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THE EFFECTS OF INFORMATION IN CONTINGENT MARKETS FOR ENVIRONMENTAL GOODS: ILLUSTRATION FROM THE DJA FOREST PARK IN CAMEROON

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ABSTRACT

This article aims at determining the impact of information on the effectiveness of the contingent valuation method in valuing environmental goods. After developing a mathematical model for information impact, it is then tested in the case of the Dja forest reserve in Cameroon. The results indicate that the type of information available to respondents significantly influence their Willingness to Pay and as such their valuation of the contingent good.

Keywords: Contingent Valuation Method, Willingness to Pay, Willingness to Accept Compensation, DJA Forest Reserve, Information.

INTRODUCTION

The contingent valuation method (CVM) is now widely used as a technique for valuing non-market environmental costs and benefits (Mitchell and Carson, 1989). By creating a hypothetical market for the environmental good in question, individuals are persuaded to reveal their willingness to pay (WTP) or willingness to accept compensation (WTA) for increases or decreases in supply of the good. These responses correspond to exact welfare measures of compensating or equivalent surplus under quantity constraints, contingent on the nature of the hypothetical market. Several features of this market have been argued to be of particular importance, such as its realism, and the payment mechanism proposed. These features, along with information provided to respondents on the good in question and the rule for provision or non-provision on the good, constitute the "framing" of the good to be valued (Cummings, Brookshire, & Schulze, 1986). Changes in this framing can be expected to change revealed values. This paper will concentrate on the possible effects of information on the revealed values. Given both the recent upsurge in the use made of CVM and information impacts, this seems an important task.

The structure of the paper is as follows: first, a discussion on a number of ways in which information provided in a CVM survey can influence stated bids, and briefly reviews previous empirical findings. The next section develops a model of information impacts, which is used to derive predictions for impacts on mean bids for two sorts of information, on the variance of bids, and on the degree of protest bidding. Following that predictions from the model are then tested using data from a recent Cameroonian application, and finally, some conclusions are offered.

INFORMATION IMPACTS IN CONTINGENT VALUATION

Hoehn and Randall (1987), and Bergstrom, Stoll and Randall (1989, 1990) modeled the two-stage decision making process. Individuals who are part of the sample for a CVM survey can be thought of as solving two problems. The first is how to

decide on the true value they place on a change in the supply of an environmental good. This is referred to as the "value formulation" stage and results in a true WTP figure for that individual at the time when the CVM question is asked. True WTP (henceforth referred to as WTP^t) is the solution to the cost-minimization problem an individual solves, where expenditure is minimized subject to a particular level of utility being held constant, given alternative levels of supply of the environmental good. For welfare-improving moves, WTP^t is a Hicksian compensating measure of the money value of the welfare change, whilst for a welfare decreasing move; WTP^t is equal to equivalent surplus.

Once individuals have solved the value formulation problem, they must decide what WTP figure to reveal to researchers. This is the "value statement" stage. If incentives exist for strategic behavior, then WTP^t may be less than or greater than the revealed WTP. As Bergstrom et al. (1989) noted, this two-stage process represents a considerable simplification over the six stage valuation process suggested by some psychologists (Beach & Mitchell, 1978.)

Information provided by the researcher impacts on both stages of this valuation process. With regard to the value formulation stage, WTP^t may change with alterations in the following classes of information:

Information on the Environmental Good Itself

Bergstrom et al. (1990) distinguished between information on services supplied by the environmental good, in terms of its "possible uses," referred to as "service information," and information on physical descriptors of the good, which they refer to as "characteristic information" (p. 614). So for a mature forest, service information would include descriptions of the importance of the forest for micro-climate regulation and soil retention, while characteristic information would include details on the size and species composition of the forest.

Clearly, if individuals are given new information about either characteristics or services provided by an environmental resource, they may change their WTP^t. For example, being told that wetlands provide flood protection benefits may cause some people to revise upwards their WTP^t. An alternative interpretation is that additional information helps individuals learn about their preferences; given this change in how they perceive their preferences, they then revise the value they placed on the environmental good, and so increase the WTP^t. Bergstrom et al. (1990) found evidence of significant impacts on WTP when the quantity of characteristic/service information given to respondents was increased, although Boyle (1989) found no significant impact in a study of preservation of Wisconsin fisheries.

Information on Substitute and Complementary Environmental Goods

If individuals are questioned in a CVM survey about the value of a particular forest, their WTP^t may well be affected by additional information on substitute and complementary environmental goods. For example, being told of the existence of a very similar forest not far from the forest being valued may decrease WTP^t, if this represents new information. Alternatively, being told that a second habitat exists for an endangered species may increase WTP^t for a first site, if this means individuals no longer perceive safeguarding the species as a lost cause. Information about substitutes and complements may concern prices, as well as physical characteristics. The provision of substitute/complement information may be more important in

cases where non users of a resource are being questioned, since they are less likely to be informed on these issues than users. Whitehead and Blomquist (1991) estimate mean bids for the preservation of a particular wetland, Clear Creek, in western Kentucky, using dummies in a bid curve to represent the inclusion or exclusion of information on other wetland sites. It was found that information about a substitute good (a lake on land reclaimed from mining) significantly reduced the probability of a yes response to the suggested cost of preserving Clear Creek, while information on a complementary wetland increased this probability (but not significantly). The authors conclude that information introduced in a contingent market produces a desirable information effect (p. 2530). Boyle, Reilling, and Phillips (1990) find largely insignificant effects on WTP^t to hunt four species of game in Maine when hunters were given new information on the cost of hunting other, substitute species.

Information on Relative Expenditure

In CVM surveys, respondents are asked to state an amount indicating their WTP for a particular resource change. However, individuals may be imperfectly informed about how this amount compares to their spending on other public goods, such as defense, how it compares to their income, or how it compares to any environmental budget that individuals formulated (Seip and Strand, 1990). Providing information on any of these items may change WTP^t. Bergstrom et al. (1989) finds no significant effect of information about relative expenditures on WTP^t in a small sample water quality study.

Information of Future Availability of the Good

This kind of information might well be subsumed under information on the environmental good itself but has been treated differently in the literature, as one determinant of option value (Bishop, 1982, Johanssen, 1987). WTP^t has been shown as a decreasing function of supply of uncertainty for a good, with individuals being willing to pay a premium to secure a reduction in supply uncertainty of a good, given demand certainty. Information relating to supply uncertainty may thus change WTP^t.

Information about the Behavior of Others and the Provision and Cost Sharing Rule(s)

The Information types above can all be considered to have possible effects on true WTP if an effect on WTP^t is expected, then CVM would only be a satisfactory value measure if average bids are affected in this expected manner. But information on the behavior of others, on the cost sharing rule, and on the provision rule will all potentially impact on revealed WTP, causing the ratio of revealed WTP (WTP^r) to WTP^t to change. Such potential impacts have been noted by many authors, from Samuelson (1954) through to Mitchell and Carson (1989). For a project which improves environmental quality, if respondents believe that stated bids will be collected, then they have an incentive to understate WTP^t since benefits of the projects are non-excludable. This is the classic free rider problem. If respondents believe bids will not be collected, but that the outcome of the survey will guide policy, then supporters have an incentive to overstate their WTP^t. Information on the behavior of others can also affect the incentive to behave strategically. If a free rider who values the environmental improvement is told that the aggregate bid is insufficient to have the project go ahead, then she may revise her bid upward, and surrender some of the rent gained by understating.

Whilst incentives for strategic behavior are very much survey specific in CVM, we would argue that in general, strategic behavior may be less common than expected. In experimental studies where respondents have been encouraged to engage in either strategic under or over statement of WTP^t, several studies have found surprisingly little divergence between WTP^t or WTP^r. Examples include Bohm (1972) and Brubacker (1982), although for contradictory evidence see Throsby and Walters (1986). Milon (1989) tests three types of strategic behavior in a field CVM setting. Strong free riding occurs when stated WTP under any payment mechanisms is zero, even though true WTP is supposed to be positive. Weak free riding occurs when $WTP^t > 0$ and $WTP^t > WTP^r$ Over-riding occurs when $WTP^t > 0$, and $WTP^r > WTP^t$: this may happen if the respondent believes that his/her response will influence supply of the public goods, but that her bid will not be collected. Milon assumes that a Hoehn and Randall closed-ended referendum set-up will produce truthful behavior, and thus uses responses under this scenario as WTP^t. Milon finds no evidence of strong free rider or "over-riding," and no evidence of weak free riding when those who could not formulate a bid were excluded.

A MODEL OF INFORMATION IMPACTS

Information affects revealed willingness to pay in a variety of ways. It will affect the probabilities attached to different possible benefits and therefore alter the expected value of a resource. Additionally, it is widely accepted in the CV literature that the hypothetical nature of the questions used in interviews is confusing and often unbelievable for many participants. Information, for instance, on threats to a species can therefore affect the credibility the CV processes, and hence modify the reported WTPs. Finally, to the extent that responses to surveys may be strategically biased, the level of information available to respondents may alter the link between individuals' WTP and their revealed willingness to pay. In particular, consumers who are more aware of the consequences of underreporting bids may be more willing to give truthful answers.

These three effects can be evaluated in a simple model which we base on the forest case, but which can be easily extended to other situations, (see the discussion section). Suppose there are potential sites that the consumer can visit. Any particular site has a variety of attributes that makes it desirable. In the case of the forest, these may include the site area and the variety and abundance of flora and fauna, but for simplicity we suppose that there is only one characteristic. Even for regular visitors to the site the scale and availability of characteristics of the site and other, substitute sites will be uncertain. So let the set of possible attributes for all n sites be Z- a subset of R. Some sites will not have many of the attributes, and it may be that people believe that a particular site does not have particular features, but both aspects of the problem can be incorporated in the probabilities rather than the characteristics themselves. This formulation allows certainty and allows for the fact that some sites may be known (or just believed, since probabilities are subjective) to have none of a particular characteristic. So that, if the attribute Z was 'having a geyser,' a rural Cameroonian forestland could have a probability of 1 that $z = 0$, and zero probabilities for all strictly positive values of z.

For site k, the subjective probability density function of potential characteristic is $g^k(z)$ for a particular individual, with $G^k(z)$ as the cumulative density function. Suppose there is also maximal element z_{max} such that $G^k(z_{max}) = 1$ for all k and similar z_{min} such that $G^k(z_{min}) = 0$ for all $k = 1,\ldots,n$. Preferences are of the form, $u(m\text{-}c^k,z)$, where m is income, c^k is the generalized travel

cost of visiting a site, U is twice differentiable and it is assumed that U is increasing in m and, at least initially, all the arguments of z, letting v^k be the expected utility for site k then,

$$V^k = \int_{Z_{min}}^{Z_{max}} U(M-C^K,Z)g^k(z)dz. \qquad (1)$$

Integrating by parts yields:

$$V^k = U(M-C^K, Z_{max})\, G^k(Z_{max}) - U(M-C^K, Z_{min})\, G^k(Z_{min}) - \int_{Z_{min}}^{Z_{max}} U_z(M-C^K,Z)G^k(z)dz. \qquad (2)$$

But $G(z_{max}) = 1$, while $G(z_{min}) = 0$, so

$$V^k = U(M-C^K, Z_{max}) - \int U_z(M-C^K,Z)G^k(z)dz. \qquad (3)$$

Willingness to pay under conditions of uncertainty has been a subject of some controversy (see Graham, 1981), since the amount an individual is willing to pay will be state dependent. Hence there is no single figure that is WTP, rather there is a locus of points all of which satisfy the condition that the expected utility of the chosen option is no less than that obtainable in the absence of the option. However CVM questions imply a particular method of financing the contribution that is constant across all states of

$$\int_{z_{min}}^{z_{max}} U(m-c^*-WTP,z)g^* dz. = v^a = \int_{z_{min}}^{z_{max}} U(m-c^a,z)g^a\, dz \qquad (4)$$

the world. Hence the appropriate measure of WTP is the option price of the site. So WTP, interpreted as the option price of the best or chosen site (indicated by *), is given implicitly by:

Where an ^{a} indicates the next best alternative if * is not available. In other words, (4) states that WTP is the maximum amount the consumer is willing to pay in every possible state of the world that leaves him or her indifferent between choosing the original site and choosing the next best alternative. With all definitions of consumer surplus, the choice made in the absence of the original site is optional given this constraint and the extra income represented by WTP. Thus it may involve visiting an alternative site, just as a consumer denied one brand of coffee may still continue to consume coffee, albeit an alternative brand. Putting the results of (4) in equation (3) yields:

$$U(m\text{-}c^{*}\text{-}WTP,z_{max}) - \int_{z_{min}}^{z_{max}} U_z(m\text{-}c^{*}\text{-}WTP,z)G^{*}(z)dz$$

$$= U(m\text{-}c^{a},z_{max}) - \int_{z_{min}}^{z_{max}} U_z(m\text{-}c^{a},z)G^{a}(z)dz \qquad (5)$$

Information is an input into the decision-making process, but in complex environments it is difficult, if not impossible to quantify. Thus it has to be measured by its effects on output-here value, but the effects of information are hard to formalize and there is no consensus on the functional form of an increase in information on G. For that reason we use a very general notion of the consequences of increasing the information available to individuals.

Because the input is not measurable, the definition of positive information is then tautological: information is positive for an individual, if it raises the expected utility of the object in question. Information is positive if it raises expected utility for all agents. Thus if all agents are risk averse, information is positive if, after receiving information the cumulative density function is $G^{k'}$ and $G^{k'}$ second-order stochastically dominates G^{k}. But this formulation is not empirically testable since we can only tell if information is positive if expected utility rises. Thus for empirical purposes we adopted a stronger from of the notion of positive information, which implies the weaker form.

Definition

Information is positive if it raises the subjective probabilities that a particular site has more of the good attributes. More formally, if after receiving information the cumulative density function is $G^{k'}$ such that $G^{k'}(z) \leq G^{k}(z)$ for all z and for all individuals and the inequality is strict for at least one point in z for at least one individual, then the information is positive for al individuals.

This amounts to saying that $G^{k'}$ first-order stochastically dominates G^{k} and is empirically testable provided that we can agree on the positive attributes of a bundle of goods. Our approach should be distinguished from that of Hoehn and Randall (1987) who consider the consequences of reducing uncertainty rather than the effects of giving specific information. Giving information can make a consumer more uncertain rather than less if prior probabilities are biased (e.g. telling someone that an amenity may be destroyed when they were sure it was absolutely safe). Information, in this context, is more along the lines of Milgrom (1981) who analyses the concept of 'good news' within choice under uncertainty. With increased information, the formula for WTP' is given by:

$$\int_{z_{min}}^{z_{max}} U(m\text{-}c^{*}\text{-}WTP',z)g^{*'}\,dz = \int_{Zmin}^{Zmax} U(m\text{-}c^{a},z)g^{a'}dz \qquad (6)$$

Putting (6) in the form of (5) and combining them yields equation (7).

$$[U(m-c^{*}-WTP,z_{max}) - U(m-c^{*}-WTP^{'}, z_{max})]$$

$$+ \int_{z_{min}}^{z_{max}} U_z(m-c^{*}-WTP,z)(G^{*'}-G^{*})dz + \int_{Zmin}^{Zmax} [U_z(m-c^{*}-WTP^{'},z)-U_z(m-c^{*}-WTP)]G^{*'}dz$$

$$= \int_{z_{min}}^{z_{max}} U_z(m-c^{a},z)(G^{a'}-G^{a})dz \qquad (7)$$

In these equations, and in the following material, a' indicates the post-information value of a variable. Equation (7) shows the ambiguity of the effects of information on willingness to pay. The first term on the left hand side (LHS) of the equation takes the sign of (WTP'–WTP) - if information raises WTP then this term is positive. The second term is negative, given the assumptions about the impact of information. Hence, if these were the only two terms in the equation, information would raise willingness to pay. However, positive information may also raise an individual's valuation of alternative sites. If this is the case, the right hand side of (7) will be negative and therefore WTP may fall. Only with site specific information should we expect WTP to rise. This is the result reported in Bergstrom et al (1990), but there is actually another reason why WTP may fail to rise.

The third term on the LHS of (7) takes the sign of the change in WTP provided that U_{zm} is negative, the marginal utility of z is diminishing in income. In this case WTP rises in the absence of any changes in G^{a}. Yet if the marginal utility of z is increasing in income, the sign of the third term is opposite to the sign of the changes in WTP and so willingness to pay may fall. Such an assumption is not unreasonable, as the valuation of environmental commodities normally rises with income. Further insight can be obtained if we note that ex-post (i.e. when the true value of z is realized, and assuming for expositional purposes that z is now a single number rather than vector), the consumer is effectively rationed in his or her choice of z. Given this, we can use the approach of Neary and Roberts (1980) to define the shadow price of z as π and therefore indirect utility in this circumstance as,

$$U(m-c^{*}-WTP,z) = U(\pi z + m-c^{*}-WTP, \pi) \qquad (8)$$

Thus,

$$U_z(m-c^{*}-WTP,z) = U_\pi \pi_z + U_m (\pi_z z + \pi) = \pi U_m \qquad (9)$$

Using Roy's identity: $U_\pi = -zU_m$ Therefore:

$$\frac{\partial \pi U_m}{\partial m} = U_m \pi_m + \pi U_{mm} \qquad (10)$$

Now the second term on the RHS is negative, but the first will usually be positive. Since z is fixed ex-post, $z_m(m\text{-}c^*\text{-}WTP,z) = 0$ and this can be used to show that

$$\pi_m = - \frac{z_m}{s} \qquad (11)$$

Where s is the own substitution effect and therefore negative. Hence, if demand for environmental characteristics is strongly increasing in income, it is possible that WTP may fall in the wake of information, even if information has no impact on the appreciation of other sites. The effect arises because increased information raises the expected level of environmental characteristics. This raises the marginal utility of income, and hence individuals are prepared to sacrifice less income in order to preserve the benefits of the site. While small changes in information may not produce this effect, it cannot be ruled out when individuals undergo major revisions of the information available to them.

So, in summary, when information raises appreciation only of the chosen site and ignoring effects via the marginal utility of income discussed above, the prediction for a given site, S is that WTP in the presence of additional good information will be higher than in the absence of such information. Terming this a "characteristics effect", we can test:

$$H_0^1 : WTP(S)^t_0 = WTP(S)^t_1 \text{ versus } H^1_1: WTP(S) < WTP(S)^t_1$$

Where the subscript 1 refers to the situation after the extra information and the subscript 0 refers to before the extra information. In what follows, we will omit the superscript t, taking all WTP amounts to refer to true WTP.
If information is positive, but is interpreted as applying to all possible sites, then the valuation of any given site may rise, but overall WTP may fall. To say anything more requires making conjectures about how the different G^k functions are affected by information. Empirically, we can test for this effect. Defining WTP(G) as WTP to preserve the option to visit sites in general, we test:

If the vector of characteristics, z is defined to include the future benefits from a site, then information on threatened future losses in the area of a given health will raise the probability that the flow of benefits on other sites will be curtailed. So $v^{a'} \leq v^a$, where a' is the expected utility from the next-best alternative after the new information has been received. If a CV question also states that the site on which the questioning is being carried out can be saved from destruction, then to the extent that there is a pre-existing perceived threat to the site, asking the question also raises the probability that the flow of benefits will continue and so $v^{*'} \geq v^*$. Therefore WTP(S) should rise. If the CV study also raises the possibility of saving all sites, then increased supply uncertainty will again increase bids, so that WTP (G) will also rise. Terming this a relative scarcity effect, we have two more testable hypotheses:
Where again the sub-scripts 1 and 0 represent, with and without additional information respectively.

$H^3_0 : WTP(S)_O = WTP(S)_1$ versus H^3_1: $WTP(S)_0 < WTP(S)_1$

$H^4_0 : WTP(G)_0 = WTP(G)$ versus H^4_1: $WTP(G)_0 < WTP(G)$.

$$\int_{z_{min}}^{z_{max}} U(m-c^*-WTP,z)g^* dz$$

$$= p \int_{Zmin}^{z_{max}} U(m-c^a,z)g^a \, dz + (1-p) \int_{z_{min}}^{Zmax} U(m-c^*,z)g^* dz \qquad (12)$$

A second issue is the question of the credibility of the CV framework. Individuals are asked to imagine a threat to the site. They put a probability, P, on the conjectured threat being true, in which case their expected utility is the sum of the expected benefits from continuing to use the site plus the expected benefits of using the second choice site if their first choice is destroyed. So WTP is defined implicitly by:

If information raises the credibility of the conditional statement 'suppose this site will be destroyed'. Then the probability P rises. From (12) the RHS falls so WTP increases, even in the absence of the previously discussed consequences for G* and G^a. Furthermore, the effect should be reflected not just in the mean WTP scores, but also in the number of Zero bids, since one of he prime reasons usually given for these bids is the interviewee's lack of belief in the credibility of the questions posed. We thus test:

$H^5_0 : \pi_0 = \pi_1$, versus H^5_1: $\pi_0 > \pi_1$,

Where, π_0 and π_1 are the percentage of protest bids with and without additional information.

In addition for its consequences for average measure of WTP, some authors (e.g. Boyle, 1989) suggested that measures of dispersion should be affected by the provision of information. In particular, it can be argued that as more information is received, those who are already informed will adjust their WTP only marginally, while those who were relatively ignorant will raise their valuations substantially. This should narrow the gap between the ignorant and the informed and hence, reduce measures of the dispersion of WTP. This requires adopting a specific functional form for the relationship between G and information

$$(1/H)\sum_{h=1}^{h=H} [WTP^{'}-WTP(m)^{'}]^2 - (1/H)\sum_{h=1}^{h=H} [WTP-WTP(m)]^2 \qquad (13)$$

(which has already argued is not realistic), but also assuming a functional form that applies across individuals. To see that in general nothing can be predicted about the variance or the standard error, consider the effect of providing positive

information on the site chosen. If there are H individuals (and the superscripts h = 1,…, H are omitted for simplicity), the change in the variance is given by,

Where (m) in front indicates the mean value. Equation (13) can be rewritten as:
The first term is negative if willingness to pay is increased by information. The second term is negative if the change in WTP, following the receipt of information. For small changes in information, it is expected that these two to be close, hence provided information increases willingness to pay, a sufficient condition for the variance of bids to fall is that the size of

$$[WTP^2-WTP(m)'^2] + (1/H)\sum_{h=H}^{h=H}[(WTP'-WTP)\ (WTP'+WTP)] \qquad (14)$$

increases in WTP are negatively correlated with actual WTP. Conversely if the correlation is positive, the variance may rise in the wake of information. How likely is this result?

Different people will bring different information set to the site, some may be completely ignorant, while others might know everything about the site and its alternatives. The vast majority of visitors are likely to fall somewhere in between, but essentially, if those with the highest initial valuation are either the most ignorant or the most receptive to new information, then the variance will rise. The first alternative does not seem likely, after all the sets of those visiting the site in the forestland case study is not random, but will tend to consist of those with the highest valuation and those most informed about the site attributes. However, the second suggestion is plausible: these people may also be the most respective to new information because they have already chosen to consume the environmental good. Therefore, in order to state that the variance of WTPs will fall after information is given, we require the eminently reasonable, but unverifiable assumption that the WTP of those most ignorant in the sample is more sensitive to information than the informed. Thus no predictions are made about changes in measures of dispersion.

In summary, the provision of information should affect an individual's WTP. Positive, sites-specific information for all individuals should raise the mean WTP figures while negative information about other sites should also increase the bids to preserve a specific site. General information about all sites should raise the WTP for the preservation of all sites together. Meanwhile, if the credibility of the whole process is enhanced by the provision of information, then the number of zero (non-protest) bids should fall. There is no clear cut prediction of the effects of information on measures of dispersion.

EMPIRICAL TESTS OF INFORMATION IMPACTS

Tests on the impact of information in accordance with the maintained hypotheses set out above were implemented in a case study of preservation values for an increasingly scarce habitat type in southern and eastern Cameroon, namely tropical rainforest. Rainforests in Cameroon have 333 wood species, 6,000 food plants and over a 1,000 medicinal plants (Betti, 2002).

A CV survey was carried out at the Dja Biosphere Forest Reserve in order to ascertain peoples' perceptions of the value of rain forests. The Dja forest reserve is owned by the Cameroon Government and managed by the Ministry of Environment for its nature conservation, informal recreation, educational and medicinal value. It is located in the East and South Provinces of Cameroon. It covers an area of 5,260 sq. km and is classified among the largest protected areas of Guinea–Congolian tropical rain forests. The reserve is bound by the Dja River which constitutes its natural boundary, except in the southeast. The climate is equatorial and humid. Average annual rainfall is 1,600 mm, while annual temperature is 23°C. The Dja loop is situated in the Congo basin on the Precambrian plateau. The altitude of this plateau varies between 600 and 700 m and the slopes slightly towards the Southeast Relief is characterized by shallow valleys (Bedel & Bousquet, 1987). According to Sonké (1998), three broad categories of forests can be distinguished in the Dja region: forests on rocks, forests on firm soil, and aquatic or hydromorphic forests. Forests on firm soil are further divided into primary forests (without perturbation) and secondary forests (subject to human or natural perturbation)

The Dja accommodates a variety of wildlife species, including such endangered species as the forest elephants (loxodonta Africana cyclotis), chimpanzees (pan troglodytes), leopards (panthera pardus), as well as, forest buffaloes (Tragelaphus euryceros) ant the gorillas (Gorilla gorilla).

All respondents were presented on-site with three CV questions. The first two (WTP_a and WTP_b, respectively) seek to estimate an option price for visitors to Dja Forest Reserve, using two different bid vehicles: an entry fee, and an annual permit. Respondents were also asked (WTP_c) about their WTP into a specially created trust fund to preserve rainforest lands in general (i.e., not just the Dja Forest). The questionnaire is given in Appendix A.

A sample of 237 replies was obtained by interviewing visitors to the Dja Reserve during August, 2006. A single interviewer sampled both weekday and weekend visitors. Questioning was spread evenly over major access points to the site, and respondents were interviewed when they returned from walks, excursions, or field work. Respondents had therefore used the reserve before being questioned. Seventy-one percent of those visiting were there as the "main purpose" of their day out, while "looking at scenery" was the most reason for the trip, followed by "walking" and "watching wildlife."

The survey used four different information sets, L, M, P and Q. These are defined as follows:

L= basic information only regarding hypothetical market (means and reason for payments);
M= L plus information on the rate and extent of depletion of Cameroon rainforest in general (relative scarcity charts showing its decline over the last four decades);
P= L plus information on what rare flora and fauna could be found at the reserve (characteristics information). Common flashcards showing gorillas, chimpanzees, and others were used;
Q= L plus M plus P sets of information

WTP bids were then available over the three payment scenarios and four information sets. Taking the sample as a whole, you obtain the data in Table 1. All mean, median and spread figures are calculated excluding protest bids, which are identified as Zero bids tendered for reason other than a zero value being placed on the site. No outliers were either identified or excluded in many of the three payment scenarios.

Table 1: Willingness to Pay for Heathland Conservation

Payment Scenario	**N**	**P**	**Mean (CFA F)**	**Median (CFA F)**	**Standard Deviation (CFA F)**	**Range (CFA F)**
WTP_a	177	58	740	500	560	0-3500
WTP_b	203	32	9730	7500	10470	0-60000
WTP_c	211	24	25570	10000	32430	0-20000

Notes: p = number of protest bids

N = number of non-protest bids

Payment scenarios: WTP_a = entrance fee; WTP_b = annual permit

WTP_c = bid for general forest preservation

Table 2: Impact of Information on Mean WTP Bids (CFA F) by Scenario

Information set

Payment Scenario	**L Basic**	**M Relative Scarcity**	**P Characteristics**	**Q (Both)**
WTP_a	590	810	760	790
WTP_b	6770	11490	10390	10320
WTP_c	21540	20640	21520	38490

Whilst for the site-specific question Dja Forest WTP_a and WTP_b, additional information on flora and fauna raises bids, the biggest impact is additional information on the scarcity of forest. Moving form data set L to data set Q increases bids by 34% in the WTP_a scenario, by 52% in the WTP_b scenario and by 79% in the WTP_c scenario. The standard deviation of WTP_a responses rises as additional information is supplied; thus it's also true for WTP_b. Since the theoretical arguments of suggested increase in WTP for those receiving information for both the sites specific and general cases, it was tested for statistical significant differences between pairs of mean values using one-sided t-tests. The null hypothesis of no significant difference was tested across 9 pairs of mean values. The results of the tests are given in Table 3, null hypotheses are indicated in the final column.

Table 3: Significance Tests for Mean

Payment Scenario	Difference Tested	|t-value|	Hypothesis
WTP_a	Set L vs set M	1.83*	H_0^3
”	Set L vs set P	1.43	H_0^1
”	Set L vs set Q	1.74*	n/a
WTP_b	Set L vs set M	2.82*	H_0^3
”	Set L vs set P	1.87*	H_0^1
”	Set L vs set Q	1.88*	n/a
WTP_c	Set L vs set M	0.18	H_0^4
”	Set L vs set P	0.01	H_0^2
”	Set L vs set Q	2.24*	n/a

Notes:* = significant at 95% level (critical value= 1.64)

Mixed conclusions may be drawn from statistical significance tests reported above:

(1) For WTP to preserve the option to visit the site [WTP(S) in the notion of section 3], increasing the level of both characteristics and relative scarcity information significantly increases mean bids in 3 out of 4 cases. The null hypothesis H^1 and H^3 are rejected at 95% level. Combining these additional pieces of information, (that is, moving from set L to set Q) significantly increase WTP for both the entry fee (WTP_a) and annual permit (WTP_b).

(2) Information affects bids to preserve forests in general (WTP_c) are less strong: only when the effect of the relative scarcity and characteristics information are combined thus WTP rise significantly. The null hypothesis H^2 and H^4 can not be rejected at the 95% level.

Non parametric tests for differences between information sets are reported in Appendix C. As will be seen, these replicates the T-tests results for both the WTP_a and WTP_c scenarios. For WTP_b , however, significant differences only exist between information sets L and M. the null hypothesis in all cases for appendix C is that of no significant information effect.

We also tested for the difference in means between information set N and set Q, and between information set P and set Q. For WTP_a and WTP_b, moving form set M or P to set Q has no significant effect on mean bids (t- statistics were – 0.2 and 0.275, respectively). In order words, adding to the information set once respondents had received relative scarcity or characteristic information had no significant effect on WTP: this could be interpreted as evidence of what Bergstrom, Stoll and Randall (1990) referred to as “weak information overload” that information effects are positive, but diminish at the margin.

It seems feasible that additional information on the characteristics of a site and on the relative scarcity of forest land might have a differential effect on respondents’ WTP according to (i) their frequency of visiting the site and (ii) the degree to which this additional information was already familiar to them. With regard to point (i), we partitioned the sample into two sub-samples, one of which contains all those responses from people who were visiting the site for the first time (new visitors), and the other containing responses for those who had visited the site before (existing visitors). Our sample contains 48 new visitors and 189 existing visitors. For the site-specific WTP questions, the number of visits is positively correlated with

WTP_b, but negatively correlated with WTP_a; whilst for sites in general (WTP_c) visits and bids are positively correlated. For new visitors, additional information has significant impact on WTP_a or on WTP_b bids, although the fact the sample sizes are very small (around 12 responses for each information set) means that the power of these tests is low (maybe failing to reject the null hypothesis of no significance when difference are in fact significant). Additional information (moving from set L to M, P or Q) significantly increases WTP_a and WTP_b for existing visitors.

There is no evidence here that those who had not visited the site before are more affected by additional information than are existing visitors. This maybe because existing visitors are displaying greater interest in the Dja Forest, and thus are more likely to raise their bid to protect the site; whilst our data does not enable us to say whether those visiting Dja Forest for the first time had visited other, similar forest sites previously. These results also shed light on the discussion of the effect on sample variance of bids in section 3; there it was shown that increasing information would only reduce the variance of bids if the marginal impact of information was higher for uninformed than for informed visitors, but the evidence is that this is not in fact the case. Thus the variance of bids might be expected in this case to rise with additional information, which is, as we already noted, exactly what occurs for site-specific bids.

With regard to point (ii), we asked all respondents who were given characteristics or relative scarcity information how familiar they were at that point in time with this information. This familiarity was scored on a scale of 1 (very unfamiliar) to 5 (very familiar). The mean score was 3.23. The sample was split into two groups according to these responses: those scoring 1 to 2 (unfamiliar respondents), and those scoring 3, 4 or 5 (familiar respondents). Since no familiarity score was recorded in information set L, the statistical approach of the previous section (paired t-tests) was not possible. We thus ran separate OLS regressions on familiar and non-familiar respondents, specifying information sets as dummy variables. Results showed that for unfamiliar respondents, neither additional relative scarcity nor any characteristic information significantly affected WTP. In contrast, for familiar respondents both information dummies were significant. Again, this may be because familiar respondents gain this position by having taken an interest in forest issues in the past, and thus are more likely to revise upwards their WTP, since a previous interest is indicative of a preference for forest preservation. Finally in this section, we note that familiarity with the information presented, and total visits to all forest sites, were not correlated with each other to a high degree ($r= +0.208$); result from the 'familiarity' and 'new-existing visitors' sections are thus not expected to be necessarily the same.

With regard to the impact of information on the percentage of protest bids, tabular results are given in Appendix B. The main conclusion is in all cases, the percentage of protest bids rises in moving from set L to set M, and rises in two out of three cases when moving from L to P. However, it falls in the majority of cases in moving from L to Q (full information). We were unable to reject the hypotheses H^5_o of no significant difference in the proportions of protest bids at the 95% level, and quite clearly there is never a statistically significant change as a result of providing extra information. This conclusion is unsurprising when one considers the reported reasons for tendering protest bids. Out of 58 protests for WTP_a, the most common motive was the area was regarded as common ground, which should be free for all to access (i.e., lack of credibility of the hypothetical market). For WTP_b the most common motives were that the area was regarded as common (i.e., as above),

respondents would prefer to pay the per-visit fee and existing taxes should be used to pay for protection. Again, credibility of the hypothetical market was not an issue. Finally, for WTP_c the 3 main reasons for protest bidding were that (i) forest should be protected by law, (ii) a different payment mechanism was preferred, and (iii) the hypothetical market would not be operational. Given the responses, it would be surprising if the null hypothesis could not be rejected in this case study.

Interestingly, however, a two-way ANOVA analysis of protest proportion against information set and payment scenario (that is WTP_a, WTP_b or WTP_c) could not reject the null hypothesis of no significant effect across payment scenario: the percentage of protest rose significantly when a daily permit (WTP_a) was used rather than an annual permit.

CONCLUSION

As a whole the results from the forest experiment support the theoretical augment of section 3 that giving information can affect the value of bids received. A relevant question is by how much individuals' information sets can be increased before significant changes in WTP. Very small changes in information about characteristics or relative scarcity may have very little effect on WTP. This might be due to the kind of threshold effects noted in studies of advertising (e.g., Lambkin, 1976). Below a certain number of adverts, consumer behavior is unresponsive to information received, but once a critical mass is reached, individuals respond.

Yet clearly this does not mean that any information can be given to CV respondents. Information must be "true and accurate" (we would argue that all four sets L–Q correspond to this description) and must be sufficient for people to understand the case being studied. The policy implication in this case of how much information was provided are clearly significant since using the highest value obtained here almost doubles the conservation value of forest lands.

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APPENDIX A

Part of Questionnaire for the Dja Forest Reserve

(Note: Scenario= WTPa)

(i) The Dja Forest is currently owned and managed by the government of Cameroon. Managing the site costs money: money to pay for wardening services, information displays, and monitoring the forest. Suppose that the government, due to financial pressures, was faced with decision of either introducing an entrance charge to the area, or else selling the site to developers. In such a hypothetical situation, visitors such as you could only retain the opportunity to visit the site by agreeing to pay such a charge. Clearly, the higher the charge that could be collected, the more likely it would be that the forest would enjoy permanent protection.

What is the most you would be willing to pay as an entrance fee to save this forest from development (in **CFA F)**?

0 500 1000 1500 2000 2500 3000

3500 4000 4500 5000 5500 6000

(Please circle one value)

If the most you would be willing to pay is not shown here, please write the amount here _____

_____

If you would not be willing to pay anything as an entrance fee, please write your reason here _____

_____

APPENDIX B

Protest Bids under Different Information Sets

Payment scenario	**Information set**	**No. of protests**	**% of sample**	**Reject H^5_0?**
WTP_a	L	15	26.3	N/A
"	M	17	28.3	no
"	P	18	18	no
"	Q	8	13.5	no
WTP_b	L	7	12.3	N/A
"	M	13	21.6	no
"	P	8	13.5	no
"	Q	4	6.7	no
WTP_c	L	5	8.7	N/A
"	M	10	16.6	no
"	P	3	5.1	no
"	Q	6	10.2	no

APPENDIX C

Mann-Whitney Test of Significant Differences

In Medians (significance level=95%)

WTP_a	Verdict on H_0
H_0: $WTP_l = WTP_m$ versus H_1 : $WTP_l < WTP_m$	Rejection (0.0393)
H_0: $WTP_l = WTP_p$ versus H_1 : $WTP_l < WTP_p$	Cannot reject (0.104)
H_0 : $WTP_l = WTP_q$ versus H_1 : $WTP_l < WTP_q$	Rejection (0.0215)
WTP_b	
H_0: $WTP_l = WTP_m$ versus H_1: $WTP_l < WTP_m$	Rejection (0.0109)
H_0: $WTP_l = WTP_p$ versus H_1 : $WTP_l < WTP_p$	Cannot reject (0.200)
H_0 : $WTP_l = WTP_q$ versus H_1 : $WTP_l < WTP_q$	Cannot reject (0.2698)
WTP_c	
H_0: $WTP_l = WTP_m$ versus H_1: $WTP_{l<} WTP_m$	Cannot reject (0.2441)
H_0: $WTP_l = WTP_p$ versus H_1: $WTP_{l<} WTP_p$	Cannot reject (0.3133)
H_0: $WTP_l = WTP_q$ versus H_1: $WTP_{l<} WTP_q$	Rejection (0.0239)

Note: Value in parentheses is the attained significance level of the test: that is, to take the example of WTP_a, set L versus set M, the differences between two sample medians is significant (100-3.93) times out of 100.