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*Bénédicte RULLEAU *, Jeoffrey DEHEZ **, Patrick POINT ****

* **Corresponding author:** Laboratoire REEDS, Université de Versailles Saint-Quentin-en-Yvelines, Bergerie nationale, Bâtiment Aile sud, Parc du Château, 78120 Rambouillet, France ; Cemagref, unité ADER ; GREThA, UMR 5113 CNRS/Université Montesquieu-Bordeaux IV, France
e-mail: benedicte.rulleau@reeds.uvsq.fr

** Cemagref, unité ADER, Cestas, France

*** GREThA, UMR 5113 CNRS/Université Montesquieu-Bordeaux IV, Pessac, France

Summary *– This paper explores the possible impact of the combination of forest and non-forest settings on recreation values. We extend the traditional contingent valuation method by introducing seven dichotomous choice occasions. To answer each valuation question, each respondent is asked to choose between a policy scheme and the status quo. Each scheme is composed of various programmes while each programme is linked to the recreational quality of one natural area. An extra distance is used as a proxy of the bid. The results show that respondents distinguish between schemes according to the number of programmes included. Nevertheless, a "substitution effect" occurs when all programmes are supposed to be implemented. Individual WTP ranges from €6.51 for the forest alone (e.g. 55.35 extra kilometres per group-vehicle) to €18.11 (e.g. 153.9 extra kilometres per group-vehicle) for the complete scheme. Our results stress the fact that recreation in forests must not be isolated from other natural areas. From a more general point of view, valuation based on multi-attribute approaches must be favoured on "multi-environment" sites.*

Keywords: *coastal forests, economic valuation, multi-attribute approach, contingent valuation method, outdoor recreation, tourism*

La fréquentation touristique des forêts littorales : la forêt a-t-elle une influence ?

Résumé – Cet article étudie l'impact de la combinaison d'espaces forestiers et non forestiers sur la valeur économique d'un site récréatif. Nous utilisons une extension de la méthode d'évaluation contingente visant à présenter sept occasions de choix dichotomiques. Lors de ces questions d'évaluation, chaque enquêté est invité à choisir entre une politique d'amélioration de la qualité du site et la situation de référence. Les politiques se composent de plusieurs programmes et chacun de ces derniers est lié à la qualité récréative d'un espace naturel. Les résultats montrent que les personnes interrogées différencient les politiques selon le nombre de programmes qu'elles comportent. Néanmoins, un effet de « substitution » se produit lorsque tous les programmes sont mis en œuvre. Les consentements à payer individuels s'échelonnent de 6,51 € (ou 55,35 kilomètres par groupe-véhicule) lorsque seule la forêt est visée à 18,11 € (ou 153,9 kilomètres par groupe-véhicule) lorsque la totalité des espaces présents profite de l'amélioration. Nos résultats soulignent la nécessité de replacer les forêts dans leur environnement immédiat et, plus généralement, l'intérêt d'utiliser des approches multi-attributs pour estimer la valeur économique de sites récréatifs aux environnements variés.

Mots-clés : forêts littorales, évaluation économique, approche multi-attributs, évaluation contingente, service récréatif de plein air, tourisme

JEL Classification: D60, H41, Q26, Q51

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1. Introduction

Outdoor recreation is one of the major concerns in many rural areas (Bell *et al.*, 2007) and numerous research programmes aim at estimating the economic value of this non-market service (Hanley *et al.*, 2003). In common with many other natural areas, forests offer recreational opportunities [1]. Yet the recreational attractiveness of many forested sites (national parks, urban parks) depends not only on the forests but also on non-forest settings – for example, rivers, beaches, pastures, rocks and cliffs, etc. In many regions, mosaics of ecosystems including forest are predominant (in Mediterranean countries, for instance). Agreements are frequently set up in order to highlight and protect these original features (*e.g.* conventions on mountain forests).

From the demand side, multi-component environments may be important. But how sensitive are people to this environmental diversity? In other words, do visitors of a coastal forest give it an additional value because of the additional presence of a beach? If so, forests would somehow be "magnified" by other natural environments. Conversely, do visitors going only to the beach give it an additional value because they can park their car in the forest? But one can also ask whether recreationists distinguish between these two environments at all. In other words, do they consider the site as a whole? Finally, visitors may entirely ignore some components of the site (including forests). Until now, authors dealing with natural diversity have generally focused on the recreational value of the forest (Christie *et al.*, 2007; Holgén *et al.*, 2000) or the beach (Whitmarsh *et al.*, 1999) and paid little attention to other natural components. This may be connected with the difficulty of treating quality in economic valuation (Hanley *et al.*, 2003; Holmes and Adamowicz, 2003). As some authors actually tried to extend the contingent valuation method (CVM) in a multi-attribute way (Santos, 1998; Laitila and Paulrud, 2006; Madureira *et al.*, 2005) one should consider the possible applications to the recreational quality.

The job of site manager is to design the recreational environment provided to visitors rather than strictly limiting the number of visits (McConnell, 1985). In other words, quality management is of prime importance. This type of natural diversity thus entails complications because managers are frequently specialised in a particular natural environment (water, forests, marshes, etc.) and focus on it. They may consequently overlook the (environmental, social) interactions that potentially occur between the various natural components of the recreation area. Furthermore, separate valuations (that are actually favoured because of the above-mentioned management responsibi-

[1] See for instance the survey of Wibe (1995) or more recently the introduction of the book by Hanley *et al.* (2003).

lities distribution) may underestimate (or overestimate) the overall value of the policy [2]. Because many recreationists may not focus on a single environment when they choose a destination site, such a bias may not be negligible in recreation either.

In this paper we examine tourist recreational demand for coastal state-owned forests in the South-West of France (Gironde). These sites are composed of three adjacent natural areas: forest, sandy beach, and the ocean. We set out to identify the possible impact of this juxtaposition on forest recreation value. To that end, we propose to use an extension of the traditional dichotomous choice contingent valuation method (DCCVM) called the multiple programmes contingent valuation method (MPCVM). This method explicitly enables us to study the possible crossed effects between three natural areas. The objective is twofold: first, to estimate tourist recreation value for components of Gironde's coastal sites and, second, to identify the relations between these components.

We first present the MPCVM. Second we describe our study site and questionnaire design. Econometric modelling and empirical results are then presented, and in the last section we discuss our main findings.

2. Theoretical framework of the multiple programmes contingent valuation method (MPCVM)

2.1. Valuing multiple items in the dichotomous choice contingent valuation method (DCCVM) [3]

Suppose that there is a policy agenda (denoted S) composed of different specific programmes, which is implemented. The G programmes denoted S_g can either preserve or enhance the environmental quality. Each S_g can be seen as an attribute of S. Then, as noted in Santos (1998), each policy agenda S can be represented as a vector $(S_1,\ldots, S_g)$ where each S_g indicates whether the programme is included in the policy agenda or not [4]. The value of the policy agenda is traditionally calculated by "independent valuation and summation" (Hoehn, 1991), hereafter labelled IVS. The procedure is based on Lancaster's multi-attribute utility theory (1966). It consists in estimating the value of each programme as if they were independent, that is, as single impact policies (Hoehn, 1991). The value of the policy agenda is then calculated by aggregating these values. This neglects possible interactions between programmes. In the same way, Hoehn and Loomis (1993) demonstrated that when two programmes of the same

[2] From a manager's view point, it is actually easier to value a single policy affecting one asset than a global policy (Hanley *et al.*, 2003).

[3] In some ways, multiple items valuation is not far from embedding effects analysis (at least regarding sub-additivity problems). We decided to focus on the former because we think it is better suited to recreation quality analysis. We nevertheless agree that many references dedicated to embedding effects would offer valuable insights if one wished to extend such work on recreation valuation.

[4] Suppose a policy agenda potentially composed of three programmes. If S_1 and S_2 are included in the policy agenda but S_3 is not, then S = (1,1,0).

policy agenda are simultaneously implemented, a substitution effect may occur. There are several ways to measure the substitution effect (Santos, 1998), obtained it by subtracting the sequential value of a programme:

$$SE = WTP[S = (1,1)] - WTP[S = (0,1)] - WTP[S = (1,0)] \quad (1)$$

with *WTP* being the willingness-to-pay [5].

Three situations must be considered. In the first, *SE* is positive. In that case, the two programmes are complements since the value given by the policy agenda *S* is higher than the sum of the values given by its programmes S_1 and S_2. In other words, the IVS procedure underestimates the true value of *S*. The second situation is the negative *SE*. The value given by *S* is then smaller than the sum of the values given by S_1 and S_2. The two programmes are said to be substitutes. Hoehn (1991) empirically demonstrated the existence of this difference: the marginal valuation of one programme declines with the level of the other. In that case, the IVS procedure overestimates the true value of *S*. Finally, if the value given by *S* equals the sum of the values given by S_1 and S_2, the two programmes are independent. *SE* equals zero. The IVS' outcome and the sequential path outcome are strictly identical. Consequently, "*an accurate valuation of a program not only accounts for the change in that program but also considers the other changes that may occur in an environmental agenda*" (Hoehn and Loomis, 1993).

The well-known contingent valuation method (CVM) frequently belies the fact that it is better-suited to global changes than to quality variations (Hanley *et al.*, 2003). The traditional valuation method used in multidimensional contexts is the choice experiment (CE) (Bennett and Adamowicz, 2001). Several authors have nevertheless tried to extend the CVM in a multi-attribute way (Santos, 1998; Laitila and Paulrud, 2006; Madureira *et al.*, 2005; Rambonilaza *et al.*, 2007). In MPCVM, respondents are given two alternatives: the reference situation and a hypothetical scenario. The dichotomous choice format is thus a "take it or leave it" situation. The attributes used to describe the scenarios have only two levels and the price is not considered as one of the attributes. Even if choices are also repeated in the CE, the choice sets are not built up the same way. In CE, respondents have to choose between two or more options that in turn are built on more attributes and levels. As a consequence, the cognitive process is rather different, which is far from neutral. Finally, one can also specifically say that the two methods do not have the same objectives (Rambonilaza *et al.*, 2007; Rulleau *et al.*, 2012) since MPCVM allows one to calculate users' WTP but is also devoted to the study of relations between the different components of an environmental policy [6]. These are some of the reasons why we favour the MCVM.

[5] Another way consists in estimating the derivatives of the utility or expenditure functions. Cross effects parameters thus give the signs of the substitution effects (see, for instance, Hoehn and Loomis, 1993; Hanemann and Kanninen, 1999).

[6] This is possible in CE only if interaction effects are taken into account.

2.2. Model formulation

During the survey, each respondent i had to choose between a policy scheme S and the *status quo*. The policy agenda S is assumed to yield utility U_{iS}, where S equals the number of choices made by the respondent. The number of choices corresponds to the number of policies proposed. The *status quo* is assumed to yield utility U_{i0}. The individual utility function U_{ik} depends on k, the characteristics of the scenario, where $k = 0$ if the policy is not implemented (that is, for the *status quo*) and $k = S$ otherwise. The utility is assumed to be composed of a systematic component V_{ik} and a random component ε_{ik} (Manski, 1977).

Let WTP_{iS} denote the WTP of an individual i. Then:

$$V_{iS}[S, y_i - WTP_{iS}(S, y_i, x_i, \varepsilon_{i0} - \varepsilon_{iS}), x_i] + \varepsilon_{iS} = V_{i0}(0, y_i, x_i) + \varepsilon_{i0} \tag{2}$$

with x_i the socio-economic characteristics of the respondent and y_i his/her income. Under the utility maximisation principle (Hanemann, 1984), i agrees to pay a bid B_S for S only if

$$WTP_{iS}(S, y_i, x_i, \varepsilon_{i0} - \varepsilon_{iS}) \geq B_S \tag{3}$$

Since the WTP function is assumed to be linear in all parameters (Santos, 1998), the probability of agreeing to pay for S is:

$$\Pr(\text{Response is "yes"}) = \Pr[\alpha_S - \beta B_S + \lambda y_i + \gamma x_i + \xi_{iS} \geq 0] \tag{4}$$

where $\xi = \varepsilon_0 - \varepsilon_S$.

Different modelling may be used to estimate (4). In this paper, we have developed a random effects probit model to account for unobserved individual heterogeneities [7]. The error term τ_{iS} can be decomposed into two components: an individual specific unobservable effect μ_i and a random term ε_{iS} (Greene, 2003):

$$\begin{cases} Y_{iS} = \beta x_{iS} + \tau_{iS} \\ \tau_{iS} = \varepsilon_{iS} + \mu_i \end{cases} \tag{5}$$

It is assumed that $\mu_i \sim iid\, N(0,1)$ and that $\varepsilon_{iS} \sim N(0, \sigma_\mu^2)$. This means that var $(\tau_{iS}) = (1 + \sigma_\mu^2)$. Furthermore,

$$\operatorname{corr}\left(\tau_{iS}, \tau_{iS'}\right) = \frac{\sigma_\mu^2}{\left(1 + \sigma_\mu^2\right)} = \rho \qquad \forall S \neq S' \tag{6}$$

ρ thus denotes the estimated correlation coefficient between responses. If ρ equals zero, there would be no need to control for individual effects, *i.e.*, a binomial probit is preferable to a random effects probit. A likelihood ratio statistics tests the null hypothesis that $\rho = 0$.

[7] One can also opt for bivariate probits, that is to say, sample selection models. But the latter don't consider the potential autocorrelation problems among the answers of the same individual.

3. Study design and implementation

3.1. Coastal forests in South-West France

Gironde, a French *département*, is located in South-Western France in which state-owned forests spread over 20,441 hectares and stretch along 70% of the coastline (87 kilometres). Pine trees meet sandy beaches and the Atlantic Ocean, thus creating a single spot suitable for many recreational activities (ONF, 1996; Daubet *et al.*, 2010). To go to the beach, people have to go through the forest, where they park their cars. Management schemes have included recreational purposes for more than thirty years (Daubet *et al.*, 2010) and most of the facilities, such as car-parks and restaurants, are located in the forests. Along with the National Forests Office (ONF), various local communities are involved in the management of the natural areas and the municipalities bear most of the management costs. Despite the broad scope of these public policies, access is free of charge almost everywhere. Financing is however becoming a thorny issue (Daubet *et al.*, 2010). In order to keep recreational quality and free entrance, local decision-makers may have to select the most valuable recreational programmes. In this case, a better understanding of users' preferences is essential. Seasonal variations are also very high and most of the visits occur during summer (June to September). During this period, tourists may represent the majority of the users of recreational sites [8].

3.2. Questionnaire design

As coastal sites are composed of three assets (the ocean, the beach and the forest), three programmes were defined. Each related to one natural asset: S_1 for the ocean, S_2 for the beach and S_3 for the forest. Seven policy agendas (or "schemes") could consequently be defined (table 1), concerning the recreation quality of one, two or three assets. Each valuation question consisted of two schemes: the *status quo* (0,0,0) and a policy agenda [9]. We estimated the compensating variation in income that visitors were willing to pay to improve recreation quality [10]. Valuation questions were presented as separate choice occasions, so that respondents had to make seven decisions.

In order to avoid valuation sequence bias due to the range of programmes in the valuation sequence (Randall and Hoehn, 1996), and fatigue and/or learning biases due to choice repetition (Adamowicz *et al.*, 1998), three orders of appearance were randomly created following a sequential non-ordered procedure (Point *et al.*, 2007). As in Point *et al.* (2007), two-programme schemes were presented first (table 2).

[8] As opposed to residents, tourists are defined as visitors who do not own a primary or secondary residence in Gironde. They may represent up to 90% of the total number of day-visits on some particular sites (Daubet *et al.*, 2010).

[9] The *status quo* stands for what may happen in the near future if recreation policies were dropped (Santos, 1998). In this situation, the recreation quality is consequently not maintained. In other words, S_1 is supposed to maintain ocean recreational quality, S_2 is supposed to maintain beach recreational quality and S_3 is supposed to maintain forest recreational quality.

[10] Yet, even if the *status quo* describes recreational quality degradation, we are estimating the WTP for quality improvements in comparison to this level (and not with regard to the existing situation).

Table 1. **Composition and acceptance of the schemes**

Programmes Schemes	Ocean	Beach	Forest	Percentage of acceptance
(1,1,1)	1	1	1	65%
(0,1,1)	0	1	1	56%
(1,0,1)	1	0	1	63%
(1,1,0)	1	1	0	59%
(0,0,1)	0	0	1	36%
(1,0,0)	1	0	0	53%
(0,1,0)	0	1	0	45%
(0,0,0)	0	0	0	

Table 2. **Order of presentation of the programmes**

Order 1	(0,1,1)	(0,0,1)	(1,1,1)	(1,1,0)	(1,0,1)	(0,1,0)	(1,0,0)
Order 2	(1,0,1)	(1,1,0)	(0,1,0)	(0,0,1)	(0,1,1)	(1,0,0)	(1,1,1)
Order 3	(1,1,0)	(0,1,1)	(1,0,1)	(1,0,0)	(1,1,1)	(0,0,1)	(0,1,0)

The WTP valuation method selected was the dichotomous choice. Following Hanemann and Kanninen (1999), five bid levels were generated (table 3) [11]. They were randomly allocated to respondents, while guaranteeing that extreme bid questionnaires were less frequent than intermediate ones.

Table 3. **Bid amounts, number of questionnaires collected and refusals per bid level**

Bid level	Min.	Inter. 1	Inter. 2	Inter. 3	Max.
1 programme	10 km	20 km	30 km	40 km	50 km
2 programmes	13 km	27 km	40 km	53 km	67 km
3 programmes	16 km	32 km	48 km	64 km	80 km
Frequency	41	105	98	98	47
"No" answers	32%	45%	55%	57%	51%

The cost of each scheme was expressed as an extra distance to cover to reach another site where quality was supposed to be maintained on some assets. The question asked was:

"Bearing in mind that an extra distance is both time-consuming and costly (about €0.40 per kilometre for petrol, car insurance, etc.) and given that all other conditions remain constant, would you be willing to cover extra kilometres, there and back, to go to the site offering these conditions or would you still come here?"

[11] Following the authors, more bids do not raise much more information and tend to lower the number of observations for each bid to a critical level.

Distance was used in order to limit the strategic bias as well as the payment vehicle bias [12]. Such a practice is now frequent in multi-attribute analysis (Boxall and Macnab, 2000; Banzhaf *et al.*, 2001; Hanley *et al.*, 2002; Laitila and Paulrud, 2006). Although this creates an obvious bias, we decided to make a clear reference to the €0.40 figure in order to point out the financial consequence of extra trips [13]. As we will see, this had a direct impact on our WTP estimates.

(1,1,0), (1,0,1) and (0,1,1) were 20% cheaper than (1,1,1). (0,0,1), (0,1,0) and (1,0,0) were 33% cheaper than (1,1,0), (1,0,1) and (0,1,1). Consequently, the maximum cost was not too high. As in Santos (1998), Hoehn and Loomis (1993) or Point *et al.* (2007), there was no cost difference between schemes described by the same number of programmes (table 3). Finally, the minimum bid amount for one-programme schemes corresponds to the distance from the beaches to the nearest towns, whereas the maximum is the distance to the largest city of the Gironde area (Bordeaux).

A pre-survey of 93 visitors was conducted in April 2006, and meetings with the ONF helped to clarify the policies implemented. Programmes were described through the same number of criteria to guarantee valuation objectivity (table 4). Photographs were used to illustrate quality changes.

Table 4. **Criteria describing each programme**

	Ocean	Beach	Forest
Cleanliness	• Maritime means to operate in case of accidental pollution	• Frequency of beach cleaning	• Frequency of dustbin collection
Congestion	• Length of watched bathing	• Surface available for each person	• Proportion of the surface devoted to recreation
Other indicators (facilities, etc.)	• Bacteriological quality of water • Watched bathing hours	• Presence of duckboards • Presence of showers	• Maintenance of cycle trails and paths • Landscape quality (replanting)

Finally, the questionnaire successively focused on visitors' frequenting habits, their recreational aims, and their general commitment to environmental issues, followed by valuation and follow-up questions, and traditional socio-economic data collection.

3.3. Data collection

Our original survey was conducted with residents and tourists visiting Gironde coastal forests. This type of material allows for separate analysis of each population. As

[12] First, entry fees are not currently charged in the study area, so people are not familiar with such a practice (Hanley *et al.*, 2002). Second, a direct payment vehicle is difficult to introduce for practical reasons. The study sites are open-access sites and exclusion mechanisms are not very efficient.

[13] Other questions were asked in this order.

mentioned earlier, we decided to focus on tourists, whose demand is deemed to be of primary importance in the area.

All coastal forest sites in Gironde were assumed to be homogeneous in terms of recreational supply. Three sites were selected for their position along the shoreline and the average daily frequentation in summer was calculated according to data of 1989 (Dehez, 2003) and 2002 (ONF, 2004). On this basis, the number of questionnaires was determined and distributed across sites. The sub-sample of tourists was composed of 201 visitors. The survey was conducted on-site in July and August 2006, on the path between the forested car parks and the beach. One passer-by out of three was questioned.

With an increase in the bid amount, the descriptive statistics revealed an increase in the proportion of respondents choosing the *status quo* in the first valuation question (table 3). Refusals could signify that the respondent's WTP for the particular scheme was smaller than the proposed bid amount. We considered these answers as "true zero" answers. But refusals could also indicate that the respondent was refusing the valuation procedure or that he/she asked for proof of the scenarios' credibility (Santos, 1998) (table 5) [14]. According to follow-up questions, the latter two types, called "protest zeros", concerned 53.33% of interviewees. These "protest zeros" have been excluded from the final sample.

Table 5. **Reasons for a "no" answer to the first valuation question**

Motivations	% [a]
1. I cannot afford to do all these extra kilometres, for financial reasons	15
2. I cannot afford to do all these extra kilometres because I will need too much time	30
3. I used to come here and do not see any reason to change	12
4. The *status quo* does not bother me	2
5. If this happens, I would not come here anymore, I would go on holiday elsewhere	35
6. I do not think that this will really happen	6
	100

Note: [a] The grey cells correspond to "real protests".

Those who accepted the first scheme or did not "really" protest ("true zeros") were presented with all the schemes ("protest zeros" were presented only with the first one). As expected, their acceptance percentage depended on the schemes (table 1). One-programme schemes and especially (0,0,1) were clearly less well accepted than others.

A Principal Components Analysis showed no clustering between the total population and the protesters. The two categories of visitors were not heterogeneous.

[14] Note that 62% of tourists found it "easy" or "very easy" to answer the valuation process and 21.4% found it "neither easy nor difficult". We thus feel that protest answers are not due to the cognitive difficulty.

The average sociological, economic and attitudinal characteristics of the sample are presented in table 6. "True zeros" included in the estimated model represent 144 individuals, that is to say, 144 groups of seven observations (*i.e.*, 1,008 observations).

Table 6. **Sociological, economic and attitudinal characteristics of the respondents**

Variables	Sample average	"true zeros" average
Gender (% female)	46%	45%
Age	39	38
Household size	2.9	2.7
Number of children under 13 living in household	0.6	0.6
Education (% holding a university degree)	64%	60%
Full-time employment rate	73%	72%
Distance covered to reach the site (in kilometres)	31	35
Total household resources (net, in € per month)	3,228	3,076
Budget for leisure activities (in € per month)	164	170
Urban (% in cities with more than 100,000 inhabitants)	38%	41%
Visits during the last 12 months to coastal forests in Gironde	12	13
Hours spent on site	4h49	4h58
in forest	1h11	1h18
in the ocean	1h26	1h28
on the beach	2h12	2h12
Often or very often goes to forest during free time	37%	59%
Goes to seaside resorts or unofficial beaches in the area	46%	41%
Does not feel restricted in leisure activities	41%	43%
Came by car the day of the interview	69%	68%
Foreign citizens	4%	5%
Sample size	201	144

4. Model estimation and results

4.1. Results

Results are presented in table 7. The first thing to look at is ρ, the correlation coefficient. ρ is significantly different from zero. Hence, the random effects probit is pertinent. Its relevance is also illustrated by the number of correct predictions that amounts to 61% [15].

[15] For discrete choice models, this percentage must ideally be higher than 73.50% (Cameron, 1988). But since the sample is unevenly distributed among the two outcomes in many binary choice studies (Donkers and Melenberg, 2002), a lower explanatory power like ours is acceptable in practice.

Table 7. **Results of the random effects probit model**

Variables	Coefficients	*t*-stat
Scheme (1,1,1)	2.84	(5.78)***
Scheme (0,1,1)	2.22	(4.99)***
Scheme (1,0,1)	2.34	(4.93)***
Scheme (1,1,0)	2.37	(5.27)***
Scheme (0,0,1)	1.02	(2.58)**
Scheme (1,0,0)	1.86	(4.59)***
Scheme (0,1,0)	1.51	(3.79)***
Extra distance to cover (cost)	– 0.02	(– 3.20)***
Scheme (1,0,1) when presented first	0.63	(1.90)*
Hours spent in water on site	– 0.37	(– 3.76)***
Hours spent on beach on site	– 0.23	(– 2.89)***
Hours spent in forest on site	0.40	(6.51)***
More than 100,000 inhabitants in the city of main residence	– 0.01	(– 1.79)*
Number of visits to coastal forests in Gironde during past 12 months	– 0.93	(– 4.19)***
Number of observations	1,008	
Number of groups	144	
Log likelihood function	– 468.04	
Wald $\chi^2(13)$	χ^2_{13} = 113.53***	
Correct predictions	61%	
Log σ_μ^2	1.23 (0.19)[x]	
σ_μ	1.85 (0.18)[x]	
ρ	0.77 (0.03)[x]	
LR test : $\rho = 0$	$\bar{\chi}^2_1$ = 341.65***	

Notes: * significance at p = 0.10 / ** significance at p = 0.05 / *** significance at p = 0.01. [x] these values are the standard-errors.

The coefficient of the distance is significant and negative. This is consistent with the theory since this distance is used as a proxy for the cost. All schemes are significantly and positively valuated.

Tourists allocate an extra premium to scheme (1,0,1) when presented first. Furthermore, the more frequently a respondent visited this kind of site during the past year, the less he or she was willing to pay. This result is logical since the cost is expressed as a per-visit extra distance [16].

Neither income nor motivation variables (*e.g.* membership of an environmental organisation) have an impact on tourists' WTP, but the hours spent on the site in each

[16] Two questions were included in the questionnaire to test respondents' rationality on that point: 27% said that, to finance the extra kilometres they would have to cover, they thought of giving up one of their other expenses, and 39% said they would visit the site less often if the policy agendas were implemented.

natural area do [17]-[18]. The interpretation of on-site time is not an easy task (Larson and Lew, 2005). The positive coefficient of forest programmes may be connected with the results of several recent studies (Dobré *et al.*, 2005; Dobré and Granet, 2009) which have demonstrated that forest users frequently develop a strong attachment to forests that actually increases with time spent in the forests. Our results tend to show that this proves not to be the case for the beach and the ocean. Here, only hours spent in the forest have a positive sign. This may be seen as a sign of the strong interest in the forests by a small part of the population. There is no particular "site effect" confirming that recreation uses are widespread and largely homogeneous.

The differences in valorisation between the schemes can simply be analysed through a Wald test (H_0: both coefficients are identical). Hence, the implicit mean value of each policy agenda *S* corresponds to its mathematical expectation (Hanemann, 1984). The Wald test looks at the incremental value of programmes, of which there are 15 possibilities of paired comparisons. We also test the differences between two-programme schemes all together and one-programme schemes all together (six additional possibilities). Results are given in table 8.

The coefficients of the one-programme schemes are always significantly different from the coefficient of (1,1,1) and from the coefficients of two-programme schemes. Furthermore, the latter are always significantly different from the coefficient of the complete policy. These results suggest that respondents distinguish between schemes, depending on the number of programmes. Finally, we note that, contrary to one-programme schemes, two-programme schemes are not valued significantly differently from one another.

Table 8. **Testing for differences in valorisation between schemes**

	(1,1,1)	(0,1,1)	(1,0,1)	(1,1,0)	(0,0,1)	(1,0,0)
(0,1,1)	7.98***					
(1,0,1)	3.82*	0.24				
(1,1,0)	4.61**	0.54	0.02			
(0,0,1)	50.87***	28.59***	24.61***	35.79***		
(1,0,0)	16.61***	2.86*	3.55*	5.76**	15.99***	
(0,1,0)	29.62***	10.81***	10.32***	15.83***	5.65**	2.93*

Notes: * significance at $p = 0.10$ / ** significance at $p = 0.05$ / *** significance at $p = 0.01$.

[17] Despite a basic economic assumption, income is often insignificant in recreational studies (Englin and Shonkwiler, 1995; Martinez-Espineira and Amoako-Tuffour, 2008). Several answers are available. From a theoretical perspective, it could be the result of a separable utility function (Loomis and Walsh, 1997). From a practical standpoint, it could also be the sign of a wrong answer. Our own experience has shown that the latter may be particularly important in face-to-face interviews.

[18] A Pearson correlation test showed that these time variables are not correlated. They can all be introduced.

4.1. Substitution effect

Another Wald test is used to study the nature of the relations between the programmes (Hoehn and Loomis, 1993). This Wald test compares the coefficient of a scheme, estimated through the regression on schemes, to the outcome given by the IVS for this scheme (sum of the coefficients of the different programmes composing it). This procedure is in fact based on formula (1). It aims at studying whether the substitution effect *SE* is significantly different from zero. The null hypotheses are reported in table 9.

Table 9. **Test of the relations between the programmes**

Null hypothesis	Estimator	IVS	Difference	Wald test	
$\alpha_{(1,1,1)} = \alpha_{(0,1,1)} + \alpha_{(1,0,0)}$	2.84	4.08	+44%	8.46	Reject
$\alpha_{(1,1,1)} = \alpha_{(1,0,1)} + \alpha_{(0,1,0)}$	2.84	3.85	+36%	5.09	Reject
$\alpha_{(1,1,1)} = \alpha_{(1,1,0)} + \alpha_{(0,0,1)}$	2.84	3.39	+19%	1.70	Accept
$\alpha_{(1,1,1)} = \alpha_{(0,0,1)} + \alpha_{(1,0,0)} + \alpha_{(0,1,0)}$	2.84	4.39	+55%	4.53	Reject
$\alpha_{(0,1,1)} = \alpha_{(0,1,0)} + \alpha_{(0,0,1)}$	2.22	2.53	+14%	0.58	Accept
$\alpha_{(1,0,1)} = \alpha_{(1,0,0)} + \alpha_{(0,0,1)}$	2.34	2.88	+23%	1.55	Accept
$\alpha_{(1,1,0)} = \alpha_{(1,0,0)} + \alpha_{(0,1,0)}$	2.37	3.37	+42%	5.81	Reject

Notes: The percentage difference is the percentage by which the IVS result exceeds the estimator / At a 10% level, χ^2 (1) equals 2.71.

The Wald test leads to an acceptation of H_0 in three cases, implying that the IVS outcome is not significantly different from any estimator. Tourists consider the programmes (0,1,0) and (0,0,1) on the one hand, and (1,0,0) and (0,0,1) on the other, as **independent** in valuation. In others words, the maintenance of the recreational quality in the forest does not significantly increase the marginal value of the other programmes when it is included in the same scheme.

In the four other cases, the programmes are **substitutes** in valuation. The utility given by the scheme is smaller than the sum of the utilities given by its components [19]. These results are in conformity with the findings of Hoehn (1991), who stated that "*substitution occurs consistently across all valuation contexts*", but they contradict the results of Santos (1998), which indicate that programmes implemented on a single site can behave as complements in valuation.

4.2. Welfare analysis

The implicit mean value of each scheme *S* corresponds to

$$E(WTP_S) = -\frac{\alpha_S}{\beta} \tag{7}$$

[19] As noted above, one can also say that an embedding effect occurs.

Its variance is calculated with the delta method (Hole, 2007). This method aims at approximating the variance of a non-linear function of random variables with the variance of a first-order Taylor expansion around the mean value of the variables (Greene, 2003):

$$\text{var}(WTP_S) = \frac{1}{\beta^2}\text{var}(\alpha_S) + \left(\frac{\alpha_S}{\beta^2}\right)^2 \text{var}(\beta) - 2\left(\frac{1}{\beta}\right)\left(\frac{\alpha_S}{\beta^2}\right)\text{cov}(\alpha_S, \beta) \quad (8)$$

The confidence interval is determined as $WTP_S \pm z_{\alpha/2}\sqrt{\text{var}(WTP_S)}$ with $z_{\alpha/2} = \Phi^{-1}[1-\alpha/2]$ where Φ is the standard normal *cdf* and α the critical value. WTP is thus normally distributed and symmetrical around the mean (Hole, 2007) and is measured in kilometres (the unit of measurement of the distance-cost) (table 10).

The debate concerning the conversion of the distance into money is ongoing in the economics literature (Englin and Shonkwiler, 1995; Earnhart, 2003; Hynes *et al.*, 2009) since this conversion is necessary for the purposes of cost-benefit analysis. Some studies used the so-called "accounting" methods by directly asking people the costs of their trip or by applying estimates of the marginal cost of running a car (Englin and Cameron, 1996; Layman *et al.*, 1996; Moran *et al.*, 2006; Martinez-Espineira and Amoako-Tuffour, 2008). Others rather consider that these costs are unobservable and treat them as a latent variable (Englin and Shonkwiler, 1995). Consequently, the possible heterogeneity of travel costs between users varies from one approach or the next. Because our analysis focused on quality variations and distance, we decided to treat costs in a very simple way by applying an estimate of the marginal cost of motoring, as provided by the French Automobile Club (the above-mentioned €0.40 per kilometre) and dividing it by the mean group size, *i.e.*, 3.4 persons (Martres, 2000) [20]. We are aware of the severe limitations induced by such a method but we still think that it provides rough estimates of the WTP, which are of potential interest for decision-makers [21].

Table 10. **Mean WTP per visit**

	WTP^{km}	$WTP^{€/household}$	$WTP^{€/person}$
(1,1,1)	153.90*** (87.38 – 220.41)	61.56	18.11
(0,1,1)	120.26*** (66.56 – 173.95)	48.10	14.15
(1,0,1)	126.77*** (68.57 – 184.98)	50.71	14.91
(1,1,0)	128.49*** (70.60 – 186.38)	51.40	15.12
(0,0,1)	55.35*** (20.37 – 90.32)	22.14	6.51
(1,0,0)	100.70*** (51.00 – 150.40)	40.28	11.85
(0,1,0)	82.03*** (40.15 – 123.91)	32.81	9.65

Notes: * significance at $p = 0.10$ / ** significance at $p = 0.05$ / *** significance at $p = 0.01$. The values in parentheses are the lower and higher bounds of the confidence interval at 95%.

[20] As we have already mentioned, MPCVM is based on a rather long interview. Our questionnaire consequently could not include another detailed part dedicated to perceived transportation costs.

[21] Even though time consumption was mentioned in the presentation of the questionnaire, we decided not to introduce the opportunity cost of time because of our inability to provide a robust estimation. Several papers have shown that the common practice based on a fraction of the individual's reported wage rate is not so satisfactory (Earnhart, 2003; Hynes *et al.*, 2009).

The use of an extra distance as a proxy for the cost allows an additional interpretation of the WTP. It could be perceived as the maximum distance a household would be willing to travel to benefit from quality maintenance of the recreational site. For management purposes, this information is quite useful. On this basis, managers may use it as a tool to create new recreational sites or to improve the recreational quality of others in order to lower the pressure on sensitive areas. In this case study, tourists are willing to travel about 154 kilometres (round trip) for the maintenance of the recreational quality on the three assets composing the site [22]-[23].

The WTP per person per visit ($WTP^{€/person}$) for the complete scheme is then €18.11. It is higher than the WTP for two-programme schemes (from €14.15 to €15.12 per person per visit), which are much higher than the WTP for a one-programme scheme (€6.51 to €11.85 per person per visit). Despite the high coverage of forests and the various efforts engaged in the management schemes, recreational quality in the forest does not appear to be the key reason for visiting these sites.

5. Conclusion

This paper confirms that in economic valuation of recreation, empirical studies must take the "substitution effects" into account, especially when recreational sites are composed of many adjacent natural settings. Thus, the recreational value of the whole site may slightly differ from the sum of the recreational values of each component of this site. Our results show that visitors significantly make a difference between the schemes (*i.e.*, the number of programmes included in a recreation policy). Nevertheless, a substitution effect (Hoehn and Loomis, 1993) occurs when all three programmes are supposed to be implemented.

In the present case, visitors attach less importance to the recreational quality in the forest than on beaches or in the water. Moreover, forest recreation value does not benefit from the presence of other natural features. In a fixed budget decision-making process, forest recreational quality may be one of the first attributes to decline. From an historical as well as an institutional standpoint, one may question the forest identity of these sites.

Previous results must be pondered, for several reasons. This paper focuses on the economic value of quality variations and not on the total economic value of the site. Moreover, as Gironde is one of the most densely forested French areas, forest recreationists have access to many substitute sites at relatively short distances. Finally, we studied only one part of the global demand, but residents as well as off-season tourists should be investigated. Since these two user categories probably attach particular importance to forests, complementary effects should not be completely excluded.

[22] More precisely, a group of tourists sharing the same vehicle.
[23] Which could appear quite high compared to the actual distance travelled (table 6), but tourists make a relatively low number of visits. This would not be the case with local people.

During summer, however, tourists remain an important part of the global demand. Following Riera Font (2000), we found that, in estimations of the economic value of recreation in the literature, tourists are sometimes neglected or, at best, pooled in the overall population of users. Moreover, tourism studies frequently focus on indirect benefits (as measured by input-output methods or economic multipliers) rather than direct benefits. In this paper we wanted to show that, under the right conditions, empirical studies of tourists may offer reliable economic estimates of consumer surplus. This information is also highly valuable for decision makers.

Implications for the management of recreational sites are numerous. First, our estimates confirm the need to consider adjacent areas in site management schemes. This may encourage forest managers to extend forest management policies in some way. In the economic literature, studies dedicated to forest recreation still take little account of the other non-forest features. Second, multi-attribute analysis may help decision-makers to select the most valuable components of the recreational quality of a site. On that particular point, one must not turn to CE (or another choice modelling technique) systematically. Third, our use of distance in the scenarios offers opportunities to design new regulating strategies. The level of use may be distributed among sites following the location of management efforts. Although distance and travel costs are connected, their exact relationship is far from being solved. Further research is needed here.

To test the relations between the three adjacent natural areas, we used an extension of DCCVM. This method is based on seven dichotomous choice opportunities contrasting a scheme with the no-policy and no-cost *status quo*. The MPCVM is specifically devoted to the study of the relations between the attributes of an environmental policy, and it proves to be of great help in complex environments like coastal forests. But the merits of this method need to be further explored, first because of the sensitivity of results to scenario design. Whereas we were particularly careful in designing the programmes, we agree that the items describing the water quality may have been associated with safety issues and that the latter may consequently have been prioritized. Second, the theoretical approach is far from being neutral. In this paper we use Hanemann's (1984) utility maximising framework to derive WTP. But Cameron and James (1987) provided an alternative approach to modelling dichotomous choices. This approach uses the household's expenditure function as a substitute for the indirect utility function. When considering only one programme, Whitehead (2001) showed that results may diverge with the framework used. From our own experiences, we observe that this divergence may likewise occur in repeated dichotomous choice contexts (Rulleau *et al.*, 2009). This point should be further investigated in order to improve the efficiency of MPCVM. Indeed, potential applications of this method in the area of outdoor recreation (and generally speaking of all public uses of natural areas) seem numerous.

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