), each bid level presented to a number of visitors who report whether they are willing to pay this amount or not. It is assumed also in the process that there exists a bid level at a value of zero, which is denoted by *Bo*. It is supposed that if a zero bid level were presented to a sample of respondents they would all be willing to pay this amount.

The whole result is a set of binary data, representing the willingness to pay (yes = 1) or not (no = 0) a certain bid for a certain conservation scheme. With binary data analysts have far less information on the shape of the survivor function than that provided by continuous data. Point estimates of the survivor function can only be calculated at each of the *J* bid levels, assuming *J* in our case values of €0.0, €2.0, €4.0, €6.0 and €10.0. The procedure described by Bateman *et al*. (2002) to calculate these point estimates is very simple, and is shortly described below. Some notations are however previously required:

- If the number of visitors in the sample is *N*, the sub-sample facing bid level *Bj* can be denoted *Nj*;

- The number of visitors replying *yes* to pay amount *Bj* are those that have an equal or higher WTP this amount. This number of visitors can be denoted here as *nj*.

An empirical estimate of the survivor function at each of the *Bj* bid values can now be calculated as:

$$\hat{S}(Bj) = nj/Nj \text{ assuming } j \text{ from o to } J$$

Assuming that everyone is willing to pay a non-negative amount for the non-market service, we can set

$$\hat{S}(Bo) = 1$$

The procedure can be illustrated with the data captured in the survey for the considered bids. A point estimate of the survivor function can be derived at each of the bid levels by dividing the number of 'yes' answers by the total number of answers in the sub-sample for that bid level. These estimates are presented in the last column of Table 4.

Table 4. Discrete Choice data from CVM survey

Bid Levels *(Bj)*	Results WTP $\hat{S}(Bj)$
0.00 €	100.00%
2.00 €	66.67%
4.00 €	16,67%
6.00 €	26.67%
8.00 €	3.33%
10.00 €	3.33%

Plotting estimates for $\hat{S}(Bj)$ in a graphic ($\hat{S}(Bj) = f(Bj)$), a *survivor function* should be the derived result. If the function is always decreasing in each step corresponding to the increasing bids, the *survivor function* is valid. When the information provided by the sample is not always decreasing, it does not generate a valid *survivor function* (Bateman *et al.*, 2002).

To correct this potential problem in DC data, analysts employ a technique known as the *pooled adjacent violators algorithm (PAVA)* (Bateman *et al.* 2002). In other words, the technique involves pooling data for two adjacent bid levels if the estimate of the survivor function for the higher bid level is greater than that for the lower bid level.

A new estimate for the survivor function over the range of the two bid levels is then calculated by dividing the sum of those responding "yes" to the adjacent bid levels by the sum of the two sub-samples of respondents. In a more formal way, the procedure involves the following steps (Bateman *et al.*, 2002):

1. For each bid level, that is for j = 0 to J, calculate $\hat{S}(Bj) = nj/Nj$;
2. Beginning with the first bid level (j = 1), compare $\hat{S}(Bj)$ *with* $\hat{S}(Bj+1)$;
3. If $\hat{S}(Bj+1)$ is less than or equal to $\hat{S}(Bj)$, then continue;
4. If $\hat{S}(Bj+1)$ is greater than $\hat{S}(Bj)$, then pool the observations at the two bid levels and recalculate the survivor function as:

$$\hat{S}(Bj) = \hat{S}(Bj+1) = (nj + nj+1) / (Nj + Nj+1)$$

5. Continue pooling until the sequence of survivor probabilities is monotonic decreasing.

Once the sequence of J survivor probabilities has been established, another question remains to be solved: how do the resulting points should be joined together in order to form a continuous function? As discussed by Bateman *et al*. (2002), different analysts suggest different approaches to the problem:

- Some suggest using linear interpolation, drawing a straight line between each of the points;
- Others suggest that the probability associated with WTP values lying between the two bid levels $Bj\text{-}1$ and Bj should be attributed the higher survivor probability $\hat{S}(Bj\text{-}1)$;
- Bateman *et al*. (2002) clearly advise taking a conservative approach, that means that the probability associated with values of WTP lying between successive observed values $Bj\text{-}1$ and Bj should be attributed the lower probability associated with the higher WTP value $\hat{S}(Bj)$.

This last procedure follows the logic that between successive bid levels $Bj\text{-}1$ and Bj, the *survivor function* must take a value that is at least the value of the survivor function at Bj. Since this is all that is known for certain, this lower bound is used to characterize the whole interval. By taking this conservative approach, the PAVA estimator can be

used to construct a lower bound approximation to the *survivor function*. This procedure has been used in the survey data obtained to draw the *survivor function* in this study.

Medians can be derived from these graphics at the point where the *survivor function* evaluates to 0.5, and mean WTP can be calculated as the area under the step function according to:

$$C = J\Sigma\ j=1\ \hat{S}(Bj)\ [Bj - Bj\text{-}1]$$

This procedure has been applied to data available, together with the methodology to calculate confidence intervals from non-parametric estimation of mean and median WTP, as described in Bateman *et al*. (2002) for binary and interval data.

ASSESSMENT OF COST EFFECTIVENESS OF DELIVERY MECHANISMS ON MAINTENANCE AND MANAGEMENT OF THE VALVERDE FRR FOR RECREATION PURPOSES

The objective of the developed DC-CVM survey was to assess a measure of the average WTP of individuals in the sample for the use of the Valverde FRR facilities. This value was then aggregated to estimate the benefits accruing to the whole population.

A) Estimating mean results

By taking the conservative approach previously described, the PAVA method (Pooled Adjacent Violators Algorithm) estimator can be used to construct a lower bound approximation to the survivor function. This procedure has been used in the survey data to draw the survivor function for the data obtained.

Both median and confidence interval from non-parametric estimation of mean and median WTP can be found through this procedure, which has been applied to data available for the different schemes. Results obtained for median and mean of WTP for the conservation and management activities on Valverde FRR, as well as their confidence intervals are presented in the Table 5. Figure 1 shows a graphic with the values after PAVA adjustment, that represents also the survivor function.

B) Aggregate benefits of maintenance and management of Valverde FRR for recreation purposes.

Per individual estimates derived from previously presented methodologies are aggregated to the whole visitor population to yield estimates of the total benefit. As previously stated, no accurate study of the number of visitors to the Valverde FRR has been carried, and hence, the used estimate (6,000 visitors in 2013) heavily relies on the 'feelings' of the staff of the FRR.

Table 6 presents aggregate benefits revealed from the WTP for the maintenance and management of the Valverde FRR for recreational activities under evaluation. Point estimates are based on the number of visitors during 2013, and per visitor means estimated from the survivor function established; lower and upper bound estimates are based on lower and upper limits of the 95 per cent confidence interval for the mean (t = 1,96).

Table 5. Survey results, PAVA adjustment, mean, median and confidence intervals

Bid (Bj)	N	Yes (n)	No	$\hat{S}(B_j)$	PAVA $\hat{S}(Bj)$
0,00 €				100,00%	100,00%
2,00 €	30	20	10	66,67%	66,67%
4,00 €	30	5	25	16,67%	21,67%
6,00 €	30	8	22	26,67%	21,67%
8,00 €	30	1	29	3,33%	3,33%
10,00 €	30	1	29	3,33%	3,33%
	150	35	115		
Mean WTP					2,33 €
Median WTP ($\hat{S}(Bj)$ = 50%)					2,74 €
Population variance WTP					6,29 €
Mean variance WTP					0,04 €
Standard deviation WTP					0,20 €
Lower bound confidence interval WTP					1,93 €
Upper bound confidence interval WTP					2,73 €

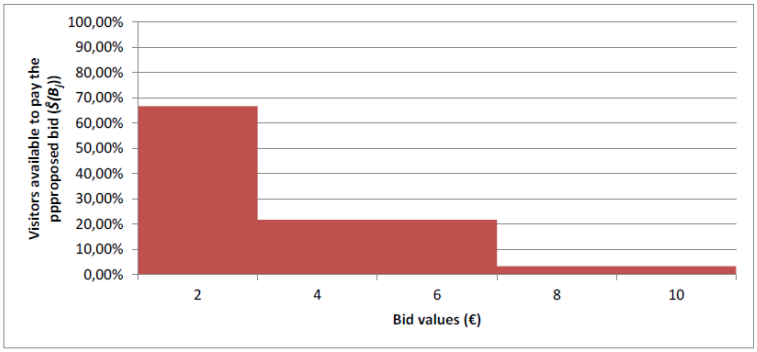

Figure 1. Discrete Choice data from CVM survey after PAVA adjustment and survivor function

Table 6. Aggregated annual benefits and Present Value of the Valverde FRR.

Aggregated benefits			Lower bound of
Average	Lower bound	Upper bound	PV of the FRR
14.000,00 €	11.592,04 €	16.407,96 €	772.802,89 €

There must be always beard in mind that non-parametric estimates of mean and median can be taken as lower bounds of these statistics (Bateman *et al*, 2002), meaning that they give the minimum value for the mean or median that is consistent with the sample data, and that the lower bounds of the 95 percent confidence intervals are a very conservative estimated of the total benefit, and upper bounds of the same confidence interval can approach a good estimate for the real benefit.

CONCLUSIONS

The aim of this study was to estimate the value of the services produced by the recreation activities in the Valverde FRR (Santa Maria, Azores), according to the amount that visitors were willing to pay for its maintenance and management. This value is a good reference for possible future conservation policies, at least as a "budget ceiling" for annual costs supporting conservation programmes. Benefits and costs analysis can be based on these values against conservation costs policies.

Taking the obtained aggregate values as a public "annual income", and considering a real rate of return of 1,5% (r) normally accepted for institutional investments, we can estimate the present value of the successive annual benefits as the present value (PV) of an annual series of constant payments (p) as

$$PV = p/r$$

where PV is the present value, p the per/year annual income and r the discount rate.

Then, and according to the results derived from the methodology previously described and discussed, and presented in the tables 5 and 6, we can conclude that a good and conservative estimate for the annual "budget ceiling" to ensure the maintenance and management of the Valverde FRR for recreational purposes is about 11,592.04 €, and the present value of the FRR is about 772,802.89 €.

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