

# DESIGNING AND IMPLEMENTING SURVEYS TO VALUE TROPICAL FORESTS

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**DESHAZO JR, CARSON RT, SCHWABE KA, VINCENT JR, ISMARIAH A, CHONG SK & CHANG YT. 2015. Designing and implementing surveys to value tropical forests.** This paper describes a household survey that was used to collect data for valuing protection and recreational use of tropical rainforests in Peninsular Malaysia. The survey was developed and implemented from 2007 till 2010 and was the largest environmental valuation survey ever conducted in Malaysia. It included modules related to both stated-preference valuation (discrete choice experiments; DCEs) and revealed-preference valuation methods (recreation demand models). The first part of this paper covers three issues: development of the survey instrument, design of the DCEs and structure of the instrument. The second part provides details on the survey itself (sample design, survey administration), presents preliminary results and suggests improvements to the survey.

Keywords: Stated preference, revealed preference, discrete choice experiment, contingent valuation, passive use, recreation, Belum–Temengor, logging, poaching, protected area

## INTRODUCTION

Methods for valuing environmental goods have advanced greatly during the past half century (Freeman et al. 2014). These methods are commonly classified into two groups. Revealed-preference (RP) methods infer values from people's real-world decisions. Inferring the value of recreational sites from the travel costs that households incur by visiting them is an example of this approach. Stated-preference (SP) methods infer values from people's decisions in an experimental setting: researchers describe hypothetical yet realistic changes in a good to survey participants and ask if the participants would support a programme that achieved those changes at a specified cost (Bateman et al. 2002). Applications of SP methods in the environmental case are usually referred to as contingent valuation (CV; Mitchell & Carson 1989, Carson 2012). CV is now often implemented using a discrete choice experiment (DCE) to value changes in multiple attributes of a programme

(Louviere et al. 2000). Throughout 2010, SP studies had been conducted in more than 130 countries and had generated more than 7500 papers (Carson 2012).

Researchers have applied both RP and SP methods to tropical forests (Ferraro et al. 2012, Kumar 2012, Lindhjem & Tuan 2012). A late-2013 search of forest-related keywords in the leading global database on valuation studies, the Environmental Valuation Reference Inventory (EVRI; <https://www.evri.ca/Global/Home.aspx>), returned 27 RP studies and 94 SP studies having been conducted in developing countries. The number has grown rapidly: of the 121 studies identified in the EVRI, 99 were conducted after 2000.

SP studies in developing countries have come under a general criticism, not specific to forestry applications, that many of them are 'so bad' that their findings are 'inaccurate and unreliable' (Whittington 2002). Three main

problems have been cited: the scenarios that describe the hypothetical environmental change ‘are often very poorly crafted’; few of the studies ‘are designed to test whether some of the key assumptions that the researcher made were the right ones, and whether the results are robust with respect to simple variations in research design and survey method’ and the ‘surveys themselves are often poorly administered and executed’ (Whittington 2002). RP studies in developing countries commonly rely on surveys too, so the latter issue probably applies to them as well.

In response to such criticism, a 2007–2012 research project in Malaysia included a component aimed at developing improved tools for valuing tropical rainforests and the biodiversity in them. This project, the Conservation of Biodiversity (CBioD) Project (<http://site.cbiod.org>), was funded by the Global Environment Facility (GEF) through the United Nations Development Programme (UNDP), with additional support from the Government of Malaysia. It included multiple valuation studies on forest-related goods and services. The valuation studies were conducted by a team of economists from the Forest Research Institute Malaysia (FRIM) and several US universities (the CBioD team).

Three of the CBioD valuation studies drew data from a common household survey. The topics of these studies were: (1) the value of protecting Belum–Temengor, a biodiversity-rich forest area in Perak, northern Peninsular Malaysia, against logging and poaching; (2) the value of recreational use of existing forest parks in Peninsular Malaysia and (3) the value of amenities and services at a hypothetical new forest park. The goal of the studies was to estimate household willingness to pay (WTP) for the indicated values and to investigate how WTP changed with economic development. The first and third studies were SP studies that used DCEs, while the second was an RP study that used a recreation demand model.

The survey targeted households in Malaysia’s legislative capital, Kuala Lumpur, and the neighbouring state of Selangor (collectively, the Selangor region). It was the largest valuation survey ever conducted in Malaysia. A prime reason for its size was the CBioD team’s desire

to obtain valid WTP estimates for not only the entire Selangor region but also the three strata within it: rural Selangor, urban Selangor and Kuala Lumpur (entirely urban). These strata-specific estimates would allow investigation of the effects of urbanisation, one of the major societal changes that occur with development. No prior forest valuation survey in a developing country had randomly sampled both rural and urban populations.

This article describes the design and implementation of the CBioD household survey. It is modelled after Mitchell (2002), which provided a similarly detailed account of methods employed in a well-known CV study on the 1989 Exxon Valdez oil spill in the United States. Mitchell justified the focus of his article on methodological aspects of a single study by arguing, “What may be lost because this case study differs in its circumstances from valuation situations that readers may face, should be more than balanced by the understanding the reader will gain about the process of designing a CV survey ....” An explication of the CBioD survey may serve a similarly useful purpose given the high level of interest in tropical forest valuation and DCEs, which is still relatively rare in tropical countries (Bennett & Birol 2010). Whittington (2002) partly attributes the lack of appreciation of challenges associated with valuation surveys in developing countries to a lack of methodological details included in published articles.

The first part of the article covers three issues: development of the survey instrument, design of the DCEs and structure of the instrument. The second part provides details on the survey itself (sample design and survey administration). Although the article emphasises methodological issues, it presents preliminary results before closing with some summary observations. The survey instrument and related materials are available in an online document (DeShazo et al. 2013), which is referenced at various points in the article.

## **DEVELOPING THE SURVEY INSTRUMENT**

The structure of a survey instrument for a valuation study is shaped by the objectives of the study. The instrument for the CBioD study

needed to include four modules: one for each of the valuation studies (modules 1–3) and one for information on respondents' socio-economic characteristics (module 4), which was needed to investigate the effects of development on the WTP estimates from the valuation studies. The content of these modules was determined through a three-year process that involved the steps described below.

### **Selecting the survey research firm**

An initial decision that affects all subsequent steps of a survey-based valuation study is whether the researchers will implement the survey entirely on their own or hire a survey research firm to assist. Hiring a survey firm creates a risk of coordination problems, but it reduces the administrative burden on the researchers, especially for large, in-person surveys. Moreover, a survey firm's knowledge of local conditions can improve survey quality. For these reasons, the CBioD team opted to hire a local survey firm.

The CBioD team selected the firm through a competitive process. The process began on 29 February 2008 with FRIM sending an invitation letter and terms of reference to 55 survey research firms registered with the Malaysian Ministry of Finance and it ended three months later with the selection of PE Research (DeShazo et al. 2013). Three criteria guided the selection process: knowledge and experience with survey administration and sampling, including valuation surveys; knowledge and training in economics, including environmental economics; and cost. Over the next two-plus years, the CBioD team relied on PE Research to organise and conduct focus groups and cognitive interviews, translate and pretest the survey instrument, liaise with the Malaysian Department of Statistics, select and train interviewers and administer the survey to the sampled households.

### **Reviewing prior studies and consulting experts**

Given the large number of survey-based forest valuation studies that have been conducted in both developing and developed countries, economists valuing tropical forests can to a certain extent model their instruments on ones

used in previous studies. They can also obtain guidance by consulting the experts responsible for those studies. Information from these sources can expedite instrument development, but preparation of a valid instrument requires use of focus groups, cognitive interviews, and pretests to identify and address potential sources of bias and ambiguity in the instrument (Mitchell 2002).

Design of the CBioD instrument was shaped by all these sources of information. The team loosely based the narrative structures in modules 1 (the value of protecting Belum–Temengor) and 3 (the value of amenities and services at a new forest park) on an instrument from a study conducted in Central America (DeShazo 2001a, b, c). An instrument used in a cross-country study on protection of endangered species in China, the Philippines, Thailand and Vietnam provided useful suggestions for attitudinal questions in modules 1 and 4 and the payment vehicle in module 1 (Glover 2008). The team also reviewed instruments used in other forest valuation studies in Malaysia (Kumari 1995, Willis et al. 1998, Othman et al. 2004, Leong et al. 2005, Pek et al. 2010). It modelled many of the socio-economic questions in module 4 on ones used in the national census and household surveys conducted by the Malaysian Department of Statistics.

The CBioD team also consulted a variety of experts while drafting the instrument. It relied on the leader of the US team for the forest ecology component of the CBioD Project (Matthew Potts, University of California, Berkeley) to formulate scenarios in module 1 that related species extinctions to logging and poaching. It received input on various methodological aspects of the survey during a four-day review of the CBioD project by an international panel in December 2008. One member of this panel was an economist with extensive experience applying DCEs to forest valuation issues (Jeff Bennett, Australian National University; see Rolfe et al. 2000, Bennett & Birol 2010).

### **Focus groups, cognitive interviews and translation**

The CBioD team developed and progressively refined a series of draft survey instruments over the course of five focus groups (October 2008–

March 2009) and 26 cognitive interviews (April–October 2009). Focus groups are moderated discussions with small groups of people that probe the participants' views on the good being valued and their reactions to different ways of presenting information on it and asking questions about it (Morgan 1997, Krueger & Casey 2000). Each focus group for the CBioD survey included four to nine adults from a wide spectrum of the public. These individuals varied in terms of age, education, work status, residential environment (rural, urban, suburban) and ethnicity (Malaysia has three major ethnic groups: Bumiputera, Chinese and Indians).

The focus groups were instrumental in helping the team identify and understand the participants' concerns about forest protection in Malaysia, terms used in the survey instrument that needed clarification and the usefulness of different types of graphics that supported the survey text. They were especially useful for module 1, which presented the greatest design challenge due to the quantity of information that needed to be conveyed. Respondents needed to understand Belum–Temengor's location and size, the biodiversity in it and the ecosystem services it provided, the effects of logging and poaching on its biodiversity and ecosystem services, how policies to protect it against logging and poaching would work and how a payment vehicle could be linked to these policies so that respondents' WTP could plausibly influence protection against these threats.

The cognitive interviews led to further improvements in the survey instrument by providing targeted, in-depth feedback on specific parts of it. Cognitive interviews involve individual members of the public working through a survey instrument one-on-one with members of a research team, explaining their thought processes, and identifying, discussing and clarifying issues as they arise (Conrad et al. 1999). One of the main purposes of the cognitive interviews for the CBioD survey was to ensure that respondents taking the survey in different languages had the same understanding of words and phrases used in the instrument. Prior to conducting the initial cognitive interviews, PE Research staff members translated the English language version of the draft instrument into Bahasa Malaysia, Mandarin and Tamil, with

reverse translation back into English by different staff members. This process of reverse translation identified many issues of word choice and phrasing and led to simpler, more direct versions of the survey instrument in all four languages.

### **Pretesting the instrument**

PE Research conducted three rounds of pretests of the draft instrument (November 2009–January 2010). With the assistance of the Department of Statistics, it randomly selected 80 pretest respondents. It solicited feedback from the respondents after the interviews and the CBioD team revised the survey instrument in response to this feedback.

### **DCE DESIGNS**

DCEs are well-suited for valuing alternative forestry policies (Holmes & Boyle 2003) but had been applied only once before to forest policy in Malaysia (Othman et al. 2004). The inclusion of DCEs in modules 1 (protecting Belum–Temengor) and 3 (amenities and services at a new forest park) made those modules more challenging to design than module 2 (recreational use of existing forest parks). DCEs always need to strike a balance between the amount of information gleaned from respondents and the cognitive burden on them, which can be challenging when valuing complicated ecosystems such as forests (Riera et al. 2012). We review the design of the DCEs in modules 1 and 3 below, highlighting how the CBioD team's decisions aimed to strike this balance.

#### **Module 1: valuing protection of Belum–Temengor against logging and poaching**

##### *Overall configuration of the DCEs*

Module 1 included four choice sets, each with three alternatives. This is one of the more typical DCE configurations (Louviere et al. 2000, Bateman et al. 2002). The alternatives were forest protection policies for Belum–Temengor, with one of the alternatives being the status quo (no protection). The alternatives were characterised by four attributes, and each

attribute had three levels: area logged (none, 150,000 ha, **300,000 ha**); area subject to poaching (none, 150,000 ha, **300,000 ha**); jobs created in Perak (2500, 5000, **7500**) and monthly cost to the household (RM0, 2, 6, 10). The status quo attribute levels are shown in bold. With each respondent receiving a block of four choice sets and each choice set containing three policy alternatives, each respondent saw a total of 12 alternatives. Figure 1 shows an example of one of the choice sets.

*Measuring protection in area terms*

The biodiversity in tropical forests and the ecosystem services provided by forests are bundled together with the supporting land. Some SP valuation studies have measured WTP for one element of this bundled good by valuing preservation of an individual species (Navrud & Mungatana 1994, Glover 2008), which is appropriate for valuing species-specific protection policies. Other studies have measured WTP to

protect a tropical forest of fixed size (Chase et al. 1998, Naidoo & Adamowicz 2005, Adams et al. 2008), which is useful if the policy question concerns the creation of a protected area of that particular size. In many cases, however, a WTP measure that is more comprehensive than the first kind and more flexible than the second kind is desirable to allow valuation of the benefits of protecting different-sized areas (Rolfe et al. 2000). The CBioD team designed the DCEs in module 1 to estimate the public’s WTP to protect varying areas of Belum–Temengor against two threats to biodiversity: logging and poaching, with protection affecting preservation of groups of species, not just a single one.

*Relationship between species extinctions and areas logged or subject to poaching*

The survey instrument needed to be explicit about the technical relationship between logging or poaching on the one hand and extinctions of corresponding groups of species on the



	Policy A	Policy B	No protection
<b>Logging</b>	150,000 ha	0 ha	300,000 ha
	Half these species go extinct	None of these species go extinct	All these species go extinct
<b>Poaching</b>	0 ha	150,000 ha	300,000 ha
	None of these species go extinct	Half these species go extinct	All these species go extinct
<b>Floods in Perak</b>	3 per year	1 per year	5 per year
<b>Jobs created in Perak</b>	5,000	7,500	7,500
<b>Cost to you</b>	RM6 per month	RM6 per month	No cost

Figure 1 Example of choice set in module 1; version shown to respondents was in colour

other. Otherwise, respondents would speculate about this relationship. The team drew on the scientific literature to identify representative groups of species in Belum–Temengor that were negatively affected by logging and poaching and to characterise the relationship between the relative numbers of extinctions and the areas subject to those threats. A substantial literature details the impacts of poaching on tropical biodiversity (Redford 1992, Robinson & Bennett 2000) and a growing but contested literature sheds light on the impact of logging on tropical biodiversity (Gibson et al. 2011, Ramage et al. 2013). Based on this literature, the team assumed that poaching affected mostly larger mammals, while logging affected mostly smaller organisms (Figure 1). It also assumed that the effects of logging and poaching did not interact significantly: although logging roads can increase poaching (Robinson & Bennett 2000), enforcement can be stronger in timber production forests than in strict reserves (Curran et al. 2004, Meijaard & Sheil 2007), and so these two effects might cancel.

The team also assumed that extinction risks were strictly proportional to the areas subject to logging and poaching: none of the species in a given risk group would go extinct if none of the forest was subject to that threat; half of the species would go extinct if half of the forest was subject to it and all of the species would go extinct if all of the forest was subject to it. Species loss scales with habitat loss, but the rate is debated (Perfecto & Vandermeer 2010). While the classical species–area relationship predicts a non-linear relationship between extinctions and habitat loss, the relationship has been updated to incorporate matrix and edge effects (Koh et al. 2010). Depending on species sensitivities to landscape fragmentation, logging may lead to a higher number of extinctions than predicted by the classical species–area relationship, which suggests that the relationship may be approximately linear.

#### *Relationship between floods and area logged*

For similar reasons, the CBioD team also assumed a linear relationship between the annual number of floods in Perak (not other parts of the country) and area logged in Belum–Temengor: there would be only one flood if none of the forest

were logged, three floods if half the forest were logged and five floods if all the forests were logged. The impact of logging on floods has long been controversial (Bruijnzeel 2004, FAO & CIFOR 2005), but recent work that accounts for the interrelated effects of logging on flood frequency and flood magnitude indicates that logging increases flooding (Alila et al. 2009). The knowledge base remains too narrow to determine with confidence the shape of the relationship between the number of floods and area logged, so the team assumed a simple linear shape.

The attribute for area logged thus represented the combined impacts of logging on extinctions and floods. As a result, the DCEs did not allow the team to distinguish the relative importance of species preservation and flood reduction on the value respondents placed on protection against logging. Given that the team's goal was to value the comprehensive benefits of logging protection, distinguishing these two components was not necessary.

#### *Relationship between protection costs and area logged*

Some participants in the focus groups and cognitive interviews voiced scepticism that policies which allowed less forest to be logged could have a lower protection cost than policies which allowed more logging. This perception is not a hard technical constraint, but it would likely hold in practice because a major cost of protection would be compensation paid by the federal government to the Perak state government for reduced revenue from logging. Failing to address this perception in the design of the choice sets would have undermined the realism of the alternatives presented to the respondents. The CBioD team incorporated this perception as a constraint in the DCE design. It used a nested design such that, across the alternatives within a given choice set, smaller areas logged were always associated with higher protection costs.

#### *Experimental design*

DCEs can generate a wealth of information on respondents' preferences (Louviere et al. 2000, Carson & Czajkowski 2014). This information includes both the main effects and interaction

effects of the attributes and their levels. A main effect refers to the effect that a change in the level of a single attribute, e.g. reducing area logged from 300,000 to 150,000 ha, has on respondents' choice decisions, averaged over the levels of all other attributes. An interaction effect indicates how the effect of a given change in a given attribute on respondents' decisions differs from the main effect when the change occurs at specific levels of other attributes. For example, is WTP to reduce area logged from 300,000 to 150,000 ha different when the area subject to poaching is 150,000 ha than when the area subject to poaching is 0 ha?

The design of DCEs determines which effects can be identified, the sample size required to identify them and the time required of respondents. Two extremes on the design spectrum are a full factorial design and an orthogonal main effects design (Louviere et al. 2000). If there are  $n$  attributes and each one has  $L$  levels, then there are  $L^n$  possible alternatives, and if there are  $m$  alternatives (excluding the status quo) in each choice set, then there are  $L^{mn}$  possible choice sets. In a full factorial design, each respondent is presented with all of these choice sets. This design has two attractive properties: it is balanced, which means that all attribute levels appear an equal number of times across the experiments, and orthogonal, which means that all pairs of attribute levels appear together an equal number of times. These properties result in unbiased estimation of both the main effects and interaction effects of all levels of all attributes, but they typically entail each respondent being presented with an infeasibly large number of choice sets ( $L^{mn}$  in the example here). Focus groups and cognitive interviews indicated that no more than four choice sets were feasible within the intended interview duration for module 1.

A more common and parsimonious approach that is cognitively less demanding of survey respondents is to employ an orthogonal main effects (OME) design. This design is straightforward to implement, but it has the drawback that the interaction terms are not generally identified. Riera et al. (2012) observe that forestry applications of DCEs often ignore interaction effects. They cite evidence that these effects can have a significant impact on respondents' choices and thus are important to include.

The CBioD team used a more sophisticated design: a balanced incomplete block design with foldovers. A balanced incomplete block design is characterised by three conditions: (1) each treatment (a pair of policy alternatives) occurs at most once in any given block (the group of choice sets seen by a respondent; four in module 1), which prevents a respondent from seeing the same policy choice twice; (2) each treatment occurs in a specified number of blocks and (3) each pair of treatments occurs together in the same block a specified number of times across the set of blocks (Louviere et al. 2000). The latter two conditions ensure desirable properties related to identification of the effects. Given that each alternative had four attributes and each attribute had three levels, and that logging and protection cost were nested, the natural combinatoric was  $27 (= 3^3)$ . So, the team's balanced incomplete block design had 27 blocks, each containing four policy pairs.

A foldover design rotates each attribute level by level. With three levels, it is possible to do this in both directions from the original 27 program pairs. For example, an area logged of 150,000 ha can be increased to 300,000 ha or decreased to 0 ha. This rotation created 81 blocks of four policy pairs (DeShazo et al. 2013). The team added the status quo alternative to each block and shuffled the order of the blocks by randomly renumbering them. It assigned the first household in the sample to the first block, the second household to the second block and so on until the 82<sup>nd</sup> household was reached. At this point, the process was repeated until the end of the sample (the 2100<sup>th</sup> household) was reached.

### **Module 3: designing a new forest recreational park**

The CBioD team's use of DCEs in module 3 differed from most prior applications of SP methods to forest-based recreation in developing countries, which had employed CV to value access to an existing site or creation of a new site with a fixed set of characteristics (Mercer et al. 1995, Chase et al. 1998). DCEs have been applied to forest-based recreation previously (Christie et al. 2007), but the few applications in developing countries have mainly valued changes in attributes of existing sites (Naidoo & Adamowicz 2005). The DCEs in module 3 were

instead intended to generate information that could be used to determine the optimal mix of natural features and on-site services at a new site, as in DeShazo and Fermo (2002).

The module included two choice sets, each with two alternatives. The alternatives were plans for a new forest recreational park, and they were characterised by nine attributes: drinking water and toilets (no, yes); walking trails (dirt/gravel, paved); picnic tables and grills (no, yes); level of crowdedness (crowded, few people); litter (noticeable, not noticeable); likelihood of seeing wildlife or birds (rarely seen, frequently seen); access to a stream or small waterfall (not accessible, easily accessible); visitor information (no, yes) and entrance fee (RM2, 5, 10, 15). Figure 2 shows an example of one of the choice sets. Aside from the entrance fee, which had four levels and applied only to adult visitors (children would be admitted for free), all the attributes were binary. Several other park features were common to all plans: the park would be located within a 2-hour drive, so the respondent could visit it and return home within a single day; a small river would flow through it; and safe and secure parking would be available with admission. The status quo alternative was a ‘choose neither’ option, whereby neither of the two offered forest parks would be developed and the respondents’ forest-based recreation options would remain limited to existing sites.

The experimental design for module 3 started out as an OME design with all of the attributes having four levels. These were then collapsed and rotated in different directions for the eight binary attributes in such a way that most

(24 out of 28) of the two-way interactions between these eight attributes were identified. A block was defined as the pair of choice sets presented to a given respondent, with each choice set containing a pair of policy alternatives. The number of blocks was expanded to 80 to be roughly the same as the 81 blocks in module 1 (DeShazo et al. 2013). The blocks were randomly assigned to households in the same way as for module 1. Since module 3 had only 80 blocks whereas module 1 had 81, an 81<sup>st</sup> block was created by randomly choosing from among the 1<sup>st</sup> to 80<sup>th</sup> blocks.

### STRUCTURE OF THE SURVEY INSTRUMENT

The result of the development and design processes described above was a 16-page survey instrument divided into four modules (DeShazo et al. 2013). This section describes the modules and rationale for their structure and content. The information presented here is intended to illustrate how the CBioD team addressed a key concern related to the DCEs in modules 1 and 3: do SP valuation methods obtain valid estimates of the public’s WTP for changes in environmental public goods? This concern was the focus of a recent symposium in the *Journal of Economic Perspectives* (Kling et al. 2012). The primary threats to validity revolve around five issues (Arrow et al. 1993, Carson & Groves 2007, Kling et al. 2012): (1) respondents not understanding the questions asked of them; (2) respondents not viewing the questions as being consequential in the sense of potentially

Feature at a new park	Plan A	Plan B
Drinking water and toilets	None	Several
Walking trails	Dirt/gravel	Paved
Picnic tables and grills	None	None
Level of crowdedness	Many people present	Few people present
Litter at the park	No noticeable litter	No noticeable litter
Likelihood of seeing wildlife or birds	Rarely see wildlife/ birds	Always see some wildlife/ birds
Access to a stream or water fall	Easy access to stream or waterfall	No access to stream or waterfall
Visitor information	None	None
Entrance fee (RM)	15	10

**Figure 2** Example of choice set in module 3; the last attribute (entrance fee) refers to a per-person charge for adult visitors only



influencing policy decisions; (3) respondents not facing a payment vehicle that is coercive, such that they can be forced to pay if the policy is enacted; (4) respondents not considering their budget constraints and (5) the possibility of survey-related effects that encourage respondents to say ‘Yes’ or ‘No’ in contradiction to their actual preferences. We refer to features of the survey instrument that responded to these threats at various points below.

### Cover sheet

The cover sheet of the survey instrument began with the following statement, which the interviewers recited to the respondents:

We are surveying people about how they think the government should manage forests in Semenanjung (i.e. Peninsular) Malaysia. The survey is conducted by the Forest Research Institute Malaysia (FRIM). Findings from the survey might affect how forests in Malaysia are actually managed, as FRIM will share the findings with the Forestry Department Peninsular Malaysia and other government agencies.

This statement was intended to enhance consequentiality from the very start of the interview. Additional text on the cover sheet assured respondents that their responses would be treated as confidential, which was important in light of later questions about sensitive issues such as respondents’ incomes and their perceptions of the efficiency of the Malaysian government.

### Module 1: Valuing protection of Belum–Temengor against logging and poaching

Mitchell (2002) observes, “The somewhat daunting challenge to the scenario designer is to distil what is often a complex issue from a technological/biological standpoint and explain it in a way that the vast majority of the relevant population can understand and the relevant policy-makers accept as accurately and fairly presenting the essence of the issue.” The risk of misunderstanding was greater in module 1 than in module 3, as Belum–Temengor was less familiar to respondents than forest parks.

The CBioD team, therefore, dedicated more pages in the survey instrument and more time in the interviews to module 1. The module takes up nearly half of the instrument, with additional visual information provided by 19 photos, maps and other graphics (‘show cards’; DeShazo et al. 2013). To make this information easier to digest, the module began with general information that was more familiar and gradually introduced information that was specific to the policy choice. To make the respondents more than passive listeners, this information was interspersed with questions (not discussed below) on their experience with and attitudes towards related issues.

#### *Characterising the forest area to be protected*

The interviewers introduced the respondents to Belum–Temengor by providing a general description of its location, supported by two maps (cards 1 and 2). They provided a sense of the relative size of Belum–Temengor by comparing it with Singapore. They next showed photos (cards 3–5) to illustrate Belum–Temengor’s landscape and fauna. They noted that most of the area is virgin forest, explaining that this means it has never been logged, and that some of the plants and animals found in it are not found anywhere else on earth. They then described a particular ecosystem service, water purification, explaining that water from a virgin forest was cleaner than water from a logged forest and that in future the area could help provide clean water to parts of the country that experience water shortages. They showed photos illustrating the water resources (rivers, a lake, waterfalls; card 6) of the area and recent water shortages in Malaysia (card 7).

This information established the baseline condition of the area as relatively pristine. This was an important frame of reference for the respondents, who evaluated degradation from this initial state in the DCEs. It also provided a rationale for the payment vehicle described later, a surcharge on household’s monthly water bill.

#### *Characterising logging*

Obtaining information on respondent preferences is challenging when policies have

complex effects and are controversial. Malaysian logging policies qualify as challenging for both reasons. The CBioD team needed to furnish sufficient information for respondents to evaluate alternative logging policies without overloading them with so much information that they were unable to process it and simply guessed. The team also needed to avoid inadvertently creating an unbalanced understanding that would favour either more protective policies or more permissive ones. The CBioD team, therefore, provided information on logging benefits (e.g. jobs, revenue) as well as its costs (e.g. extinctions, reduced watershed services), using neutral language and keeping the scenarios presented to the respondents within the bounds of scientific understanding.

The interviewers began the discussion of logging by showing photos of logging activities (card 8) and describing the job creation and tax revenue benefits of logging to Perak. They then described several ecosystem impacts of logging, starting with watershed services. This description reinforces the water purification service of virgin forests mentioned in the previous section by explaining that logging increases soil erosion, which reduces water quality when the soil winds up in rivers and reservoirs (card 9). The interviewers next introduced a second watershed service of virgin forests, flood mitigation (card 10). They noted that large-scale logging in Belum–Temengor could increase the number of floods in Perak but not in the Selangor region where respondents live.

The interviewers described the type of logging that would occur as selective logging, with only large trees harvested (card 11). This is the legal type of logging in forest reserves in Malaysia. They presented it as a sustainable form of timber harvesting. They also pointed out that even selective logging could cause some species to disappear from Belum–Temengor. They showed a montage of a representative set of 25 species that were sensitive to logging (card 12), which was the same as the set shown later in the DCEs (Figure 1).

### *Characterising poaching*

The interviewers next introduced poaching as a second threat to the species found in Belum–Temengor. They defined poaching as illegal

hunting and showed photos of animals injured or killed by poachers (card 13). They then presented a montage of a representative set of 13 species threatened by poaching (card 14), similar in style to the one for the species threatened by logging.

### *Establishing a status quo scenario to contrast with protective policy counterfactuals*

Perhaps the most fundamental theoretical concept that underlies environmental valuation is that valuation must refer to a well-defined environmental change (Freeman et al. 2014). Respondents need to understand the benefits and costs they will experience not only if an environmental protection programme is implemented but also if it is not. Riera et al. (2012) highlight this as one of the crucial steps in SP forest valuation studies.

The CBioD team followed the standard practice of establishing a clear understanding of the status quo scenario for Belum–Temengor before describing the consequences of new protective policies. The interviewers explained that Belum–Temengor is currently not well protected from logging and poaching. As a result, under the status quo, all of the forest would be logged over the course of 20 years and existing anti-poaching laws would not be actively enforced. Consequently, all 25 species that are negatively affected by logging and all 13 species that are negatively affected by poaching would become extinct within the area in 20 years. In addition, there would be four to six floods a year in Perak. On the positive side, 7500 jobs would be created and sustained in Perak. Since the status quo does not involve any additional protection effort, it would not impose any cost on the respondent. The interviewers illustrated these features of the status quo scenario with a show card (card 15) whose layout mirrored the layout of the choice sets that the respondent saw later in the module.

The status quo scenario was literally true at the start of the CBioD Project in 2007, but the creation of Royal Belum State Park later that year banned logging in about a third of Belum–Temengor. The de facto situation remained close to the status quo scenario, however, because the Perak state government

retained the right to reopen the park for logging and the lack of national park status restricted access to federal resources for combating poaching.

#### *Explaining how protection policies would work*

Respondents need to understand how proposed policies would work to believe that they are feasible. The interviewers explained that protecting Belum–Temengor against logging would require the federal government to compensate the Perak state government for lost logging revenue (card 16), with a larger payment required if a larger area was protected. They then explained that poaching could be prevented by hiring game wardens. This would also be costly but would create jobs. The interviewers noted that the larger the area protected against poaching, the more wardens the federal government would need to hire.

#### *Explaining the payment vehicle and oversight of collected funds*

The interviewers next stated that the federal government wanted to determine how much of the forest to protect against logging and poaching and how much funding would be required. Here, the CBioD team needed a credible coercive payment vehicle such as a government tax or fee to enhance the validity of the responses. Fees for utilities (e.g. water, electricity; Glover 2008) are often used as payment vehicles in SP studies in developing countries, where the collection of broad-based taxes such as income taxes is often partial and surcharges on petrol and other fuels can be deeply unpopular. The CBioD team explored several alternative payment vehicles in the focus groups and cognitive interviews and found that participants favoured a mandatory surcharge on the household water bill over the alternatives. While use of this vehicle might have induced survey respondents to be more concerned about protection against logging (which had a water-related effect, i.e. reduced flooding) than protection against poaching (which did not have such an effect), a cross-country valuation study on endangered species protection in Asia found that payment vehicle had little effect on WTP (Glover 2008).

The participants' acceptance of this payment vehicle was accompanied by scepticism about the government's ability to ensure that all of the funds would be allocated to forest protection. After assessing several alternative ways of assuring participants that funds would be spent as intended, the team settled on telling survey respondents that a committee comprising members of the public and non-profit environmental groups would be created and empowered to provide oversight of the use of the funds.

#### *Staging the choice occasion*

The interviewers next informed the respondents that they were about to show a pair of protection policies that the government could potentially implement. They reviewed the five attributes that would vary with the amount of protection: the area logged and associated amount of extinction; the area poached and associated amount of extinction; the number of floods in Perak; the number of jobs created in Perak; and the increase in the respondent's monthly water bill. Before asking the respondents which policy they would want the government to implement, the interviewers asked them to carefully consider their budget constraints—how much extra money they could afford to pay each month and where that money would come from given the other expenses in their household budgets—and to choose neither protection policy if both seemed too costly relative to the benefits they would provide. They also asked them to reflect on the consequences of choosing the status quo policy (card 19). Finally, the interviewers reinforced consequentiality by informing respondents that their preferred policy, whether protection or the status quo, was more likely to be implemented if they said they supported it.

The interviewers then presented the first choice set: the first pair of protection policy alternatives (policies A and B), along with the status quo (Figure 1). In addition to showing a card with information about the three policies, interviewers stated and pointed to the level of each attribute for each policy to ensure that respondents clearly understood the choice sets.

*Interpreting the ‘choose neither policy’ decision*

The CBioD team phrased the choice question as, “Do you prefer policy A or policy B, or do you choose neither policy?” If a respondent chose neither programme, then the interviewer followed with an open-ended question, “May I ask why you preferred neither option?” The cognitive interviews revealed three common reasons: participants considered the cost to be too high for what was offered; they could not afford either policy because their income was too low and they doubted that the protection policies would actually be implemented and be effective. The survey instrument listed these reasons, but the interviewer did not suggest them to the respondent. Instead, the interviewer checked any that the respondent mentioned and recorded any other reasons given by the respondent.

*Administering subsequent choice sets*

The rest of module 1 consisted of identical presentations of three additional choice sets (policies C and D, E and F, and G and H). To help reduce potential order effects (choices being influenced by cumulative expenditure effects or prior-purchase substitution effects; Taylor et al. 2005), the interviewers asked the respondents to evaluate each choice set independent of previous ones (Ubel et al. 2002, Bruine de Bruin & Keren 2003).

**Module 2: Valuing access to forest recreational opportunities**

Recreational use was not an attribute in the DCEs in module 1 because Belum–Temengor was mostly off-limits to the public and had few visitor facilities at the time of the survey. Module 2 collected data for estimating RP recreation demand models for forest sites in Peninsular Malaysia where recreation was a primary use. It consisted mainly of a list of such sites, with columns for recording information on visits to them. It did not include any show cards.

Riera et al. (2012) offer seven recommendations for applying recreation demand models to forest sites. Four of them pertain to data: obtain data on a large number of distinct sites instead of a small number of

aggregate sites; determine if trips were day trips or overnight trips; provide information that helps respondents recall sites they have visited; and exclude multipurpose trips. The structure of module 2 aligned with these recommendations.

*Defining natural places*

The CBioD team was interested in choices within the category of outdoor, nature-based recreation. So in the introduction to the module, the interviewers informed respondents that they were going to be asked to recall all the natural places they had visited within the last 12 months. To help define ‘natural places’, the interviewers mentioned five popular Malaysian examples: FRIM, Templer Park, Taman Negara, Krau Wildlife Reserve and Pulau Tioman. They asked respondents to exclude incidental visits that were made during trips motivated primarily by family visits.

*Recalling site visitation over the last 12 months*

As recalling site names could be difficult, interviewers showed respondents a list of 55 sites grouped by state in Peninsular Malaysia, with an ‘other sites’ option for sites not on the list. The CBioD team compiled the list from suggestions made by participants in the focus groups and pretests and by staff members from FRIM and the Forestry Department Peninsular Malaysia. Site types included recreational forests administered by the Peninsular Malaysia Forestry Department, national and state parks, hill stations, urban parks, beaches, islands and other natural places. Although forests were of specific interest to the CBioD team, estimating the recreational value of forested sites required information on substitute, non-forest natural places that respondents might also have considered visiting. The interviewers asked respondents if they had visited each site in the last 12 months and recorded the number of visits in the first column.

*Controlling for on-site time and calculating travel costs*

Recreation-demand modelling requires controlling for the quantity of time spent at a

site and the effective cost of accessing the site (Phaneuf & Smith 2005). In the second column, the interviewers recorded information on time spent at a site by asking respondents if they stayed overnight on their last trip to it, and if so the number of nights. The CBioD treated the number of nights spent at the site on the last trip as an estimate of the average number of nights spent at the site across all trips to it during the last 12 months.

Travel cost estimates are typically differentiated by respondents' modes of transportation, which determine the per-kilometer cost of travel. The interviewers recorded information on the mode of transportation to a given site in the third column, with four options offered: private car, minivan, motor bike and others. This information was requested for just the last trip to the site, not all trips, to save time and because respondents might have difficulty recalling such details for earlier trips (Parsons 2003). As it turned out, most sites were visited just once by most respondents, so the 'last' trip was usually the only trip. Transportation costs could then be estimated by multiplying round-trip distances between respondents' residences and the sites, determined using Google Earth's road-distance tool, by mode-specific costs per kilometre, obtained from the Malaysian Road Transport Department.

In Malaysia as elsewhere, members of more than one household sometimes travel together to recreational sites. When this happens, a given household's transportation cost depends on the cost-sharing arrangements among the members of the travelling party. In the last column, the interviewers recorded information that allowed the CBioD team to allocate costs in proportion to the number of people who shared them.

### **Module 3: valuing services and amenities at a new forest park**

Module 3 concerned the creation of a new forest park located relatively near the respondent's residence. Placing module 2 before module 3 served two purposes: it helped ensure that respondents did not mistakenly believe that the new park would be located in Belum–Temengor and it prompted respondents to think about their existing forest-based recreational options, which was a natural lead-

in to the DCEs in module 3.

Module 3 was much shorter than module 1. Focus groups and cognitive interviews revealed that respondents had a clear understanding of trails and other common features of forest parks. The CBioD team, therefore, did not need to provide as much explanatory text or any show cards for module 3. The module was also short because the team made the DCEs more cognitively manageable by including only two choice sets and defining the non-price attributes as having only two levels.

#### *Staging the choice occasion (1)*

The module presented respondents with a scenario in which the government plans to open a new park. The interviewers read them this text:

How much you enjoy a forested park can depend upon the services at the park. Park services include things like well-maintained trails, picnic facilities, water and toilets, and other amenities. The government needs information on what services are important to you. I want you to think about the possibility that the government will open a new forested park. ... The government must decide which services and amenities to provide at this park. Assume that this park will be located within a 2-hour drive of your home so you could visit it and return home within a single day.

This established that the park would be used for day trips, not overnight trips as in the case of some of the sites that the respondent might have reported in module 2.

#### *Motivating the payment vehicle*

The payment vehicle took the form of an entrance fee that would be paid per adult visitor. This was clearly a feasible, coercive mechanism: visitors pay entrance fees to enter many outdoor recreational sites in Malaysia, including national and state parks, recreational forests administered by the Forestry Department Peninsular Malaysia and FRIM. The interviewers motivated this payment vehicle by explaining,

On the next page we are going to show you different plans (A and B) for the new

park. Both plans will include a well-lit and secure parking lot. The costs of these plans differ because they provide different levels of services. To cover costs, entrance fees will be charged for each adult. Parking is free with admission.

Participants in focus groups and cognitive interviews expressed reluctance to visit any park that did not provide safe parking, so the CBioD team held this feature constant across plans.

### *Staging the choice occasion (2)*

Interviewers told respondents, “We want to know which plan you would most prefer and be willing to pay for,” and then showed them a tabular display of the attribute levels for plans A and B (Figure 2). They also told the respondents that not creating a new park was an option. After the respondents made their choices, the interviewers presented the second choice set (plan C, plan D and the no-park option).

### *Interpreting the ‘choose neither policy’ decision*

Before presenting the choice sets to the respondents, the interviewers told them, “You are free to choose neither of the two plans if neither one seems worth the cost for what you would get.” As in module 1, the interviewers asked respondents who chose neither plan why they made this decision. The cognitive interviews revealed three common reasons: both plans cost too much; neither plan had the services the respondent wanted; or the respondent did not visit parks. As before, the interviewers recorded the respondent’s answer without suggesting these possible reasons.

## **Module 4: collecting information on socio-economic, attitudinal and survey administration variables**

Module 4 included 11 socio-economic questions for the respondent and four administrative questions for the interviewer. The socio-economic questions included ones on household income and size and the respondent’s ethnicity, age, education, occupation and type of place where they grew up (rural area, small town, city or suburb). The attitudinal questions requested

respondents’ views on whether they considered themselves to be environmentalists, whether the government generally spends money efficiently and in ways that benefit the public and whether the government is currently spending too much, too little or the right amount on environmental protection. The interviewers also recorded the respondent’s gender, the language of the survey instrument and the language in which the interview was conducted, and the respondent’s level of attentiveness and engagement.

## **SAMPLING DESIGN**

The sampling design was developed jointly by the CBioD team and PE Research in close consultation with the Malaysian Department of Statistics. The CBioD team’s objective was to develop a cost-effective design that would enable it to investigate preferences for forest protection and forest recreation for not only the overall population of the Selangor region but also the populations of the three strata within it (rural Selangor, urban Selangor and Kuala Lumpur). This objective led to a stratified two-stage design with households clustered by enumeration blocks. An enumeration block is the smallest spatial unit by which census data can be attributed to a geographical area in the Malaysian census. It typically contains 80–120 living quarters (physical abodes, e.g. houses and apartments) and 500–600 people (Talha et al. 2009). The Department of Statistics randomly drew 70 enumeration blocks from each stratum in the first stage and 10 living quarters from each enumeration block in the second stage. The sample thus consisted of 2100 living quarters. The Department of Statistics provided information on the sample to PE Research in the form of enumeration block maps and living quarter address lists.

An alternative design would have been a simple random draw of living quarters from across the Selangor region, but this would have been less efficient and less cost-effective. Stratification increased efficiency (i.e. decreased sampling error) by reducing the possibility of extreme random draws such as having all the living quarters being in a single stratum (Kish 1965). Randomly choosing small geographic areas (enumeration blocks in this case or clusters as they are called in the sampling literature)

and then randomly choosing living quarters within each cluster was attractive because it reduced the costs associated with in-person interviewing by decreasing the distance interviewers needed to travel between living quarters. Clustering tends to make confidence intervals for sample statistics wider, however, because respondents who live in relatively close proximity are more likely to share unobserved characteristics than respondents chosen by simple random sampling (Moulton 1986). This effect is smaller when the number of clusters is larger. The CBioD team chose a relatively large number of clusters, 210 enumeration blocks (70 in each stratum), to keep this effect within the range typically seen in high-quality sample designs.

An implication of this design is that sampling intensities varied across the three strata, as the strata subsamples were equal-sized (700 living quarters in each) but the total number of living quarters in each stratum was not. At the time the sample was drawn, the Department of Statistics estimated that there were about 1.3 million living quarters in urban Selangor, 0.5 million in Kuala Lumpur and only 0.1 million in rural Selangor. The oversampling of Kuala Lumpur and rural Selangor relative to urban Selangor helped ensure that the number of observations was sufficient to obtain reasonably precise WTP estimates for each stratum.

## ADMINISTERING THE SURVEY

Household surveys can be conducted in several ways: in-person (face-to-face), telephone, mail, internet and mixed-mode surveys (Stopher 2012). The complexity of the DCEs in module 1 and the many visual aids used in it made an in-person survey the clear favourite for the CBioD survey and ruled out a telephone survey. In-person surveys have the added advantage of yielding higher response rates than mail surveys if a rigorous callback schedule is used (Sitzia & Wood 1998). They also reduce potential sample selection bias relative to mail surveys, where potential respondents can look through the entire survey before deciding to participate.

In-person surveys are more expensive and administratively more complicated than other survey modes, however. They require interviewers to conduct the interviews (unlike

mail and internet surveys) and the interviewers must travel to the survey locations (unlike telephone surveys). Whittington (2002) writes, “It is not an exaggeration to say that the primary job of the CV researcher, after designing the questionnaire itself, is to train and manage the team of enumerators (i.e. interviewers).” He adds that careful training and supervision are needed even when a local firm with experienced enumerators has been hired to implement a CV survey as CV surveys pose unique and complex challenges even for experienced enumerators. We highlight interviewer issues below.

## Selecting and training interviewers

PE Research identified potential interviewers by drawing on its pool of regular interviewers and individuals recommended by them (snowball sampling). It retained 35 candidates for training after applying three screening criteria: a minimum of a pre-university certificate or 12 years of education; proficiency in at least one of the four survey languages and a willingness to work in the evening and on weekends.

In line with Whittington’s recommendations (2002), PE Research’s training of the interviewers involved a mix of classroom training, role-playing (mock interviews) and on-the-job training. It held classroom training on 20 March 2010 at FRIM, with the candidates divided into four groups, each led by a supervisor. It held mock interviews a week later, with each candidate required to make an appointment with a supervisor and invite a friend or relative to serve as the mock respondent. The supervisor gave the enumerator feedback at the end of the mock interview. Based on the interviewer’s performance during the mock interview and reaction to the feedback, the supervisor determined whether the candidate was suitable for the survey team.

Supervisors accompanied interviewers during the first few interviews for on-the-job training. They confirmed that interviewers knew how to locate respondents included in the sample, determine the specific versions of modules 1 and 3 assigned to each respondent, greet respondents and encourage their cooperation, and use the survey instrument and show cards. They allowed interviewers to work on their own only after ‘certifying’ them through this on-the-job training. The final group of interviewers numbered 30.

## **Conducting the fieldwork**

Interviewers who were confirmed for the job received a survey kit, which contained a map of the enumeration block assigned to them and an address list for the 10 living quarters in it that were included in the sample. It also included survey instruments with the versions of modules 1 and 3 assigned to those living quarters and the associated show cards; these materials were included in each of the four languages. Finally, the kit included a survey introduction letter and gifts for respondents who completed the survey.

To help obtain a high response rate, PE Research sent a letter to each living quarters a week prior to the interview date to seek its cooperation and inform it of the survey team's plan to visit it (DeShazo et al. 2013). PE Research considered the typical daily schedule of working Malaysian adults when it selected the interview slots. Interviewers were required to make at least three attempts before they reported a household as non-responsive. They made an initial visit during a weekday after 5 p.m. or a weekend. The intended respondent was the household head, spouse or any other family member who was at least 18 years old and a Malaysian citizen. If no qualified respondent was available, interviewers made a first callback during a time period different from the initial attempt (e.g. the weekend instead of a weekday after 5 p.m.). If that attempt failed, interviewers made a second and final callback at a time suggested by a neighbour or other local source. To promote high-quality interviews, interviewers were not allowed to conduct more than four interviews in a day.

Households were interviewed from April–July 2010. The 30 interviewers reported to four supervisors and the survey manager. Supervisors met individually with their assigned interviewers each week to review the interview schedule, check the completed survey instruments and address unexpected issues that arose. Both the supervisor and the interviewer signed off on every completed survey instrument, stating that the standard protocol for the survey had been followed. Completed survey instruments that did not pass a data-quality screen (e.g. no incomplete answers) were probed through an additional visit or a telephone call. Depending on the severity of the issues, the additional visit

was conducted by the interviewer, the interviewer with the supervisor or just the supervisor.

## **Data entry**

Data entry consisted of four steps: creating the data entry form; entering the data; manually checking the data entry and computerised checking. PE Research created the data entry form using MS Excel, with each cell including criteria that limited the entries to a feasible set. PE Research staff members entered data from survey instruments that had been checked by supervisors into this form, with different staff members manually checking the data entry. Finally, PE Research used MS Access to run the entered data through a series of logical tests. It provided the final data set to the CBioD team in December 2010.

## **SURVEY RESULTS**

A discussion of econometric analysis of the SP data from modules 1 and 3 and the RP data from module 2 is beyond the scope of this article, whose objective is to explicate the survey-based methods used by the CBioD team to generate these data. Here, we highlight quantitative information on survey performance and descriptive statistics on responses to attitudinal questions and, to a limited degree, data from the SP and RP modules.

### **Response rate and other measures of survey performance**

Ten per cent of the 2100 living quarters were found to be ineligible for the survey because they were either vacant or occupied by non-Malaysians. PE Research obtained complete or nearly complete data for 1261 of the remaining 1890 eligible living quarters. Very few answers were missing in the final dataset: the age of one respondent, the number of adults and children in the household of a second one, and responses for two choice sets for a third. This attests to the quality of PE Research's training and supervision of the interviewers.

A high response rate is another indicator of a high-quality valuation survey (Arrow et al. 1993). After accounting for the ineligible living quarters, the response rate was 67%, which is



high for an in-person survey. The Exxon Valdez CV study achieved a 75% response rate (Mitchell 2002), but response rates for in-person surveys in the US have experienced declines since then (Groves 2006). Subsample response rates were 79% for rural Selangor, 72% for urban Selangor and 49% for Kuala Lumpur. Slightly more than two-thirds of the respondents were interviewed on the first attempt (69%), 21% on the second attempt and 10% on the third attempt. Median interview length was 35 min.

### **Environmental attitudes and nature-based recreation in the Selangor region**

Obtaining population-level estimates of mean responses to the attitudinal questions for the Selangor region requires correcting for stratification, clustering and differences in response rates across strata (Kish 1965, Heeringa et al. 2010). Table 1 shows means and 95% confidence intervals (CIs) for responses corrected in these ways. The CIs are all fairly narrow, indicating that the means are estimated quite precisely.

Nearly 90% of adults considered themselves to be environmentalists, with about 40% considering themselves to be strong environmentalists. This question was asked in module 4, however, so the responses could have been affected by information presented in modules 1–3. Evidence of strong environmental preferences is perhaps more reliably signalled by responses to a question from module 1 that was asked before any of the choice sets, which indicated that nearly 75% of adults believed the Malaysian government should place higher priority on environmental protection than economic development. Consistent with this, very few adults thought the government was spending too much money on environmental protection (a question from module 4); more than 40% thought it was spending too little. This might help explain why about a third of respondents felt the government was not spending money efficiently and in ways that benefited the public.

Adults in the Selangor region recognised that forests provide multiple goods and services. About two-thirds thought that the timber industry was very important or important to the Malaysian economy (a question from module 1, before

the choice sets). At the same time, results from module 2 indicate that forests and other natural places were important recreation sites for Malaysian households. About 60% of households had made a trip to at least one such site in Peninsular Malaysia during the last 12 months. About a third had visited a site in the Selangor region and nearly half had visited sites in other states in the peninsula.

### **Features of new forest park plans selected by respondents**

Table 2 presents summary statistics from module 3 for the sample of respondents (not population-level estimates for the Selangor region). For the eight non-fee attributes of the new forest park, Table 2 shows the prevalence of the attribute levels across the park plans selected by the respondents. For example, for the first attribute in the table, nearly half of the plans selected by respondents (49.4%) included drinking water and toilets; respondents were much less likely to select plans that did not include this attribute (only 27.7% of the selected plans). The two percentages for this attribute and the other seven do not add to 100% because respondents selected the ‘neither plan’ option in 22.8% of the cases.

The difference in percentages between the two levels of each attribute provides a crude indicator of the strength of respondents’ preferences for one level over the other. It is crude because it does not control for variation in the levels of the other attributes, as an econometric model would do. Yet, it is informative because the design of the DCEs randomly varies the levels of the attributes. The difference in percentages for a given attribute should thus be relatively free of confounding by other attributes.

Table 2 lists the attributes from the largest difference in percentages to the smallest. Respondents cared most about a built feature of the park: the presence of drinking water and toilets. After that, they cared most about three natural features: frequent sighting of wildlife or birds, easy access to a stream or small waterfall and litter not being noticeable. The differences were near zero for the last three attributes: picnic tables and grills, paved trails and crowdedness. These patterns suggest that respondents were

**Table 1** Estimated shares of households in the Selangor region (Selangor and Kuala Lumpur combined) with particular environmental perceptions and behaviours

Question/Response	Mean (%)	95% confidence interval
Do you consider yourself to be an environmentalist?		
Yes, strongly	39.5	34.7–44.3
Yes, somewhat	48.4	43.6–53.1
No	3.6	2.3–4.9
Not sure	8.5	5.3–11.7
Do you think the Government of Malaysia should place higher priority on economic development or protecting the environment?		
Environmental protection	73.8	70.0–77.6
Economic development	26.2	22.4– 30.0
With regard to environmental protection, do you think the government is currently spending too much money, too little money, or about the right amount of money?		
Too little money	44.3	40.5–48.1
Right amount	44.0	40.2–47.7
Too much	11.7	9.4– 14.0
Indicate your level of agreement with the statement, “The government generally spends money efficiently and in ways that benefit the public.”		
Strongly agree	15.8	12.6–19.0
Somewhat agree	43.1	38.6– 47.7
Somewhat disagree	25.6	21.7– 29.5
Strongly disagree	8.5	6.1–10.9
Not sure	6.9	4.3–9.6
How important do you think the timber industry is to Malaysia’s overall economy?		
Very important	21.8	16.9–26.6
Important	45.5	40.7– 50.2
Somewhat important	26.0	22.2 –29.9
Not important	6.8	4.7–8.8
Did your household make any trips to natural recreation sites during the last 12 months?		
Yes (all sites in Peninsular)	60.7	56.8–64.6
Yes (only sites in Selangor/Kuala Lumpur)	32.2	28.9 –35.4
Yes (only sites in other states)	46.8	42.7–50.9

split between two types of park users: those who favoured a more natural recreational experience (fewer built features, more solitude) and those who favoured a less natural one (more built features, less solitude).

**WTP for protection of Belum–Temengor against logging and poaching**

Responses to a question at the start of module 1 revealed that only 34% of adults in the

**Table 2** Characteristics of plans for new forest parks selected by respondents in module 3

Attribute	Level	Share
Drinking water and toilets	Present	49.4%
	Absent	27.7%
	Difference	21.7%
Likelihood of seeing wildlife or birds	Frequently seen	43.4%
	Rarely seen	33.8%
	Difference	9.6%
Access to a stream or small waterfall	Easily accessible	43.0%
	Not accessible	34.2%
	Difference	8.8%
Litter	Not noticeable	42.7%
	Noticeable	34.5%
	Difference	8.2%
Visitor information	Present	41.2%
	Absent	36.0%
	Difference	5.3%
Picnic tables and grills	Present	39.8%
	Absent	37.4%
	Difference	2.4%
Walking trails	Paved	39.5%
	Dirt/Gravel	37.7%
	Difference	1.7%
Level of crowdedness	Crowded	38.9%
	Few people	38.3%
	Difference	0.6%

Shares add to 77.2% for each attribute because respondents chose neither of the proposed forest plans in 22.8% of the choice sets presented to them

Selangor region had heard of Belum–Temengor (95% CI = 30–38%). This underscores the importance of the CBioD team's effort to convey information about it in the module.

Vincent et al. (2014) presented results from an initial econometric analysis of the module 1 DCEs. They reported that mean household WTP was significantly greater than zero for both types of protection: expressed as monthly payments to protect 100,000 ha, USD1.08 (95% CI =

USD0.95–1.20) for logging protection and USD0.71 (95% CI = USD0.66–0.78) for poaching protection. These amounts were equivalent to about 0.1% of mean monthly household income. The greater WTP for logging protection might reflect the bundling of two benefits from that form of protection (reduced extinctions and fewer floods) compared with just a single benefit from poaching protection (reduced extinctions), although this explanation is not certain because

the groups of species subject to the two threats differed. Incremental WTP declined as more of the forest was protected against a given threat, which is consistent with theory (diminishing marginal utility). As evidence of the importance of allowing for interaction effects in forest-related DCEs (Riera et al. 2012), households were willing to pay a premium for plans that protected against both threats instead of just one.

Riera et al. (2012) advocated checking the theoretical validity of SP forest valuation studies by testing the effect of income on WTP, with the effect expected to be positive and significant. Vincent et al. (2014) found that income significantly increased WTP for households with monthly incomes above USD2329 (in per capita terms, USD6223 per year). A 1% increase in income above this threshold was associated with 0.26 and 0.27% increases in WTP for protection against logging and poaching respectively. This positive but less-than-proportional relationship mirrors results from meta-analyses of conservation valuation studies (Jacobsen & Hanley 2009, Lindhjem & Tuan 2012).

## DISCUSSION

The CBioD survey was more complicated than most forest valuation surveys in tropical countries, involving three distinct valuation modules with two of them based on DCEs. From a sampling standpoint, it was also larger and more population-representative than the norm, as it sampled both rural and urban households. The CBioD team's ability to develop and implement such a complicated survey was aided by several factors. The five-year GEF grant gave the team ample time to develop the survey instrument and design the DCEs and sampling plans. The team benefited from the expertise of the Peninsular Malaysia Forestry Department, the Department of Wildlife and National Parks, the Malaysian Nature Society and WWF Malaysia on the forestry policy issues being studied. It similarly benefited from Malaysia's Department of Statistics having the expertise and population database to draw a survey sample according to its specifications. Implementation of the sampling plan and DCEs was greatly facilitated by Malaysia having highly experienced survey research firms, including ones with prior experience with valuation studies. We hope that these advantages do not preclude

this article from being useful to researchers who are planning forest valuation surveys in tropical countries where conditions are less propitious than in Malaysia.

The high response rate for the CBioD survey, small number of missing answers, internal consistency of answers to the attitudinal questions and theoretical consistency of the module 1 results all suggest that the survey was successfully implemented. With the benefit of hindsight, however, several changes that may have improved the survey are apparent. More attitudinal questions could have been asked before the extended narrative and DCEs in module 1 to provide a larger set of exogenous variables for modelling heterogeneity in tastes in all three valuation modules. Questions could have been added after the module 1 DCEs to confirm respondents' understanding that extinctions referred to Belum–Temengor (not all Malaysia) and that the surcharge to protect it was indefinite (they could have been asked how long they expected to pay it). Other questions at that point could have probed the motivations for their choices such as their expectations about future use of Belum–Temengor as a recreational site or water source and their perceptions of the relative importance of species preservation and flood mitigation, which were aggregated in the WTP measure for protection against logging. Although the survey was already complex, one or more split-sample tests of selected features of module 1 perhaps could have been included such as tests of alternative payment vehicles, variation in the number or type of species depicted as being at risk of extinction and the effects of the script that encouraged respondents to answer truthfully.

Increasing the number of choice sets in modules 1 and 3 would have made estimates at the individual level more precise; recent research suggests that data quality would not have deteriorated even if the number had been doubled (Louviere et al. 2013). Also in module 3, a screening question could have been added to divert respondents with no interest in a new park from answering the choice questions in that module. In module 4, more information on income and income-related variables could have been collected to allow the calculation of discretionary income, which is probably a better predictor of WTP than gross income.

Last are two sampling issues. First, although some information was collected on non-responsive households, additional information might have helped explain the lower response rate for Kuala Lumpur, which is similar to the rates experienced recently in the US. Second, the great effort expended to survey both rural and urban households might not have been necessary after all, at least for valuing Belum–Temengor: Vincent et al. (2014) found that stratum did not significantly affect WTP for protection against either logging or poaching after controlling for income and other household characteristics.

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