

ANALYSIS

Valuation of tropical rainforests: philosophical and practical issues in the use of contingent valuation

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**Abstract**

This paper explores the possibility of using a large scale multi-country contingent valuation study for making decisions concerning global resources in the specific context of valuing a large set of tropical rainforests. Before considering the practical issues involved in implementing such a study, the paper addresses philosophical issues related to the use of contingent valuation including the role of passive use motives such as altruism and the role of information. The implications of empirically based criticisms which argue that contingent valuation results are unreliable are also considered. The main portion of the paper sketches the practical difficulties likely to be encountered in actually implementing a large contingent valuation study in multiple countries which seeks to value a common set of tropical rainforests. Some key study design choices are discussed. © 1998 Elsevier Science B.V.

*Keywords:* Tropical rainforests; Contingent valuation; Information

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**1. Introduction**

Contingent valuation (CV) is a survey-based technique for eliciting preferences for non-marketed goods, such as environmental amenities, in a form which allows one to estimate how survey respondents trade-off private consumption for a non-marketed good in monetary terms. It is the most commonly used approach to placing a non-

etary value on non-marketed environmental resources.<sup>1</sup> Recent applications have valued improving water quality, restoring wetlands, preventing oil spills, preserving natural areas, and reducing health risks. In developing countries, contingent valuation has been principally used to value the provision of basic public services such as

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<sup>1</sup> Mitchell and Carson (1989) provide a comprehensive overview of contingent valuation. Carson et al. (1995b) provide a bibliography which includes over 2000 CV papers and studies from over 40 countries.

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water delivery and waste removal. The success of contingent valuation is due to the technique's flexibility in constructing markets for non-marketed goods, and the fact that the elicitation of stated preferences is the only approach to valuing non-marketed goods which is not limited to inferring value from past actions.

Interestingly, there have been few instances where contingent valuation has been used to help determine the monetary benefits of providing environmental amenities of global proportion. There are three reasons why applications of contingent valuation have been limited in this area. First, various philosophical issues surrounding contingent valuation obscure its usefulness for this purpose. Second, empirically based CV criticisms may discourage a use this ambitious. Third, the practical implementation considerations of such an undertaking are formidable. This paper first takes up the two general issues and then considers the third issue in the specific context of assessing the monetary benefits of preserving a set of tropical rainforests.

## 2. The economic approach and contingent valuation

Among the basic tenets of benefit-cost analysis is the need to consider all relevant opportunity costs. Failure to survey opportunity costs for any scarce resource represents an abandonment of the principles which make an economic approach appealing. Some have argued against the application of benefit-cost analysis for exactly this reason—important aspects of the problem are simply ignored. Decisions are often made on the basis of incomplete benefit-cost estimates as if no other considerations exist. In these cases, critics justifiably argue that benefit-cost analysis is being used in lieu of good judgment and is simply an abdication of responsibility. The use of contingent valuation often represents a departure from this overly narrow approach.<sup>2</sup>

There is often a lack of information from which to infer the values of many environmental goods.

With market goods, one can rely on the information triad—*income, prices, and quantities demanded*. In the case of environmental goods, quantities are fixed (or changed only through collective action) and price information is non-existent. When applying economic principles to decisions involving collective goods, one needs the shadow price information for all affected individuals. The attraction of contingent valuation is that it facilitates the construction of a market (Carson, 1991) in which the researcher can observe an economic decision directly related to the good of interest. In principal, it is possible to construct CV survey markets so as to focus on determining the benefits to the public (in monetary terms) of undertaking a project such as the protection of a large set of specified tropical rainforests in different countries, or on determining the benefits to the public of an incremental change in a project such as increasing the size of a particular rainforest already slated for protection. These benefit estimates can then be compared to their cost counterparts.

Traditional benefit-cost analyses rely almost exclusively on individuals' observed past behavior in markets. In many cases of global environmental problems, this approach may be wholly inadequate because of the acquisition of new information and the lack of markets where preferences for dealing with these problems can be observed. Individuals who are now aware that a particular past action was environmentally detrimental may behave in a very different manner than recorded in past actions. Of equal importance is researchers' inability to estimate how new information would affect subsequent decisions. Another shortcoming to the traditional approach is the difficulty in establishing linkages between market goods and environmental goods, an issue that has long been noted in the environmental economics

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to the provision of environmental goods. However, contingent valuation should be seen as something more primitive, the non-marketed analogue to measuring the price and income elasticities of demand for a private good under a particular set of circumstances. For instance, other preference-based decision rules such as in Baumol's (1986) 'superfairness' can use the results of CV studies. What is clear is that without contingent valuation, a comprehensive benefit-cost analysis involving non-marketed goods with substantial passive/nonuse values is impossible.

<sup>2</sup> Many of the critiques of the use of contingent valuation (e.g., Blamey and Common, 1992) can be seen as more general critiques of the benefit-cost paradigm and its use with respect

literature (Freeman, 1993).<sup>3</sup> Even in cases where linkages are identifiable, some of the value, frequently termed passive use values (e.g. non-use value, existence value, stewardship value, bequest value), may not be measurable unless a direct market for provision of the environmental good is created.<sup>4</sup>

Contingent valuation represents a departure from traditional applied benefit-cost analysis in that individuals are faced with a current choice based on a current set of information provided in the survey.<sup>5</sup> There are two key aspects to this divergence, one having to do with the choice offered and one with the information conveyed. As contingent valuation does not require a linkage with an existing market, respondents can be faced with an economic choice directly related to the provision of the environmental good of interest. This property of contingent valuation makes it the only economically consistent approach available for making holistic judgments about the benefits of providing environmental amenities with substantial passive use values.<sup>6</sup>

The designer of a CV survey has a substantial degree of control over the information provided to survey respondents. There are, of course, limitations to the amounts and types of information which can be meaningfully conveyed in a survey. Some of these limitations simply follow from the amount of time available in the survey, others follow from the inability of some respondents to quickly process complex information, and still others relate to the prior information possessed by

respondents. A CV survey provides one means by which a respondent can obtain information about a good, and the choice offered in the survey provides an incentive to process that information.<sup>7</sup>

During the past several years, contingent valuation has been at the center of an acrimonious debate over the propriety of using economic values as input into the environmental decision-making process. Some critics have argued that preferences for environmental goods are somehow fundamentally different from preferences for market goods. This theoretically based argument contends that some of the self-reported motives of CV respondents for holding values for environmental goods are illegitimate from an economic perspective.<sup>8</sup> These motives include things such as preservation of ecosystems for their own sake, for their children, for others in the current generation, and for the sake of future generations. These motives may be particularly important for global environmental amenities with long time horizons. The criticism here centers around a belief that economics is relevant only in cases of narrowly defined self-interested motivations. This widespread belief leads to the conclusion that many motives behind preferences for environmental goods represent a break with traditional economics.

Considering the uneasiness with which some economists look at altruism, Samuelson (1993) in an *American Economic Review* paper remarks:

<sup>7</sup> It is not the case that in a contingent valuation survey respondents can or should possess a perfect information set (if such a set could even be defined). Consumers in private goods markets routinely make decisions on incomplete information and, in spite of some statements to the contrary, nothing in neoclassical economic theory requires consumers to be perfectly informed, only that they make rational decisions based on the information set they possess. Over the last three decades work in microeconomic theory has focused on the process of acquiring information and the influence information has on choices. This brings us to the link between contingent valuation creating the missing market for the amenity of interest and information about that amenity. Markets where choices concerning particular goods can be made provide much of the impetus for individuals to obtain information about those goods. As long as the market for the environmental amenity remains missing, most individuals have little incentive to obtain detailed information about it.

<sup>8</sup> For an example of this debate see the exchange between Rosenthal and Nelson (1992) and Kopp (1992).

<sup>3</sup> These difficulties should not discourage such efforts as discovering and estimating the magnitude of such linkages as critical to the formulation of sound policy (Mäler et al., 1994) where contingent valuation and household production approaches can serve as useful complements to each other.

<sup>4</sup> See Carson et al. (1996b) for a detailed discussion of issues related to passive use.

<sup>5</sup> Note that this perspective is not a departure from what a researcher ideally would like to have in a benefit-cost analysis, but a departure from the data typically used in a benefit-cost assessment.

<sup>6</sup> From a practical perspective much of the history of the field of environmental economics can be written in terms of its development of techniques to measure a larger and larger fraction of that portion of economic value which had previously been deemed unmeasurable or intangible (Hanemann, 1992).

When the governess of infants caught in a burning building re-enters it unobserved in a hopeless mission of rescue, casuists may argue: ‘She did it only to get the good feeling of doing it, because otherwise she wouldn’t have done it’. Such argumentation (in Wolfgang Pauli’s scathing phrase) is not even wrong. It is just boring, irrelevant, and in the technical sense of old-fashioned logical positivism ‘meaningless’. You do not understand the logic and history of consumer demand theory—Pareto, W.E. Johnson, Slutsky, Allen-Hicks, Hotelling, Samuelson, Houthakker,...—if you think that is its content.

The axiomatic development of economic utility theory does not a priori exclude any motive or any good from an agent’s utility function.<sup>9</sup> Thus, it is perfectly acceptable for the basic economic model to include goods such as environmental quality for current or future generations. Economic theory only requires that preferences be consistent with a few basic axioms of choice.<sup>10</sup>

<sup>9</sup> Part of the confusion over appropriateness of altruism as an economic motive is likely to be due to the often arcane nature of the debate on altruism within economics. What is often missed is that the debate is not over whether economic decision makers sometimes exhibit altruism or that the basic neoclassical model can accommodate altruism. The debate is over how important this phenomena generally is, whether it is important enough to justify adding additional structure to the basic model to accommodate it, and if structure is to be added, what it should look like. See, for instance, the work of Margolis (1982) and McConnell (1997).

<sup>10</sup> The basic ones are comparability and transitivity. Even these axioms can generally be relaxed to allow phenomena like ‘thick’ indifference curves and some types of violations of transitivity without doing substantial harm to the basic theoretical framework (Bandyopadhyay and Sengupta, 1991; Mas-Colell, 1974). Other axioms are frequently assumed by economists to help ensure the existence of well-behaved utility functions. These too can generally be relaxed although this flexibility is usually purchased at the expense of considerable mathematical complexity. There has been a substantial amount of theoretical and applied work over the last several decades which deals with corner solutions, non-linear constraints, and discontinuities in demand and supply (Pudney, 1989). It can also be shown that most of the basic results of expected utility theory are robust under more general specifications (Machina, 1995).

From a theoretical perspective, there is simply a good, an environmental amenity, which individuals may care about and for which certain costs (explicit and implicit) are involved in maintaining, improving, or destroying it.

Due to the likely cost associated with conducting a major CV study of tropical rainforests, it is prudent to consider the empirically based critique (e.g. Diamond and Hausman, 1994) against the use of contingent valuation. This critique argues that contingent valuation does not measure the quantities it purportedly wants to measure.<sup>11</sup> The three major points usually raised by critics are that: (1) CV estimates are overly sensitive to the order in which goods are valued; (2) CV estimates are insensitive to the scope of the good being valued; and (3) that CV overestimates ‘true’ economic value. The term embedding (Kahneman and Knetsch, 1992) has often been used to refer to the first two phenomena. These two phenomena, however, are quite distinct from an economic perspective (Carson and Mitchell, 1995).

Economic theory predicts that estimates of value should be sensitive to the order in a sequence in which a good is provided due to income and substitution effects (Hoehn and Randall, 1989; Carson et al., 1995a). While it has sometimes been argued that these effects should be small and inconsequential (Kahneman and Knetsch, 1992), carefully working through the underlying theoretical framework shows this is not the case (Flores, 1995; Hanemann, 1995; Randall and Hoehn, 1996; Flores and Carson, 1997). The reason is that willingness to pay is directly related to a quantity constrained inverse demand function, a context where large sequence related effects are likely to be the norm. In contrast, economic intuition is typically based on observing quantity and price changes related to ordinary demand functions, a context where small sequence

<sup>11</sup> Much of this debate has gone on in the context of the use of contingent valuation for natural resource damage assessment for cases such as the Exxon Valdez oil spill (Carson et al., 1992). See, for instance, the 1993 symposium articles in choices by Carson et al., 1993; Desvousges et al., 1993, and Randall, 1993 in the 1994 *Journal of Economic Perspectives* symposium articles by Portney, 1994; Diamond and Hausman, 1994 and Hanemann, 1994.

related effects are typically the norm.<sup>12</sup> The possibility of large, theoretically consistent, sequence order effects in willingness to pay (WTP) estimates does suggest, however, that obtaining the value of a set of goods by adding together the independently derived values from the members of the set can grossly over-estimate the value of providing the set of goods (Hoehn and Randall, 1989). This issue obviously has serious implications for any non-market valuation study, not just contingent valuation studies, since public goods are simply a special case of rationed goods.

The second embedding phenomena has to do with the notion of one good being nested within or encompassed by another good. Here under fairly reasonable assumptions, economic theory suggests that the good which is larger in scope should be more highly valued (Carson and Mitchell, 1995). The evidence on whether CV estimates systematically vary with the scope of the good being valued has been recently reviewed in Carson (1997). That review shows that direct tests of the hypothesis based on split sample comparisons overwhelmingly reject the null hypothesis that valuation estimates do not vary in the expected manner.<sup>13</sup> While this finding clearly rejects the critics' contention that scope insensitivity is a generic, largely unavoidable problem, there are studies which have found that WTP estimates do not vary with the scope being valued. The problems in these instances are likely to be the result of the use of particular survey design features and methods of survey administration. Carson and Mitchell (1995), for instance, discuss several CV

survey design problems which are likely to mimic an apparent insensitivity to the scope of the good being valued. These problems include failure of the survey designer to clearly communicate the characteristics of the goods involved and failure to keep constant the perceived probability that the good can actually be provided as the scope of the good increases. Cases of scope insensitivity also seem to be concentrated among telephone surveys and some forms of self-administered questionnaires, such as mall-intercept surveys, where respondents are less likely to pay attention to the details of the good they are being offered, and in situations involving changes in low probability risks, where difficulties with consumer understanding both in surveys and in private markets raises important issues.

With respect to the over-estimation issue, Carson et al. (1996a) conducted a large meta-analysis looking at 616 comparisons of contingent valuation to revealed preference (RP) estimates from 83 separate studies conducted over a 30-year period. Those results suggest two things; first, that the CV estimates on average are somewhat smaller (mean CV/RP ratios ranged from 0.77 to 0.92 depending on the treatment of the data), and second, that the correlation between the two types of estimates is in the 0.7–0.9 range. Clearly, there are some instances where large divergences between estimates based on actual behavior and CV surveys occur. These are concentrated in situations using voluntary payment mechanisms where there can often be an incentive to free-ride with respect to actual behavior and to over-pledge in the CV survey.

From an empirical standpoint, contingent valuation seems to face two ongoing problems. First, CV surveys often appear to be cheap and easy to do. As a consequence, there has been a proliferation of poor quality studies. Second, economists have a long history of being skeptical of data collected by surveys, even though most data used in empirical economics, at some level, are derived from survey responses. As a result, they are willing to view aberrant results from a particular CV survey as an indication that CV surveys in general do not work, rather than as a problem in the implementation or analysis of that particular CV

<sup>12</sup> Flores (1995) and Randall and Hoehn (1996) have looked at different previously estimated empirical demand systems appearing in the literature and shown that the estimated parameters of these models suggest large sequence order effects once quantity constraints are imposed even though the reported income and substitution elasticities of these systems are generally small.

<sup>13</sup> There are over 30 different studies providing a clear rejection of the hypothesis and only four which uniformly accept the scope insensitivity hypothesis. A majority of these studies value goods thought to be dominated by passive use considerations. The Carson (forthcoming) review also discusses a large body of indirect evidence which suggests rejection of the scope insensitivity hypothesis.

survey. Perhaps the NOAA CV Panel report (Arrow et al., 1993) conclusion that CV surveys can be informative from a decision-making perspective, but are difficult to reliably implement, helps address these concerns.

There is another more fundamental argument against the use of contingent valuation. This philosophical argument rejects consumer sovereignty, and therefore, ‘value’ in an economic sense as an acceptable basis for making government decisions.<sup>14</sup> The reasoning underlying this critique is simple and its logic at some level unassailable: the public may have preferences which are inconsistent with the future viability of human life on the planet and these preferences may remain unchanged even in the face of complete information. This poses a basic dilemma for a government policy-maker whose job in a democracy represents the conflict of doing what is best for the people and following their will. At this point there seems to be little evidence that the public’s preferences are inconsistent with sustainable development. More important is the lack of evidence that their preferences are unchanging in the face of information about environmentally detrimental actions.<sup>15</sup>

The legitimacy of a role for public preferences in democratic public policy-making seems difficult to deny. Uncovering ‘preference’ and ‘value’ information is the first, necessary step in this process. On this point, a quote from Starrett’s

Foundations of Public Economics (Starrett, 1988; p. 293) seems appropriate:

It is important to reject the view that since welfare measurement is still quite imprecise, we may as well leave public decision making to the politicians. To do so invites mistakes that are costly on a scale that dwarfs any possible measurement error.

It is ironic that submissions on behalf of industry to the US rule-making process on natural resource damage assessment guidelines have advocated a similar point of view—leave the outcome to experts and politicians. With political processes so highly influenced by special interest groups, one must ask the question—who picks the experts? Should the experts be chosen by Greenpeace or the American Petroleum Institute? Oddly, it appears interest groups on both sides may fear the generation of information about public preferences. Industry fears public values for preserving the environment may be high, which may impose additional costs and reduce profits; environmental groups fear the public’s preservation values may be too low to support the policies their members favor.

Like any economic methodology, contingent valuation has its limitations and may be difficult to implement well. Further, it can never alone provide the definitive answer to any major policy question. A CV survey can, however, help overcome fundamental difficulties with traditional revealed preference techniques by: (1) providing individuals with more complete information; and (2) allowing them to make choices concerning the provision of the particular environmental amenity in a forward-looking manner. From these choices the CV analyst is then able to derive an informative set of bounds on the monetary value of providing the good. The challenge is in designing a choice scenario which is meaningful both to survey participants and decision makers utilizing the information. This challenge is complicated in situations involving global environmental problems, but is nonetheless a potentially tractable problem.

<sup>14</sup> An eloquent and reasoned statement of this position is Common and Perrings (1992). Portney (1992) raises the same fundamental issue concerning consumer sovereignty and expert information in his article ‘Trouble in Happyville’, when he asks the question, should government officials provide a drinking water filtration system for a substance that experts say is harmless but which the public still fears causes cancer even after hearing from experts?

<sup>15</sup> Public opinion polls show growing awareness and knowledge about a number of global environmental problems. An interesting observation from this data is that many people are prepared to sacrifice, particularly if their neighbors do, and accordingly expect their political leaders to adopt plans mandating such shared sacrifice (Dunlap and Scarce, 1991). Perhaps a greater difficulty than public acceptance of plans to deal with global environmental issues is that political leaders who are concerned with their short-term political survival face incentives to deny there is a problem or to contend that it is relatively costless to fix.

### 3. Contingent valuation: successful implementation

For contingent valuation to work, it is essential that three conditions hold: (1) the nonmarketed good must be well defined, (2) the scenario must provide a plausible means of provision, and (3) there must exist a plausible mechanism for making the trade-off between the consumption of private goods and the non-marketed good of interest. If a CV survey violates one or more of these conditions, the survey's results become difficult to interpret.

Similar conditions apply to marketed goods as well—it is difficult to obtain consumer surplus estimates for goods which are poorly defined in terms of their inherent characteristics or terms of trade. If I approach you with the opportunity to buy my car without revealing its make and model, without specifying the date in the future when the car would be available, without specifying whether there was a guarantee against mechanical failure, and without specifying either the time period or interest rate over which the car could be financed, it would be difficult to infer a very meaningful concept of your value for my car based on your response to my offer of a selling price. Poorly defined goods are difficult to value under any circumstances whether the goods are traded in private markets or not. The notion that the terms of trade and the characteristics of the goods being traded matter to individuals is fundamental to the development of economic theory.<sup>16</sup> Non-marketed goods, such as environmental amenities, are no exception to this maxim (Hanemann, 1995).

Using intuition from marketed goods, one can easily grasp the notion that goods differentiated by perceived characteristics, terms of provision, or terms of payment will have different values. However, intuition from market goods does not always carry over to environmental goods because freedom of choice is generally no longer an option. The provision of environmental goods is a collective venture and collective provision has important economic implications for what agents need

to consider. In particular, whether the payment obligation is coercive or voluntary can influence an agent's optimal strategic response. Where multiple collective goods are under consideration and the government has the ability, say through taxation, to ensure payment, the possibility of the provision (and payment for) other additional collective goods can influence an agent's optimal response. The general caveat is that the economic value for a particular good is not 'crystallized' or set in stone.<sup>17</sup> Instead, economic value depends upon the circumstances faced at the time the choice is made.

CV design practice has evolved in the direction of providing explicit details about the good. In addition, the method by which the environmental good will be provided is described in some detail. CV studies now typically involve the government's use of coercive payment vehicles in conjunction with incentive compatible question formats. In order to elicit meaningful responses from individuals, respondents must understand what good they are getting, accept that it can be provided, and realize that their choice may have later implications in the government's decision to provide and collect payment for the good. For instance, instead of asking individuals to state their maximum willingness to pay to prevent a particular type of oil spill, contemporary CV researchers usually present a specific program to accomplish the oil spill prevention and give respondents the opportunity to indicate whether they favor or oppose implementing the program at a specific cost to their households. The usual CV survey representation is that all households in

<sup>16</sup> For example, Debreu (1959) considers deliveries of the same good, but at different points in time as distinct goods.

<sup>17</sup> Some critics of CV, and particularly psychologists, appear to assume that economic theory dictates that people have a complete catalogue of monetary 'values' for all non-marketed goods in a mental file cabinet in their heads; as a result, they seem to maintain that the existence of behavior which appears consistent with this catalogue is a precondition if CV surveys are to be a reliable method of estimating value. Economic theory, however, does not dictate this for marketed goods, much less non-market goods. Economic measures of value are always defined implicitly by choices which involve tradeoffs. Much of the confusion undoubtedly comes from the fact that outside of economics, the term 'value' takes on a wide variety of different or loosely defined meanings.

the population of interest will be required to pay for the program if it is provided. The CV scenario explains both the burden on the respondent, as well as the burden on other households, a detail which often makes a difference to respondents.

In order to obtain information about the distribution of the sample's willingness to pay, different respondents within the sample are faced with different costs. When a given individual facing a cost of \$X favors the project, one can infer the individual's maximum willingness to pay lies in an interval bounded from below by \$X. Similarly, if another individual opposes the project at \$X, one can infer the individual's maximum willingness to pay lies in an interval bounded above by \$X. Because of the random assignment of costs, one can take the set of intervals implied by the choices observed and employ statistical techniques to infer information about the distribution of willingness to pay for the sample. Finally, with appropriate corrections for non-response, the sample information can be extrapolated to the population as a whole.

It is sometimes difficult, if not impossible, to implement the process described above. For example, one may not be able to convince respondents that payment coercion is possible. This can occur when the good is located in a distant region and respondents know that imposing a tax on them is virtually impossible. Another potential problem lies in being able to devise a realistic implementation program. Convincing most respondents that a particular problem can be corrected may be an insurmountable task for a CV survey designer.

Valuing the provision of a global environmental amenity involves the standard set of issues a CV survey designer typically faces, but often with some new twists which are worth discussing. This will be illustrated by considering how one might implement a CV survey which values the preservation of a set of tropical rainforests.

#### 4. Valuing tropical rainforests

An analyst simply asked to 'value' the tropical

rainforests faces an ill-defined, if not impossible task.<sup>18</sup> For the analyst, many questions should immediately arise. The first may be which tropical rainforests are to be valued by the CV survey? In an ideal world, it would be possible to estimate a marginal valuation function in terms of the attributes of interests such as the number of hectares protected and the particular types of ecosystems involved. While in principle obtaining such a marginal willingness to pay response surface is possible, reality is starkly different. The cost of conducting a state-of-the-art CV study in conjunction with limitations on how much information on preferences can be reliably collected from each respondent severely limits the nature of the valuation function which can be estimated. Coupling this with the possibility noted earlier of strong sequence order effects suggests that the CV valuation effort should be focused on at most a small number of feasible options.

Other questions which are likely to arise include: What is going to happen to this set of tropical rainforests in the absence of the proposed preservation plan? What are the temporal dimensions of the problem, e.g. is the set of tropical rainforests going to be preserved for 10 years, 20 years, or forever? What service flows will the protected tropical rainforests provide? Then there are questions concerning who will be asked to pay to protect the rainforests. What payment mechanism will be used and over what time period? How will the rainforests involved actually be protected? Who will receive compensation for protecting the rainforest? How are the protection costs to be distributed across the public? Finally, questions about other possible public programs will arise. Are other similar programs under consideration which may be simultaneously provided? How might the provision of these other programs affect the values of protecting the set of tropical rainforests offered to respondents in the CV survey? These questions are

<sup>18</sup> It is largely beyond the scope of this paper to discuss the causes of tropical deforestation or the need to value them in monetary terms. See Barbier et al. (1991), Brown and Pearce (1994), Deacon (1994), and Panayotou (1992), for insightful discussions.

important because CV responses should not be seen as context independent.

Most of these questions must be jointly addressed by policy-makers and the analyst.

Good communication at all stages is a must, but it is particularly crucial in the early stages of development if one wishes to extract information which will be useful in making the decision at hand. Without guidance from the policy-makers who will use the information, the analyst is not in a position to proceed irrespective of the time and money available for conducting the study. The questions the analyst must ask fall roughly into three main categories: (1) commodity definition, (2) the extent of the market, and (3) the payment and provision mechanisms. Once the essential questions are answered, the analyst will have to determine if the time and money available for the study is sufficient to provide decision makers with the desired information.

Before proceeding, it will first be useful to illustrate the problem facing the researcher who wants to conduct a CV study valuing tropical rainforests. Assume for a moment that the researcher asks a sample of respondents the simple question: ‘how much would you be willing to pay to save tropical rainforests?’ The problem can be summed up by noting that the researcher would likely get answers to this question from most respondents. Unfortunately, it is not clear to what economic question these answers apply, if any. Different respondents are likely to consider different sets of tropical rainforests. Further, because of the vague nature of the question, many respondents will perceive that there is no link between their answer and the amount that they would have to pay if a tropical rainforest protection plan is actually implemented. To overcome the tendency of most survey respondents to try to answer questions put to them without complaint, the CV survey designer must clearly convey the important aspects of the good being valued, and the institutional aspects surrounding the choice offered. To be effective, the choice offered must be seen as a real one.

## 5. Commodity definition

It is impossible to protect tropical rainforests in the abstract. The first issue to be addressed when designing a CV survey is providing respondents with a fairly precise description of the non-marketed good and a provision context in which the choice offered is meaningful to respondents.<sup>19</sup> The survey designer’s job is much like that of a newspaper reporter, conveying information in a manner that survey respondents will understand and find meaningful. Newspaper reporters, like survey designers, are taught to ask six questions (MacDougall, 1972): ‘who, what, when, where, why, and how’.

The ‘what’ question will entail explaining to respondents what a tropical rainforest ‘is’ and what a tropical rainforest ‘does’. Here the survey designer faces a number of distinct issues. The first will be the wide divergence in the prior knowledge that respondents hold about tropical rainforests; namely, some respondents will be quite knowledgeable while others will be ignorant of the good. Perhaps the survey designer’s most difficult task is ensuring that almost all respondents share a common basic understanding of tropical rainforests. While it is unnecessary (and probably impossible) to make respondents into rainforest experts, it is important that all respondents be given the information needed to make an informed choice.

Many respondents will be interested in the services provided by tropical rainforests. Here it will be necessary to describe the general types of habitat provided by these tropical rainforests as well as more specific descriptions of plants and animals. A decision will need to be made on how much, if any, of this description material to convey visually in the form of drawings, pictures or

<sup>19</sup> Respondents will tend to fill in whatever details are missing in the CV survey with default assumptions. These may differ considerably from what the researcher perceives unless substantial development work is undertaken to explore these default assumptions. Such development work is important because it is impossible and undesirable, due to problems of informational overload, to specify all possible minute details. See Fischhoff and Furby (1988) and Mitchell and Carson (1989) for discussions of this issue.

video tape. The term biodiversity, if introduced, will need to have its meaning conveyed to respondents in a very simple way. Similarly, the ecological significance of the tropical rainforests being considered for preservation vis-à-vis other tropical rainforests, will need to be conveyed in understandable terms. A decision must be made whether to introduce the subject of endangered species and, if so, how?

Other services, such as the role of tropical rainforests in mitigating global warming by sequestering carbon, could be explained to respondents.<sup>20</sup> Some respondents will want to know whether the rainforest, if preserved, will be available for ecotourism. The continued availability of the rainforests for medical and other scientific research will undoubtedly be considered by other respondents. Other questions which may need to be addressed under any forest preservation plan is the treatment of the indigenous people inhabiting the forests, the impact on those who are now employed in activities which lead to rainforest destruction, and the future commercial availability of tropical hardwoods, such as mahogany and teak.

The ‘where’ question will mean conveying the geographic locations of the rainforests to be preserved. Some of the rainforests of interest may be in countries familiar to the respondent, while others may be in countries the respondent has never heard of.<sup>21</sup> Some rainforests may cover a small area and others a large; some may be close to respondents’ homes, while others are on the other side of the globe. These factors all suggest that in order to effectively communicate the good to respondents, visual aids such as maps will be needed to convey the geographic locations of the rainforests to be preserved and their relative sizes.

<sup>20</sup> The decision on whether to include carbon sequestering as a benefit of tropical rainforest preservation may be a complex one which is influenced by whether a world market exists for trading carbon emissions and the prior knowledge which potential respondents hold on this issue.

<sup>21</sup> It may be useful to compare the situation facing the CV designer here with that of asking users of the large rainforest comprising Thailand’s Khao Yai National Park (Dixon and Sherman, 1990) or Costa Rica’s Monteverde Cloud Forest Preserve (Echeverría et al., 1995) about their willingness to pay for those forests.

The ‘when’ question actually encompasses two questions. When will the program start and how long will the rainforest be protected? Both of these factors are straightforward to convey, but are often overlooked in CV surveys. It may make a difference to respondents if tropical rainforests are being protected for 50 years or in perpetuity. In addition, the credibility of the ‘when’ information will depend crucially on the ‘how’ information discussed below.

One final point on defining the commodity to be offered—one should always clearly define the status quo; namely, what will happen in the absence of the plan’s adoption? With respect to tropical rainforests, this relates to both the set of tropical rainforests being considered for protection, as well as the fate of other tropical rainforests.

### 5.1. *Extent of the market*

In the context of a CV survey, the question of ‘who’ means who will be asked to pay for the non-marketed good of interest? There are a number of interesting candidates which could be considered. First, the CV study could be done in a single country.<sup>22</sup> This makes the most sense if that country is being matched with one or a small number of tropical rainforests. Second, if preserving tropical rainforests is truly a global issue, then another possibility is to consider the citizens of all countries. Third, since preserving tropical rainforests is often framed as a developed versus developing countries issue, conducting a survey exclusively in the developed countries might be an interesting choice.<sup>23</sup>

<sup>22</sup> It would be possible to value a very large set of tropical rainforests by matching specific rainforests in selling countries to specific purchasing countries. Respondents in one country could be told that similar surveys were being done in other countries and residents of those countries were being offered an opportunity to preserve other specified rainforests. This would raise the interesting issue of expectation of respondents in one country about the actions of respondents in another country to preserve another rainforest.

<sup>23</sup> This, of course, raises the issue of what is a developed country and, in particular, where does a rapidly industrializing country like South Korea fit in.

Under any of these definitions of the extent of the market, an additional issue must be faced. A major attraction of sample surveys is that a huge, even infinite population can be represented quite precisely by a survey of one or two thousand respondents. Each country as a sovereign state, however, will undoubtedly want to know how its citizens valued the preservation plan. As a result, it may be necessary to survey a sizeable number of respondents in a sizeable number of countries to develop country-specific estimates.

### 5.2. *Payment and provision mechanisms*

The ‘how’ question requires conveying enough details about the tropical rainforest protection program that respondents find implementation of the program plausible, and one which could actually protect the specified tropical rainforests. If a CV survey design has done an adequate job of conveying what good the respondent is being offered, the major questions on a respondent’s mind should be how much will the good cost, how it will be paid for, and how it will be provided.

‘How much’ can be answered in a direct fashion by the use of a binary, discrete choice question. The respondent is simply told that the cost of the preservation plan to their household is a specific monetary amount. The respondent then chooses whether paying and preserving the set of tropical rainforests is preferable to the status quo.

The second part of the ‘how’ question, ‘how will it be paid for’, is known as the payment vehicle issue. Payment vehicles serve a variety of functions. The primary function is providing a plausible means to ensure payment if a decision to undertake the preservation plan is made. A payment vehicle should ideally have the ability to coerce payment from households if the good is provided.<sup>24</sup> This property of a payment vehicle is

needed to ensure that respondents take the CV survey seriously and do not have an incentive to over-estimate their willingness to pay for the preservation plan. It is also desirable for the payment vehicle chosen to be perceived as a reasonably fair and equitable way of collecting the money necessary to purchase preservation rights for the set of rainforests described in the CV survey. Payment vehicles not meeting this criteria will tend to reduce respondent willingness to pay for the preservation plan. Finally, payment vehicles should be as plausible and understandable as possible. While it might be nice from a theoretical perspective to have a payment vehicle like the imposition of a global flat tax per household, this is unlikely to be a plausible payment vehicle to many respondents. It will probably be necessary to use different payment vehicles in different countries to accommodate for cultural differences in the manner for which public goods are typically paid.

‘How will the good be provided,’ is likely to be even more difficult to answer than the payment vehicle. Many respondents will be skeptical that the set of rainforests described can be preserved, and simply telling respondents that the set of tropical rainforests will be preserved is not the solution. A concrete plan for preserving the set of tropical rainforests will have to be described with a fair amount of detail. This plan will probably require that respondents are assured that losses of the tropical rainforests they are being given an opportunity to preserve could be detected and that the country containing the rainforest would be severely punished in the event of losses. Even with a plausible enforcement mechanism there will be respondents who believe that even if they pay for the preservation plan, the tropical rainforests will still disappear as a result of corrupt politicians or simply the inability of some developing countries to enforce tropical rainforest preservation policies.

<sup>24</sup> In one of the few CV studies to look at tropical rainforests using a group of non-users, Epp and Gripp (1993) asked a sample of residents of the state of Pennsylvania how much they would be willing to voluntarily contribute to a non-governmental organization to help preserve tropical rainforests. While questions of this sort can help to provide some information on public preferences toward tropical rainforests,

it may not be indicative of the amount which could be collected with a payment vehicle where the government had both the ability to compel payment for a specific set of tropical rainforests and to guarantee that preservation would occur if the payment were extracted.

The answer to the ‘why’ question is the glue that holds the CV scenario together and which makes it plausible to respondents as to why they are being asked about this program now. Another important aspect of the why question is to make the respondent comfortable giving either a ‘yes’ or a ‘no’ response to the trade-off choice question posed to them and the realization that their response may influence the eventual outcome.

### 5.3. *Two design details and a practical issue*

With respect to valuing a set of tropical rainforests, there are two CV design details that transcend contingent valuation and are perhaps the most interesting policy questions. The first is how to put together the set of tropical rainforests for which respondents will be given a preservation choice. The second is how to make a survey comparable across different countries which have different languages, cultures, and political institutions. An interesting practical issue is whether there would be any way to implement such an action even if the population surveyed were willing to pay more for preservation of the rainforest than the costs. This practical issue may influence the ability and advisability of conducting a CV survey along the lines suggested here. Each of these issues will be taken up in turn.

CV researchers typically value a policy to provide an environmental good determined by policy-makers which is largely outside the purview of the CV survey designer. Putting together the package of rainforests for which preservation will be valued requires that a prioritization of rainforests to be preserved be made. This exercise, a form of agenda setting, should be as inclusive as possible. Researchers from a wide range of disciplines should be consulted and various rainforests should be evaluated from a multi-dimensional perspective. Obtaining reliable estimates will depend upon CV researchers’ ability to translate the survey into the various languages and ensure the economic choice offered in the scenario is equally plausible across different institutional-cultural settings. This is a

formidable task and one which few CV researchers have faced.<sup>25</sup> There are, however, other instances of survey administration that may serve as reference points. The best known examples are the Eurobarometer survey (Reif and Inglehart, 1991) and the Dunlap et al. (1993) survey on environmental attitudes in 24 countries. There have also been efforts by the OECD and others at coordinating public opinion surveys across countries. Designing a multi-country CV study will require careful attention to the development of protocols and extensive pretesting to ensure that the CV results obtained from different countries are as compatible as possible.

Suppose that the results of a multi-country CV survey showed that the aggregate willingness to pay to preserve the specific set of tropical rainforests is substantially larger than the cost of preserving those rainforests. How would one actually go about implementing such a plan? At the simplest level, some sort of agreement on how to allocate the costs of the tropical rainforest preservation plan will be required between the countries agreeing to fund the plan. Moreover, negotiations with the rainforest host countries is a distinct and complex issue.

The valuation of a set of tropical rainforests was chosen to illustrate the issues involved in designing and conducting a CV study which values an environmental good of global significance. In many ways, valuing a set of tropical rainforests is likely to be an easier task for a CV survey designer than global warming because it is possible to make the good concrete through the use of photographs and maps. The service flows from tropical rainforests are generally easier to describe, less subject to uncertainty, and closer in time relative to global warming solutions. Further, the plan and its payment could be portrayed as a one-time action rather than a long series of actions over time. This is not to

<sup>25</sup> There has been work across a number of developing countries valuing reasonably similar water and sanitation systems commissioned by international lenders such as the World Bank Water Demand Research Team (1993) where some of the knowledge gained in designing such CV studies is transferable across countries.

say that contingent valuation could not be used to value a program to prevent global warming, but rather that valuing a program to prevent global warming is likely to be more difficult than valuing a set of tropical rainforests.<sup>26</sup>

## 6. Concluding remarks

The major issues that must be addressed before implementing a CV study which values an environmental good of global significance have been outlined. In a CV study of any environmental good, respondents must be confronted with a scenario that provides: (1) a well-defined good; (2) a plausible means of provision; and (3) a plausible mechanism for making the trade-off between consumption of private goods and the environmental good. For global environmental goods, satisfying these requirements is more challenging, but not insurmountable. In considering the valuation of goods of global proportion, one should not forget the maxim that poorly defined goods result in poorly defined values, for marketed or non-marketed goods.

Many of the more difficult CV issues stem from the multi-country aspect of global environmental goods. As the relevant population is potentially the world, the selection of the implementing program, the distribution of costs, implicit as well as explicit, and appropriate decision rules between countries become thorny issues that must be faced. However, these issues transcend contingent valuation and must be addressed regardless of whether a CV survey is conducted.

If economics is to be used to help make allocation decisions concerning global environmental goods, contingent valuation results can be a useful input. If the changes being considered are large, using valuation techniques which exclusively rely on observed, past behavior may be analogous to tracing out the values of ghosts. New information

and possible institutional changes are too important an issue to ignore. This may mean that individuals need to be confronted with the options currently open to society.

Finally, efficient (democratic and economic) collective action is directly linked to individual preferences. As a global society we should not fear learning about preferences via inferred economic values because these values are just another form of information which may be used in the decision-making process. It is possible that learning about preferences with respect to tropical rainforests will act as a catalyst for action in a way that other information has not.<sup>27</sup>

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<sup>26</sup> For global warming, a natural direction for a contingent valuation survey might be to describe a fairly small number of major changes in probabilistic terms and to offer the program as an insurance policy against the possibility of such changes.

<sup>27</sup> The present record of action on preservation of tropical rainforests is mixed. Substantial scientific research has broadened our knowledge of the ecological role played by tropical rainforests (Mabberley, 1992; Terborgh, 1992). There have also been a number of relatively isolated transactions, typically debt for nature-swaps, involving tropical rainforests. There are a few countries such as Costa Rica who actively court opportunities for tropical rainforest preservation and ecotourism and which also have reasonable control over the tropical rainforests within its borders. Much of the promise of Rio, however, goes unfilled.

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