An Evaluation of Economic and Non-economic Techniques for Assessing the Importance of Biodiversity to People in Developing Countries.

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By

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1. **EXECUTIVE SUMMARY**

Biodiversity supports a range of goods and services that are of fundamental importance to people, for health, well-being, livelihoods, and survival (Costanza et al., 1997; Daily, 1997). Often, it is the people from the poorest nations that have the greatest immediate dependency on these stocks; such as direct reliance on natural resources for food, fuel, building material and natural medicines. Thus, gaining a better understanding of the role of biodiversity is fundamental for securing the livelihoods and well-being of people in developing countries.

Economic valuation of biodiversity is important since it provides a useful vehicle to highlight and quantify the range of benefits delivered by biodiversity. Importantly, placing monetary values on biodiversity and its ecosystem services will bring biodiversity into a common currency for use in decision-making, allowing its benefits to be directly compared with other development trajectories.

In recent years there has been considerable research undertaken to examine how people value biodiversity (Nunes and van den Bergh, 2001; Christie et al., 2004; Christie et al., 2007b). The majority of this work has been conducted in the developed world; with only limited application in developing countries (Abaza and Rietbergen-McCracken, 1998; Georgiou et al., 2006; van Beukering et al., 2007). There are, however, a number of significant challenges associated with valuing biodiversity in a developing country context.

**Aims and method:**

This report aims to provide an evaluation of economic and non-economic techniques for assessing the importance of biodiversity to people in developing countries. Specifically, the report aims to:

(a) assess the ability of a range of techniques to: (i) reveal the complex relationship between people and their natural environment; (ii) identify meaningful preference revelation; and (iii) produce results that are meaningful to policy-making;
(b) use case studies to illustrate the difficulties, issues and solutions encountered and delivered by the techniques examined;
(c) identify ways in which people use and think about the natural environment in the contexts being examined.

**Research method:**

To address these objectives and to ensure that the review of biodiversity valuation in developing countries is comprehensive, four data gathering protocols were utilised to identify relevant studies:

- A systemised search of the Environmental Valuation Research Inventory (EVRI) database of economic valuation studies;
- A systemised search of the Web of Knowledge database of published academic papers;
- A questionnaire survey of researchers and policy makers that were known to have undertaken or used research on the valuation of biodiversity in developing countries;
- Five in-depth case studies (Southern Africa, Montserrat, Uganda, Solomon Island, and Agatti Islands) which examine the methodological problems that researchers and practitioners may experience when applying a range of techniques.

The economic techniques reviewed included market-based approaches (production function, opportunity costs, damage costs, and replacement costs), revealed preference methods (travel cost method and hedonic pricing), stated preference methods (contingent valuation and choice modelling), participatory approaches to valuation (deliberative monetary valuation and mediated modelling), and benefits transfer. The non-economic techniques reviewed included non-economic consultative methods (questionnaires and in-depth interviews) and non-economic deliberative and participatory approaches (focus groups, citizen’s juries, health-based valuation methods, Q-Methodology, Delphi surveys, rapid rural appraisal, participatory
rural appraisal and participatory action research), and methods of review information (systematic reviews).

**Key findings:**

The search of the EVRI database identified 195 economic studies that valued biodiversity in developing countries, while the Web of Knowledge search identified 183 economic studies and 101 non-economic studies. These developing country studies represent approximately one-tenth of all published biodiversity valuation studies. The studies identified in the review were equally distributed between ‘lower middle income’ and ‘lower income’ countries; with no studies identified in ‘transition economies’. Half the studies were conducted in Asia, 18% in Africa and 5% in South America. The most commonly used methods included contingent valuation (73 studies), opportunity costs (56 studies), and questionnaires (48 studies); while the review failed to identify any studies that utilised mediated modelling, citizen’s juries, Delphi studies or systematic reviews.

The methodologies reviewed differ in terms of the types of values that they can elicit. Only the economic techniques are capable of eliciting economic values for biodiversity; the non-economic methods alternatively can only provide a quantitative and/or qualitative indicator or description of how people might benefit from biodiversity. Further, only the stated preference methods have the capacity to assess all components of ‘total economic value’ (e.g. use and non-use values), while revealed preference methods can only capture use values. Market-price and market-cost based approaches do not address ‘total economic value’, but alternative capture proxies for direct use. Researchers therefore need to be discerning in terms of his/her choice of method to ensure that it is the most appropriate for the task in hand, which in some instances might mean utilising a range of methods.

The review highlights the fact that applications of economic and non-economic techniques to value biodiversity in developing countries is in its infancy, and that there are a wide range of methodological, practical and policy challenges specific to their application in developing countries.

**Methodological issues:**

- Low levels of literacy, education and language creates barriers to valuing complex environmental goods, as well as creating difficulties for utilising traditional survey techniques such as questionnaires and interviews. More deliberative and participatory approaches to data collection may overcome these issues.
- Many developing countries have informal or subsistence economies, in which people may have little or no experience of dealing with money. The consequence of this is that they would find it extremely difficult to place a monetary value on a complex environmental good.
- Most of the methods reviewed have been developed and refined by researchers from developed countries. There is evidence that the current best-practice guidelines for these methods might not be appropriate for applications in developing countries.

**Practical issues:**

- Many developing countries are affected by extreme environmental conditions which may affect the researcher’s ability to access areas or effectively undertake research.
- In many developing countries there may be a lack of local research capacity to design, administer and analyse research projects. However, the involvement of local people is considered essential within the research process to ensure that local nuances/values are accounted for.
- There is some evidence that it may be easier to administer valuation studies in developing countries: response rates are typically higher; respondents are receptive to...
listening and considering questions posed; interviewers are relatively inexpensive (allowing larger sample sizes).

Policy issues:

- The lack of local research capacity in many developing countries may result in a lack of awareness of valuation methods and of the importance of biodiversity to people. A capacity building programme on these issues is considered important if developing countries are to effectively address biodiversity issues.
- The lack of empirical valuation studies in developing countries is an issue for effectively illustrating the importance of biodiversity to people and for future input into benefits transfer.
- Much of the existing biodiversity valuation research has been extractive, with little input or influence on local policy. Incorporating ideas from action research into valuation is seen as being essential if this type of research is to meaningfully influence policy.

Conclusions:

- It was clear that the way people in developing countries think about the natural environment is different to those in developed countries. People in developing countries tend to have much closer ties to their natural environment. Much of their knowledge however is implicit, experiential knowledge, which may be difficult to elicit. Further, low levels of literacy and education mean that most people will have little or no scientific understanding of their natural environment. All of the above means that it may be extremely difficult for people from developing countries to express their value for natural resources.
- Given the above, standard approaches to valuation are unlikely to effectively reveal the preferences of people in developing countries. Evidence from this reports suggest that valuation may be more effective if (i) local researchers are used throughout the research process, and (ii) deliberative, participative and action research approaches are incorporated into the valuation methods.

Recommendations:

- The valuation of biodiversity is clearly an important step to recognising the importance of biodiversity to people and bringing biodiversity into the realm of decision making and politics. However, research into the valuation of biodiversity in developing countries is in its infancy and further research effort is required.
- Many of the economic and non-economic techniques have been developed and refined for use in a developed country context. Often, best-practise in a developed country context might not be appropriate in a developing country context. Further research is therefore required to develop best-practice guidelines for valuation research in a developing country context.
- Deliberative, participatory and action research approaches appear to provide useful avenues for improving valuation research in developing countries. Further research is required to assess ways in which these approaches might best be incorporated into economic valuation.
- Valuation research will be more effective and valid if local researchers are utilised at all stages in the design, administration and analysis of valuation studies. However, there is often a lack of local research capacity in many developing countries. A research capacity building programme is therefore seen as essential if we wish to effective value biodiversity in developing countries.
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2. Introduction

2.1. Background to research

Biodiversity / natural resources provide a range of goods and services that are of fundamental importance to human beings, for health, well-being, livelihoods, and survival (Costanza et al., 1997; Daily, 1997). Often, it is the people from the poorest nations that have the greatest immediate dependency on biological resources, such as direct reliance on natural resources for food, fuel, building material and natural medicines. However, much of the world’s biological resources are located in developing countries (Fazey et al., 2005b) and are under the greatest threat from human driven pressures (from both inside and outside the developing world) such as population growth, economic growth, and climate change (WWF, 2006). It is therefore important to understand the role of biodiversity in securing livelihoods and well-being of people in developing countries.

Economic valuation of biodiversity is important since it provides a useful vehicle to highlight and quantify the range of benefits delivered by biodiversity. Importantly, placing monetary values on biodiversity and its ecosystem services will bring biodiversity into a common currency for use in decision-making, allowing its benefits to be directly compared with other development trajectories.

In recent years there has been considerable research undertaken to examine how people value biodiversity (Nunes and van den Bergh, 2001; Christie et al., 2004; Christie et al., 2007b). The majority of this work has been conducted in the developed world; with only limited application in developing countries (Abaza and Rietbergen-McCracken, 1998; Georgiou et al., 2006; van Beukering et al., 2007). There are, however, a number of significant challenges associated with valuing biodiversity using available environmental economic techniques in a developing country context. These challenges include low literacy levels; the high reliance on subsistence economies; lack of local research capacity; lack of capacity to build awareness of importance of biodiversity; high cultural diversity; and strong spiritual and cultural values associated with biodiversity. Such problems may mean that a distorted picture of the value of biodiversity could be presented for developing countries if inappropriate methods are used, resulting in reduced efficacy of resource allocation and policies for poverty alleviation and biodiversity conservation. The use of non-economic techniques (such as questionnaires, focus groups, participatory appraisal approaches) to assess the importance of biodiversity has been suggested as a possible way to address some of these issues. However, it is not clear how these techniques can best complement economic approaches to elicit values and provide meaningful results that can inform policy at national and international levels.

2.2. Research aims

This report therefore aims to provide an evaluation of both economic and non-economic techniques for assessing the importance of biodiversity to people in developing countries. In particular, the research objectives are to:

- assess the ability of a range of economic and non-economic techniques to: (i) reveal the complex relationship between people and their natural environment; (ii) reveal meaningful preference revelation; and (iii) produce results that are meaningful to policy-making;
- use case studies to illustrate the difficulties, issues and solutions encountered and delivered by the techniques examined;
- identify the ways in which people use and think about the natural environment in the contexts being examined.
2.3. Research method

This report reviews the application of economic and non-economic techniques within developing countries and the extent to which these reveal the importance of biodiversity to indigenous people and other policy makers. To achieve this, the review is structured into the following sections.

Following the introduction in this section, Section 3 provides a contextual review on why it is considered essential to assess the importance of biodiversity to people in developing countries. In particular, we explore the concept of biodiversity and discuss why biodiversity, and its associated ecosystem services, are important to people; outline the economic and non-economic methods that are available to value biodiversity; and discuss the policy context for valuing biodiversity.

Section 4 then provides a summary of the extent to which valuation techniques have been applied to value biodiversity in developing countries. Two data sources are used in this broad review.

- A systemised search of the Environmental Valuation Research Inventory (EVRI) database of economic valuation studies;
- A systemised search of the Web of Knowledge database of published academic papers.

In Section 5, we provide a review of the suitability of a range of economic and non-economic techniques to value the importance of biodiversity to people in developing countries. The economic techniques reviewed include: market-based approaches (production function, opportunity costs, damage costs, and replacement costs), revealed preference methods (travel cost method and hedonic pricing), stated preference methods (contingent valuation and choice modelling), participatory approaches to valuation (deliberative monetary valuation and mediated modelling), and benefits transfer. The non-economic techniques reviewed include: non-economic consultative methods (questionnaires and in-depth interviews) and non-economic deliberative and participatory approaches (focus groups, citizen’s juries, health-based valuation methods, Q-Methodology, Delphi surveys, rapid rural appraisal, participatory rural appraisal and participatory action research), and methods of review information (systematic reviews). For each technique, we aim to identify: (i) objectives and background to the methods; (ii) the range of applications addressed by the different techniques; (iii) any methodological issues and solutions associated with applying the techniques in a developing country context; (iv) practical issues and solutions; (v) how the results are utilised by policy makers; and (vi) exemplars of the application of the methods to value biodiversity in developing countries. These method reviews are predominantly based on the research papers identified in the broad review (Section 4), but are also supplemented from the results of a questionnaire of researchers and policy makers who were known to have undertaken or used research on the valuation of biodiversity in developing countries.

Section 6 then provides details of five case studies that have utilised economic and / or non-economic techniques to assess the importance of biodiversity to people in developing countries. The case studies present research undertaken in the Southern Africa, Montserrat, Uganda, Solomon Islands and India and illustrate the practical challenges and solutions to valuation in developing countries.

Finally, Section 7 provides a critique of the research approach and then provides a synopsis of the methodological, practical and policy challenges associated with applying economic and non-economic techniques to value biodiversity in developing countries. Section 8 the draws some conclusions specifically relating to the research objectives and provides a list of recommendations from this research.
3. Valuing biodiversity’s contribution to human welfare and livelihoods

In this section we provide a review of the scientific literature that provides a case for valuing the importance of biodiversity to people in developing countries. Specifically we consider (i) the concept of biodiversity, the ecosystems services associated with biodiversity, and how these contribute to human welfare; (ii) economic and non-economic techniques for valuing the importance of biodiversity to people in developing countries; (iii) why monetary valuation of biodiversity is important to policy makers.

3.1. Biodiversity, ecosystem services and human welfare

The concept of biological diversity was first defined in the way it is mostly used today during the 1970s to mid 1980s (Peet, 1974; Lovejoy, 1980b, 1980a). Initially, definitions of biological diversity focused on the diversity of species, but by the mid 1980s biological diversity was increasingly being defined as diversity at genetic (within-species), species (species numbers), and ecological (community) levels (Norse et al., 1986). The contracted term “biodiversity” came from a “National Forum on Biodiversity” held in the USA in 1986, where the term, and concept, were brought into more general use (Wilson, 1988). Although there are many possible definitions, perhaps the most widely-accepted, and the closest to a single legally accepted definition, is that provided in Article 2 of the “Convention on Biological Diversity” (signed by 157 national and supra-national organizations) at the 1992 UN Conference on the Environment and Development:

“Biological diversity means the variability among living organisms from all sources, including, inter alia, terrestrial, marine and other aquatic systems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems”.

Although there are now generally accepted broad definitions of biodiversity, there is still much debate regarding how biodiversity is measured (Christie et al., 2007b). It is, however, clear that biodiversity is important to people. Indeed, the Convention on Biological Diversity recognises that all levels of biodiversity (from the genetic level of species to the ecosystem level) provide a range of fundamental goods and services (termed ‘ecosystem services’), which are essential in the support of human existence, for health, well-being and the provision of livelihoods (Costanza et al., 1997; Daily, 1997).

A number of frameworks have been developed over the past two decades to categorise the ecosystem services provided by biodiversity. The most widely recognised being the UN Millennium Ecosystem Assessment (Millennium Ecosystem Assessment, 2005), which sets out four main categories of ecosystem services as outlined in Table 1. Further examples of recent categorising and the establishment of frameworks include those of the Convention on Biological Diversity and Defra (2007).

Biodiversity is currently being lost at unprecedented rates. The MEA (2005) suggest that 60% of the World’s ecosystem services are degraded or used unsustainably, while the recent Living Planet Index reports that global biodiversity has declined 27% since 1970 (WWF, 2006). The rate of biodiversity loss, however, is likely to be greater in developing countries. For example, WWF (2006) estimate a 46% reduction in tropical ground-living species. Further, WWF (2008) argue that targets for reducing biodiversity loss set by the 2002 Convention on Biological Diversity (CBD, 2002) are unlikely to be achieved.

Much of the loss of biodiversity is due to human-induced pressures. Global population is estimated to increase from 6 billion to 9 billion by 2050 (UN, 2007), most of which will occur in developing countries. Over the same period, per capita growth of GDP is predicted to increase by a factor of between two- and four-fold (Millennium Ecosystem Assessment, 2005). Atmospheric global CO2 stock is also predicted to rise to double the level of the pre-industrial era with significant implications for global biodiversity through alterations in climate (Stern, 2006). In all cases, it is likely that these pressures will have a
disproportionately higher impact on the biodiversity within developing countries which both
harbour the majority of the world’s biodiversity and ecosystem services, and have the least
capacity to deal with the problem (Fazey et al., 2005b).

Table 1: Ecosystem services from the Millennium Ecosystem Assessment framework.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provisioning Services:</td>
<td>Products obtained from ecosystems e.g. food, fuel, materials for building.</td>
</tr>
<tr>
<td>Regulating Services:</td>
<td>Benefits obtained from the regulation of ecosystem processes e.g. climate regulation, water purification.</td>
</tr>
<tr>
<td>Supporting Services:</td>
<td>Those that are necessary for the production of all other ecosystem services. They differ from provisioning, regulating, and cultural services in that their impacts on people are often indirect or occur over a very long time, whereas changes in the other categories have relatively direct and short-term impacts on people.</td>
</tr>
<tr>
<td>Cultural Services:</td>
<td>Non-material benefits people obtain from ecosystems and landscape through spiritual enrichment, reflection, recreation, and aesthetic experiences. Also includes the value that people place on the existence of plant and animals.</td>
</tr>
</tbody>
</table>

Source: Adapted from MEA (2005).

Predicted losses to the Earth’s biodiversity will have a substantial detrimental effect on the provision of ecosystem services that are important for human welfare and livelihoods. This will be particularly prevalent in developing countries where livelihoods are more directly dependent on ecosystem services (Millennium Ecosystem Assessment, 2005; UNDP et al., 2005). For example, areas known as Globally Important Agricultural Heritage Systems, where agricultural, biological and cultural elements are closely tied, provide direct use values supporting 1.4-2 billion people, most of which are living in developing countries (Altieri and Koohafkan, Unknown). Much of these direct use and other values of biodiversity are often unaccounted for in national accounting statistics, leading to the undervaluation of the ecosystem services and subsequent over-exploitation. This failing to effectively value ecosystem services has been recognised in the Where is the Wealth of Nations? report by The World Bank (2006), and is highlighted by the Millennium Ecosystem Assessment (2005). It also has implications for sustainable development generally, including approaches to achieving the UN Millennium Development Goals (United Nations, 2007).

With biodiversity at the frontline of the human driven change, continued undervaluing of biodiversity and ecosystem services or their treatment as ‘free goods’ is, in the long-term, an unsustainable policy. To counter the under-valuing of these goods, some form of valuation is required to capture the complexity of uses and values that are associated with biodiversity and ecosystem services, thus enabling ecosystem managers to understand the dynamic nature and relationship between people and their environment and support the development of policies with appropriately resourced implementation programmes (OECD, 2001).

3.2. Methods to assess how people value biodiversity

Biodiversity is important to humans for various reasons. In economic terms, we can think of this as contributing to different elements of ‘Total Economic Value’, which comprises both use and non-use values (Figure 1). Biodiversity may increase an individual’s welfare through direct provision of a good (e.g. for food, fuel, or recreational use of natural areas) or indirectly through its contribution towards the maintenance of ecosystem services such as the regulation
of the water and carbon cycles (Pimm et al., 1995; Fromm, 2000). People may also value biodiversity through non-use (or passive-use) benefits (e.g. derived from the knowledge that biodiversity is being protected for future generations to enjoy). The conservation of the Earth’s biological resources is thus essential to preserve the well-being of both current and future generations. An assessment of the contribution of biodiversity to people’s welfare and livelihoods should, ideally, be considered within this TEV framework.

![Figure 1: The elements of Total Economic Value](source)

Environmental economists have developed a range of economic techniques to capture some or all of the elements of TEV (Table 2). Clearly, some valuation methods may be more suited to capturing the values of different elements of TEV. For example, revealed preference techniques might be more suitable to capturing use values e.g. the travel cost method which utilise information on the costs incurred travelling to a biodiversity-rich area to assess the recreation value of that area (Navrud and Mungatana, 1994; Shrestha et al., 2002), while stated preference techniques would be more suited to the capture of non-use values e.g. the contingent valuation method may be used to assess how much people are willing to pay to protect an endangered species or habitat (Nunes and van den Bergh, 2001).

There are currently a large number of economic studies that have valued some element of biodiversity (Nunes and van den Bergh, 2001; Christie et al., 2004; Pearce, 2006) or the ecosystem services associated with biodiversity (Costanza et al., 1997; IUCN, 2004; Eftec, 2006; Barbier, 2007). The majority of these studies have, however, have not been applied in developing countries (UNEP 1993).

Although environmental valuation studies have now been generally accepted by both academic and policy-making communities (Arrow et al., 1993; HM Treasury, 2003), there has been (and still is) debate about the validity of these methods (Sagoif, 1988, Diamond and Hausman, 1993; Bate, 1994; Gowdy, 2004). Specific concerns related to the valuation of biodiversity include incommensurate values and lexicographic preferences (Spash, 1993; Spash and Hanley, 1995), intergenerational rights (Bromley, 1995), and people’s limited capacity to understand complex goods (Limburgh et al., 2002; Christie et al., 2006b).

There has also been recent debate relating to the way in which values should be expressed. In neoclassical economics, the focus is upon the expressed preferences of an individual. This
generates exchange values, which may subsequently be aggregated and fed into cost-benefit analysis. However, advocates of more political approaches to valuation have suggested that people may express their preferences either as individuals, as individuals in a group setting, or as a group. They also make a distinction between individual (disaggregate) values and social (aggregate) values. Spash (2007b) provides a useful summary of this debate.

There have also been concerns regarding the quality of the social process of valuation, which has led to calls for a more participatory and deliberative approach to valuation (Spash, 2007a). These Deliberative Monetary Valuation (DMV) approaches aim to combine the advantages from neoclassical valuation with participatory methods (Spash, 2007b).

Finally, in addition to these generic methodological issues, there are also specific issues that relate to difficulties of valuing biodiversity in developing countries, such as low literacy levels and strong spiritual and cultural values (Whittington, 1998, 2002).

Given such difficulties, some researchers have used non-economic techniques (Ormsby and Kaplin, 2005). These range from structured survey techniques (e.g. questionnaires, and interviews) to more participatory approaches (e.g. participatory rural appraisal and participatory action research). Many of these methods do not provide monetary valuations of biodiversity but still provide useful information on the importance of biodiversity to people in ways that economic methods cannot. Further, given that many of these non-economic techniques have been extensively utilised in developing countries on a wide range of issues, the knowledge and insights gained from this experience may provide useful insights into how economic techniques might better be conducted in developing countries.

Table 2: Economic and non-economic techniques available to value biodiversity.

<table>
<thead>
<tr>
<th>Economic techniques</th>
<th>Non-economic techniques</th>
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<tbody>
<tr>
<td>Market price approaches</td>
<td>Consultative methods:</td>
</tr>
<tr>
<td>Market cost approaches</td>
<td>Questionnaires</td>
</tr>
<tr>
<td>Replacement costs approaches</td>
<td>In-depth interviews</td>
</tr>
<tr>
<td>Damage cost avoided approaches</td>
<td>Deliberative and participatory approaches:</td>
</tr>
<tr>
<td>Production function approaches</td>
<td>Focus groups, in-depth groups</td>
</tr>
<tr>
<td>Revealed preference methods</td>
<td>Citizen juries</td>
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<tr>
<td>Travel cost method</td>
<td>Health-based valuation approaches</td>
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<td>Hedonic pricing method</td>
<td>Q-methodology</td>
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<tr>
<td>Stated preference methods</td>
<td>Delphi surveys</td>
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<tr>
<td>Choice modelling</td>
<td>Rapid rural appraisal</td>
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<td>Contingent valuation</td>
<td>Participatory rural appraisal</td>
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<td>Participatory approaches to valuation</td>
<td>Participatory action research</td>
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<td>Deliberative valuation</td>
<td>Methods for reviewing information:</td>
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<td>Mediated modelling</td>
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<td>Benefits transfer</td>
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3.3. **Why monetary valuation of biodiversity is important to policy makers**

Assigning monetary values to biodiversity is important since it allows the benefits associated with biodiversity to be directly compared with the economic value of alternative resource use options. Failure to do this may result in a loss of biodiversity and their associated ecosystem services. For example, a recent UN report concluded that much of the 20 million square kilometres of land and sea designated within some form of protected area are currently not being effectively managed (United Nations, 2007). In-depth knowledge of the values attributed to the biodiversity within these protected areas would help to ensure optimal resource allocation and opportunities for reducing conflict between user groups. Further, identification of biodiversity values can assist in the determination of the extent of damages paid in cases of liability for landscape and habitat degradation and provide a platform for the design of mechanisms aimed at providing incentives for biodiversity conservation, such as Payments for Ecological Services (Pearce and Pearce, 2001). The (OECD, 2001) also recognises the importance of measuring the economic value of biodiversity and identifies a wide range of uses for such values, including:

- Demonstrating the value of biodiversity: awareness raising showing the importance of biodiversity;
- Determining damages for loss of biodiversity: liability regimes;
- Revising national economic accounts;
- Setting charges, taxes, and / or fines;
- Land use decisions, e.g. to make a case for sustainable agriculture / forestry or to protect an area;
- Limiting biological invasions;
- Limiting or banning trade in an endangered species;
- Assessing biodiversity impacts of non-biodiversity investments, e.g. road building;
- Setting priorities for biodiversity conservation within a limited biodiversity budget.

The acceptance of the role of environmental economic valuation methodologies in policy formulation is being increasingly recognised. The Convention on Biological Diversity raises the issue of the need for local and global valuation through the Council of the Parties (COP) Decision IV/10, acknowledging: ‘economic valuation of biodiversity and biological resources is an important tool for well-targeted and calibrated economic incentive measures’ and encourages the Parties to ‘take into account, economic, social, cultural, and ethical valuation in the development of relevant incentive measures’. Further, the recent Potsdam Initiative aims to explore the economic implications of inaction on biodiversity loss and the proposed update of the MEA in 2015 is also likely to adopt valuation techniques to measure economic, social, cultural and ethical aspects of biodiversity.

The scope for the expansion of environmental valuation techniques and its utilisation by decision-makers is therefore becoming more widely accepted. However, it is currently unclear as to the extent to which policy makers in developing countries use economic valuation and there has been no comprehensive review of the methodological and practical challenges of applying these techniques in a developing country context.
4. Overview of biodiversity valuation studies in developing countries

In this section, we provide a broad review of the extent to which economic and non-economic techniques have been utilised to assess the importance of biodiversity to people in developing countries. To achieve this, we utilise systematic searches of two search databases: (i) the Environmental Valuation Research Inventory (EVRI) and (ii) the ISI Web of Knowledge (WoK). The EVRI database was selected as it is the most comprehensive portal of valuation studies, while the Web of Knowledge is the World’s largest database of scientific papers.

The approach used in the systematic searches draws on the guidelines from systematic reviews (Fazey et al., 2004; Pullin and Stewart, 2006). In particular, the searches are based on a small number of specific search terms. This approach helps to ensure that the search findings are robust, comprehensive within the limits of the search terms and are repeatable. Further, given that consistent search terms are used across the valuation methods, the searches will produce data that will allow comparisons of the relative extent to which the different methods have been used to value biodiversity in developing countries. The restricted search terms will, however, mean that we may not pick up every research article (i.e. those articles that do not include the specific search terms); but we argue that the benefits from a systemised search outweigh this issue.

Given the differences in the way each database operates, we present the results of the database searches separately.

4.1. Review of the EVRI database

The Environmental Valuation Research Inventory (EVRI) database (http://www.evri.ca/) was developed by an international consortium led by Environment Canada with the primary aim to collate empirical studies on the economic value of environmental benefits (for subsequent use in benefits transfer studies). EVRI is thus reputed to be the World’s single largest portal of economic valuation studies and as such is considered to be an extremely useful reference source for this review. It should, however, be noted that the focus of EVRI is the collation of economic valuation studies and that non-economic methods are not represented in this database.

The systemised search of the EVRI database involved the use of the searching module contained within this web-based resource. This involved working through a number of set terms contained in the search module. First, the term ‘biodiversity’ was entered as the ‘Environmental Goods and Services, and Environmental Asset’. Next, a ‘Continent’ e.g. ‘Africa’, ‘Asia’ etc. was selected from the ‘geographical characteristics’ presented. Third, a ‘Country’s State of Development’ (i.e. national income) was selected. For the purposes of the systematic searches ‘developing countries’ are defined as those countries listed within the ‘Transitional’; ‘Lower Income’ and ‘Lower Middle Income’ economies. The EVRI database sourced information on economic status from World Bank data in July 2007 (Rittmaster, 2008). Fourth, a ‘Valuation Technique’ for review was selected from the list in the ‘Economic Measure and Market Characteristics’ section. Methods selected for inclusion in this review included: ‘choice experiments’, ‘contingent valuation’, ‘travel cost method’, ‘hedonic property’, ‘hedonic pricing’, and ‘replacement costs’. Finally, the ‘Year of Data’ section was selected to cover five year periods i.e. 1960-1964, 1965-1969, and so on up until a final period of 2005 – July 2008 was reviewed.

Based on the above searches of EVRI, 1686 studies (written in English) that valued biodiversity were identified. Of these, 1487 (88.4%) were from high income or upper middle income countries and 195 (11.5%) were from developing countries. Of those conducted in developing countries, 94 (5.6%), 101 (5.9%), 0 (0%) studies were from lower middle, lower income, and countries with transitional economies respectively (Figure 2).
Of the studies conducted in developing countries, 48% were in Asia, 17% in Africa and 6% in South America (Figure 3). Note that the studies listed as being from Europe and North America largely represent studies that were undertaken in the lower middle and lower income countries within these continents and / or may form comparison or review studies in association with developing countries. In terms of level of development, the majority of studies undertaken in ‘lower middle income’ countries were undertaken in Asia and North America, while those from ‘lower income’ countries were largely undertaken in Asia or Africa. No studies were found in the poorest ‘transitional’ countries group (Figure 3).

Figure 2: Cumulative total of biodiversity valuation studies sourced from EVRI for all National Income States from 1960-2008.

Figure 3: Percentage of papers conducted in transitional, lower and lower middle economy nations by continent.
Of 195 papers, the most widely adopted technique used in developing countries was the contingent valuation method (121 applications; half of which were undertaken in Asia), followed by the travel cost method (36 papers; again mostly conducted in Asia). Other methods identified include the hedonic pricing method (12 papers), replacement cost method (21 papers) and choice experiments (5 papers) (Figure 4).

![Figure 4: Number of biodiversity valuation papers undertaken in developing countries by technique and continent identified through the EVRI database.](image)

4.2. Review of ISI Web of Knowledge database

The Web of Knowledge (WoK) ([http://wok.mimas.ac.uk/](http://wok.mimas.ac.uk/)) is a scientific database that provides access to scientific papers from over 22,000 scientific journals, 192,000 conference proceedings and 5,500 Web sites.

The systemised search of the WoK database was administered using the WoK’s Web-based search engine. For each of the economic or non-economic techniques listed in Table 2, a search was undertaken that included the name of the technique (e.g. ‘contingent valuation’, questionnaires, etc.), and one of the following terms relating to biodiversity (‘biodiversity’, ‘species’, ‘habitats’, or ‘ecosystems’). The term ‘developing countries’ was also used to narrow the search where a large number of studies were identified. The papers identified from the searches were then reviewed to select only those studies directly relevant to this review.

The search of the WoK database sourced a total of 284 papers using all the systematic terms. Figure 6 provides a summary of the techniques used in these papers. The most widely adopted techniques included contingent valuation (73 papers), opportunity costs (56 papers) and questionnaires (48 papers).
The information collated from the selected studies was also used to identify the type of biological resources being valued, the context under which most valuation took place and the continent where the study took place (Figure 6). In terms of the biological resource being valued, most studies focused on the ‘ecosystems’ level (58.8%), with ‘biodiversity’ being the least studied component (6.7%). The context in which the majority of studies were undertaken was ‘natural resource management’ (65.5%) with ‘agriculture’ and ‘park management’ respectively accounting for 16% and 13% of studies. There were similar numbers of papers found from studies conducted in Africa, Asia and South America (32.7, 32.0%, and 26.1% respectively). Further detail of the extent to which each valuation technique was applied to the good, context and continent can respectively be found in Table 6, Table 7 and Table 8 in the appendix.
Figure 6: Analysis of the Good (biological resource), Context and Continent reviewed in papers sourced from the Web of Knowledge.

Data from the WoK review was also used to identify the authorship of the papers. In particular, analysis is focused on whether the authors of the papers were resident in a developing country. This information is useful as it indicates the extent of research capacity within developing countries.

This analysis indicates that out of the 284 papers identified in the WoK: 80 papers (28%) were authored solely by researchers from developing countries; in 92 papers (32%) the first author was based in the developing country under investigation; and in 136 papers (48%) at least one of the authors was from a developing country (Figure 7). However, 138 (48%) of the identified papers had no authors from developing countries. Thus, although approximately 1/3 of the biodiversity valuation research in developing countries appears to have been led by researchers in developing countries (suggesting a reasonably level of research capacity within these countries), half of the published papers were undertaken with no input from researchers in developing countries.
4.3. Discussion of systematic searches

The systematic searches aimed to provide a general overview of the extent to which economic and non-economic techniques have been used to value the importance of biodiversity to people in developing countries; rather than provide a comprehensive review of all studies relating to biodiversity values. The review, for example, did not include detailed searches of the grey literature. The lack of consideration of the grey literature may have resulted in a lack of representation of non-economic techniques, such as participatory rural appraisal and participatory action research. Developing countries are also likely to have published or presented work in languages other than English (Fazey et al., 2005a).

Further, the review only included studies that were identified using our specific search terms. We are aware that other relevant papers may exist which were not picked up by our search terms. However, we emphasise that the aim of our review was to adopt a systemised, and therefore repeatable, review of studies and therefore provide a snapshot of the extent of research that values biodiversity in developing countries across the range of techniques.

Analysis of the systematic searches highlights five key points:

1) There is a scarcity of biodiversity valuation studies in developing countries. Our searches of the EVRI and the WoK identified 195 and 284 papers respectively. Further, in the EVRI search, developing country studies represent only 11.5% of all biodiversity valuation studies.

2) The EVRI database, which was set up largely to provide a portal of valuation studies for use in future benefits transfer, appears to have successfully picked up the majority of economic studies: the EVRI collated a total of 195 economic studies, while the WoK search identified 183 economic studies. This bodes well for the potential future use of EVRI for benefits transfer in developing countries; although the low number of papers may be an issue. The reason for the disparity in numbers between the two searches stems from the slightly different search terms used. However, a review of the actual papers identified in the searches indicates much commonality between the two databases.
3) There appears to be a reasonable distribution of valuation studies across continents (although the EVRI tends to pick up predominantly Asian studies). The EVRI data, however, highlights that the majority of studies have been undertaken in the more advanced developing countries; with no studies reported in the poorest countries with transition economies.

4) Contingent valuation, opportunity costs and questionnaires tend to dominate the literature on valuing biodiversity in developing countries; with limited apparent use of the other techniques. However, it is likely that many of the non-economic applications are published in the grey literature and therefore not picked up in our searches.

5) About half of the studies conducted in developing countries did not appear to involve researchers from those countries. This may raise questions about the ability of these studies to account for local nuances. However, one-third of studies were led by local researchers indicating some local research capacity.
5. **Review of Economic and Non-economic techniques**

5.1. **Review method**

In this section, we present evidence on the suitability of a range of economic and non-economic techniques to assess the importance of biodiversity to people in developing countries. This review includes: a summary and overview of method; the extent of the use of the method in developing countries; an evaluation of methodological, practical and policy related issues; and a state-of-the-art exemplar of the application of the technique. We avoid methodological details as these have mostly been presented in a previous Defra review of valuing natural resources (Eftec, 2006).

Data for this review was principally derived from the papers identified from the two systematic searches (See Section 4). The results of the database searches provided example papers of the application of different valuation methods in developing countries. Because of the general lack of methodological papers relating to the application of methods in developing countries, additional literature was also examined and referred to, such as methodological and theoretical work that did not directly apply to developing countries. Further, because many valuation studies in the review were lacking in specific details about the problems associated with application to developing country contexts, a questionnaire was also sent to researchers and practitioners. This questionnaire aimed to collate further information on methodological and practical challenges and issues associated with apply the techniques in developing countries and where possible identify solutions or design adaptation to address these challenges. The questionnaire also sought to identify significant barriers to adoption of the outcomes of the research at local, regional and national levels and steps taken to address these issues. Around thirty questionnaires were received from researchers and practitioners from a wide range of developing countries. The comments from respondents were incorporated into the technique reviews.

The review of techniques is structured according to broad groupings of techniques, as outlined below:

- **Economic methods**
  - *Market-price approaches*: market prices, tourist revenues, bio-prospecting;
  - *Market-cost approaches*: replacement costs, damage cost avoided, production function approaches;
  - *Revealed preference approaches*: travel cost method, hedonic pricing method;
  - *Stated preference methods*: contingent valuation, choice modelling;
  - *Participatory approaches to valuation*: deliberative monetary valuation, mediated modelling;
  - *Benefits transfer*

- **Non-economic methods**
  - *Non-economic consultative methods*: questionnaires, in-depth interviews;
  - *Non-economic deliberative and participatory methods*: focus groups, citizen’s juries, health-based valuation methods, Q-methodology, Delphi surveys, Rapid Rural Appraisal, Participatory Rural Appraisal, Participatory Action Research;
5.2. Market-based Approaches

5.2.1. Market-price approaches

Objectives and background

Market-price approaches utilise directly observed prices and / or costs from actual markets related to the provision of an environmental good or services as a proxy to the value of that environmental good or service. The proxy market prices might include observation of patterns of resource use and local trading prices, tourist revenue from visits to a biodiversity-rich site, or bio-prospecting contacts. There are a number of alternative market price approaches; the distinction between which is largely based on the type of price used as a proxy to value.

There are three main types of market-price approaches that are used to value biodiversity, namely: those based on patterns of resource use and local trading prices (e.g. Turpie et al., 2003; Le Roux and Nahman, 2005); those based on financial revenues from tourists to areas of high biodiversity; and those based on the value of bio-prospecting contracts (Nunes and van den Bergh, 2001; Nijkamp et al., 2006).

It is important to stress that ‘price’ and ‘values’ are two distinct notions. Market pricing approaches focus on the ‘supply-side’ aspects of the provision of environmental goods and services. As such they do not directly correspond to the notion of ‘total economic value’ or ‘maximum willingness to pay’, and therefore can only be considered to provide proxies for direct use (and sometimes indirect use) values. Other components of the value of biodiversity are not captured by market price approaches include option use and non-use values. Therefore, great care needs to be taken in the application of these methods and in the interpretation of results using these methods.

Application of the technique in countries with developing economies

In our systematic search of biodiversity valuation studies in developing countries, no studies were found in either the EVRI or Web of Knowledge searches. However, a number of studies were identified in a broader search of the literature.

In South Africa, market-price approaches based on resource use patterns and trading prices and tourism revenues have been used in estimating the direct use values of biodiversity in terms of consumptive use e.g. food, fuel, grazing, traditional healing, building, crafts, etc. and tourism (e.g. Turpie et al., 2003; Le Roux and Nahman, 2005). McCauley and Mendes (2006) also utilise market-price based approaches to value alternative ecosystem services associated with Centre Hills, Montserrat – see case study in Section 0 for more detail.

Nunes and Van den Bergh (2001) refer to bio-prospecting agreements in Costa Rica and Brazil, claiming that the value of such agreements ($1 million for 2000 samples of Costa Rica’s genetic pool; and $3.2 million for 30,000 samples of biota in various parts of Brazil) can be seen as a lower bound estimate of the market value of biodiversity in the areas in question. Ten Kate and Laird (1999) also provide an extensive review of bio-prospecting agreements.

Methodological issues in the context of countries with developing economies

The market-price method based on tourism revenues can provide a useful indication of the recreational value of biodiversity, such as sightseeing (Nunes and van den Bergh, 2001). However, the majority of market-price methods can only be used to estimate direct use values of biodiversity; thus, indirect use, option use and non-use values are not considered. This is a significant shortcoming, since direct use values may represent only a small proportion of the total economic value of biodiversity in the region (Koo and Wright, 1999; Nunes and van den Bergh, 2001; Le Roux and Nahman, 2005). The exception to this is the bio-prospecting contract approach, which can be seen as providing an estimate of the option and quasi-option
values associated with biodiversity (i.e. the value of leaving biodiversity intact for possible future use; e.g. in medicines).

**Practical and policy issues in the context of countries with developing economies**

Market-price approaches based on tourism revenues and local resource use are relatively straightforward and generally less time consuming and resource-intensive to apply than non-market valuation techniques. Thus, they can relatively easily be applied in countries where skills and/or resources are lacking; as is often the case in developing countries.

These methods, however, requires reliable information on tourism revenues or resource use patterns and prices, which may be difficult to obtain in many developing countries, and particularly in rural areas. Further, the informal nature of market transactions in many rural areas means that prices may vary widely in different circumstances, or may be absent altogether (e.g. in cases where goods are bartered rather than traded for money).

Since market-price approaches may be sensitive to the ability to pay (incomes) of the local population, and also only capture direct use values, they are likely to underestimate the actual value of biodiversity to local populations in poor rural areas, which in turn may create a bias against the protection of biodiversity in these areas. There is therefore a limit to the extent to which values based on market-price approaches can be used to inform management and policy at local and/or regional levels. Values based on market-price approaches should ideally be supplemented with values based on other approaches which are less sensitive to ability to pay (such as non-economic techniques) and/or which are able to capture other types of value (such as replacement cost, damage cost avoided, and stated preference techniques).

**Examples of using the technique**

The Montserrat case study (Section 6.2) provides a useful example of some of the difficulties and solutions to using market-price approaches to value biodiversity.

**References:**


5.2.2. Market-Costs Approaches

**Objectives and background**

Market-cost based approaches include a range of methods in which the costs of a market good or service related to the environmental good or service is used as a proxy to the value the environmental good. For example, the replacement cost method uses the costs of replacing an environmental service as a proxy to the value of that service, while the damage cost avoided approach uses the costs associated with mitigation of environmental damage as the proxy to value. The opportunity cost approach explicitly considers the value that is foregone in order to protect, enhance or create a particular environmental asset. Other cost approaches include shadow price costs, mitigation costs, costs of alternatives, subsidy costs (Eftec, 2006). The final market-cost approach, the production function approach, focuses on the (indirect) input costs of a particular environmental service to the production of a marketed good. It is stressed that none of these market-cost approaches measure the total economic value of the environmental resource, but rather a proxy to value.

**Application of the technique in countries with developing economies**

In our systematic search of biodiversity valuation studies in developing countries, 21 studies were found in the EVRI search relating to the replacement cost, whilst a total of 80 studies were found in the Web of Knowledge search including: 4 studies that utilised the replacement cost method, 9 studies that utilised the damage cost avoided method, 55 studies that utilised opportunity costs and 12 studies that used production function approaches.

The replacement cost method has been used within a number of developing countries to value the cost of soil erosion, including in Sleman, Java (Moller and Ranke, 2006), and in Sri Lanka (Gunatilake and Vieth, 2000). Other applications have focused on the valuation of wetlands in Shanghai (Su and Zhang, 2007) and sustainable forest management in Malaysia (Kumari, 1996).

The damage cost avoided approach was been used to value the storm protection services delivered by mangroves forest in Thailand in terms of the reduction in expected future storm damage (Barbier, 2007), and the value of rodent pest control in Tanzania (Skonhoft et al., 2006). A more novel application of the method include the study undertaken by Hein and Gatzweiler (2006) who examined the potential value of the Ethiopian coffee gene bank to coffee harvests globally on the basis of increased avoidance of coffee berry disease and coffee rust, avoided costs of decaffeination and an increase in overall yields. The calculated values reveal the Net Present Value attributed to the coffee genetic resources of the Ethiopian highland forests to be $420-$1458 million annually.

The opportunity costs approach has been utilised across a wide range of study areas. For example, Naidoo and Adamowicz (2006) use the technique to develop spatial maps of the opportunity costs of conserving forest corridors between landscapes; Wale (2008) use the estimated average opportunity costs of sorghum production to estimate the size of policy incentives required to promote on-farm conservation in Eastern Ethiopia. The approach has also been extended to the ecosystem services level. Zelek and Shively (2003) measure the opportunity costs of carbon sequestration on tropical farms in the Philippines, and conclude that carbon storage is less costly if delivered through agroforestry than through pure tree-based systems. Dong et al. (2007) use opportunity costs (in conjunction with shadow price and market price approaches) to calculate the value of agricultural ecosystem services in the Loess Plateau in China where severe soil erosion threatens the ecological environment. In their study they revealed the economic values of: conserving soil and water; the fixing of $CO_2$ and release of $O_2$; the maintenance of nutrient cycling and the decontamination of the environment. The gross value of these services was calculated as being 170 times higher than the agricultural production value.
The production function approach has been used in developing nations predominately to study agricultural and related areas. These range from: examining changes in agricultural production within 18 developing countries from 1961-1985 (Fulginiti and Perrin, 1998); examination of the economic efficiency of alternative land tenure arrangements within Ethiopia (Ahmed et al., 2002); and investigation into the determinants of food crop production and technical efficiency in the guinea savannas of Borno State, Nigeria (Amaza et al., 2006). At the species and gene level, areas as diverse as the technical efficiency in cattle farming in Colon County, Venezuela has been measured (Ortega-Soto et al., 2007), while studies from the Punjab, Pakistan, use the production function to measure the contribution of genetic resources and diversity to wheat production (Smale et al., 1998). Within marine habitats, use of the production function has helped to value and subsequently protect mangrove forests in Southern Thailand from conversion to shrimp aquaculture (Barbier et al., 2002). In the Solomon Islands, the technique has been used to assess the extent of technology transfer in fisheries, in the context where local fishing rights had been transferred to ‘distant water fishing nations’ in return for technology transfer (Campbell and Hand, 1998).

Finally, it is interesting to note that a number of studies have used a combination of market and non-market valuation techniques to assess the total economic value of environmental resources. For example, Kumari (1996) uses a combination of market prices (where available), damage cost avoided approach, surrogate/replacement cost approach and production function effect to assess the total economic value of benefits from various ‘sustainable’ management options for the peat swamp forests of North Selangor, Malaysia. Similarly, Su and Zhang (2007) utilise direct market valuation, replacement costs and contingent valuation to assess the total economic value of the Jiuduansha Wetland, Shanghai.

Methodological issues in the context of countries with developing economies

Market-cost based approaches can only be used if a set of conditions are met. For example, the replacement cost approach requires that human-engineered replacement options are available and that individuals would be willing to accept this replacement (Bockstael et al., 2000). Other approaches require that the environmental goods have clear market-based substitutes, or that the degradation of the environment can be mitigated against.

Further, all of the market-cost based approaches require detailed information on the effect of the environmental resource on production costs, supply conditions for output, demand curve for the final good and/or factor supplies (Efte, 2006). Data availability therefore plays a significant role in the selection and structure of a market-cost based approach. Indeed McCauley and Mendes (2006) indicate that data availability and quality was a serious constraint for implementing various market-cost approaches in their Montserrat study. Further, on several occasions, they were forced to transfer information / data from other regions, as well as make some rather large assumption on the use of that data (more detail of this case study can be found in Section 6.2).

Practical and policy issues in the context of countries with developing economies

Most market-cost approaches are relatively straightforward and generally less time consuming and resource-intensive to apply than non-market valuation techniques (Gunatilake and Vieth, 2000). Thus, they may be relatively easy to apply in countries where skills and/or resources are lacking; as is often the case in developing countries. However, Gunatilake and Vieth (2000) demonstrate that although the replacement cost method may be relatively inexpensive, they question the reliability of the method to assess the on-site costs of soil erosion.

The production function approach, however, does require significantly higher levels of technical input and thus there may be local research capacity issues in some developing countries.
Examples of using the technique

Naidoo and Adamowicz (2006) utilise a novel approach to assess the opportunity cost of land preservation in landscapes that are changing from natural habitats towards agriculture in Paraguay. Their basic approach is interesting in that the models developed are based on only the most basic data that is generally available in the data-poorest regions of developing countries. The model developed integrates probabilities of habitat conversion with region-wide estimates of the economic benefits from agricultural land uses and discounted land values. From this model, a map of the opportunity costs was produced to estimate the costs of conserving forestry, and to allow for the creation of an ecological corridor between landscapes.

References:


5.3. Revealed Preference methods

5.3.1. Travel Cost Method

Objectives and background
The travel cost method (TCM) is a revealed preference method in that it uses data on people’s actual behaviour in real markets that are related to the environmental good in question; rather than their conjectured behaviour in hypothetical markets as is the case with stated preference methods. In travel cost models, the environmental good in question is usually outdoor recreational resources such as public forests, national parks etc., which importantly for this review may harbour high levels of biodiversity. The behaviour studied is the number and distribution of trips that people make to such sites, as a function of, most importantly, the cost of a trip. The basic zonal travel cost model was originally developed by Wood and Trice (1958) and Clawson (1959). Two types of travel cost models now dominate the literature: count models in which the valuation data are based on the number of trips to a site (Haab and McConnell, 2002; Christie et al., 2006a) and random utility travel cost models in which recreation trips to all potential sites is observed, allowing valuation of the environmental attributes of the sites to be undertaken (Hanley et al., 2002). More recently, contingent behaviour models have been developed that combine travel cost models with stated preference models (Christie et al., 2007a).

The travel cost method is generally not used to value biodiversity in its entirety. Rather, its focus tends to be on recreational benefits derived from visits to a biodiversity-rich site such as protected areas, national parks etc. It should be noted that the TCM can not estimate non-use values and is not well suited to measuring change in environmental quality (Freeman, 1979).

Application of the technique in countries with developing economies
In our systematic search of biodiversity valuation studies in developing countries, 36 TCM studies were found in the EVRI search, while 7 studies were found in the Web of Knowledge search.

The method has been used to estimate the recreational value associated with particular aspects of biodiversity in developing countries, such as recreational fishing in Brazil (Shrestha et al., 2002), wildlife viewing in Kenya (Navrud and Mungatana, 1994), coral reefs in South East Asia (Seenprachawong, 2003; Ahmeda et al., 2007), and estuaries in South Africa (Cooper et al., 2003; Le Roux et al., 2005; Turpie et al., 2005). Although the majority of TCM studies have focused on international tourist travel costs to biodiversity-rich recreation sites in developing countries (Navrud and Mungatana, 1994), there are some applications in which local recreation trips have been valued. For example, the sample used by Maharana et al. (2000) in their TCM study of the recreational, biodiversity and sacredness values of lake Khecheopalri, Sikkim State, India comprised local residents of Sikkim, pilgrims, residents from outside Sikkim, and tourists from outside India. The results from this study indicated that local residents had significantly lower values for the preservation of the lake (US$ 0.88) than those of the international tourists (US$ 7.19). Also, the study demonstrated that the cultural aspects of the site significantly increased the value of the site compared to other comparable sites.

More novel applications of TCM include Pattanayak et al. (2004) who applied insights from travel cost modelling to value the contribution of fuel-wood collection from the Ruteng Nation Park, Indonesia to rural households.

Methodological issues in the context of countries with developing economies
The TCM has limitations in terms of what it can usefully be used to value. In particular, the methods has predominantly been used to value recreational use values such as sightseeing (Nunes and van den Bergh, 2001). Recreational values are a particular type of (non-consumptive) direct use value. The method, however, can not readily be used to value other
aspects of the total economic value of biodiversity, and in particularly it can not value non-use values. Furthermore, TCM is generally not able to value changes in environmental quality without prior information or without the use of data from multiple sites or over time, which can become data- and resource-intensive and/or time consuming.

The current literature unfortunately does not provide much insight into specific methodological issues relating to the application of TCM in developing countries. Potential issues might include: how to calculate the costs of travel if people walk / cycling to recreation site; how to estimate the value of time in a subsistence economy. Although these issues are far from insurmountable, further research is required to clarify best practice.

**Practical and policy issues in the context of countries with developing economies**

Although the TCM has successfully be used to estimate the value that international tourists have for trips to biodiversity-rich areas within developing countries (Navrud and Mungatana, 1994), people in the poorest economies tend not to travel for recreation, which in turn may preclude the use of the TCM for valuing the importance of biodiversity to indigenous populations. Further, even when people from developing countries do visit their local biodiversity-rich areas, by definition, their travel costs will be significantly lower than that of international tourists (as illustrated in the Maharana et al. (2000) study). This in turn might suggest that local residents value their local biodiversity rich resources much less than visitors; even although in many cases the indigenous population may be very much more reliant on that resource for survival (Pattanayak et al., 2004). This imbalance of values between local and international people may lead to policy makers putting lower weighting on local people’s values. Perhaps a potential solution to this issue would be to present value estimates in terms of its percentage of total expenditures of the different user populations.

As outlined above, the values obtained from TCM are restricted to capturing use values; as such, these techniques provide only a lower bound estimate of the value of a particular biological resource (Nijkamp et al., 2006). Results may therefore have to be supplemented with results obtained by other methods in order to provide useful policy information regarding the total economic value of biodiversity in a particular area.

As with many of the other types of economic valuation studies, there are also likely to be issues with respect to the capacity of local researchers to design, administer and analysis travel cost surveys.

**Examples of using the technique**

One of the more novel applications of the TCM was a study undertaken by Pattanayak et al. (2004), who applied insights from travel cost modelling to estimate the contribution of firewood collection to the welfare of households in the buffer zone of the Ruteng National Park in Flores, Indonesia. The TCM was based on the opportunity cost of time taken to collect firewood relative to household’s reported wages; where wages were based on the market value of the household’s animals, farm size, and a wealth index (which was linked to a count of household possessions). GIS analysis was used to identifying some of the environmental determinants of the travel costs such as forest quality and the distances to roads. Individual surplus estimates of $0.55 per trip and $122 consumer surplus per annum could be attributed to firewood collection. This is a substantial amount in this poor part of Indonesia where restrictions in access to forest would represent high costs to the local population.

**References:**


5.3.2. Hedonic Pricing Method

Objectives and background
Hedonic pricing (HP) is a revealed preference method in which the value of a non-market, environmental good is revealed through observations of the demand for a related complementary marketed good (Freeman, 1993). Hedonic Property Pricing (HPP) is a particularly application of HPP in which ‘weak complementarity’ is assumed between the price of a property and the quality of the surrounding environmental (e.g. landscape amenity, noise, air quality etc.). HPP was first applied to environmental valuation by Ridker and Henning (1967), who examined the impact of air pollution on residential property values. Typically, HPP proceeds through three stages: (i) a hedonic price function is estimated; (ii) implicit prices are calculated for the environmental good of interest which yields marginal values; and (iii) welfare measures of discrete changes in environmental quality are estimated. The method is generally suited to value the impacts of localised and site-specific ‘goods’ such as pleasant landscapes, and ‘bads’ such as noise from airports. However, the method is largely limited to those few environmental impacts that have clear links to property prices.

Application of the technique in countries with developing economies
In our systematic search of biodiversity valuation studies in developing countries, 12 HPP studies were found in the EVRI and 2 studies in the Web of Knowledge search. An example of the application of hedonic pricing is the study that applied the method to value environmental amenity in Windhoek, Namibia (Humavindu and Stage, 2003).

Methodological issues in the context of countries with developing economies
The existing literature provides little discussion of the methodological issues relating to the application of HPP in developing countries. However, it is envisaged that access to reliable data on property prices may be an issue in many developing counties. In the poorest countries and / or in more remote rural areas, this might be articulated in terms a total absence of a market for property. In the more advanced developing countries, it may be that that property market is poorly defined, or that data on property prices is not collected or available in a format suitable for analysis.

More generally, the HPP technique is limited in terms of finding meaningful relationships between biodiversity and house prices. Existing studies have generally been based on the relationship between house prices and landscape amenity / environmental quality (Humavindu and Stage, 2003). Other possible applications in developing countries could be based on potential relationships between the ease-of-access from a property to biodiversity resources such as rivers (for fishing) or forests (for fuel wood, and other non-timber products); however, we are unaware of any such studies.

Practical and policy issues in the context of countries with developing economies
The Hedonic Pricing Method requires a developed property market in the country of study. Often in developing countries, such a market may not exist; particularly in countries where there are issues related to the title ownership of land. Further, even if a property market exists, access to high quality data on property prices is likely to be a significant practical issue in many developing countries.

Examples of using the technique
The HPP technique was used in Windhoek, Namibia, where the municipal government pursued a policy of land release to low (incomes of $160 US per month) and ultra low ($45 US per month) income families. The study was based on analysis of the sale of 479 properties within the north and north-western suburbs of the city. The analysis indicated that close proximity to the Goreangab reserve raised house prices by $1980 US dollars (Humavindu and Stage, 2003).
References:
5.4. Stated Preference Methods

5.4.1. Contingent Valuation

Objectives and background
The contingent valuation method (CVM) is a stated preference, non-market valuation technique. Contingent valuation estimates economic values by constructing a hypothetical market and asking survey respondents to directly report their willingness to pay (WTP) to obtain a specified good, or willingness to accept (WTA) to give up a good. Because it creates a hypothetical market place in which no actual transactions are made, contingent valuation has been successfully used for commodities that are not exchanged in regular markets, or when it is difficult to observe market transactions under the desired conditions (Alberini and Cooper, 2000).

Since CVM is able to value goods that are not exchanged in regular markets, the method is generally recognised as being one of the most appropriate economic valuation techniques for the valuation of biodiversity; primarily because it is able to estimate non-use values (for which no market transactions occur) as well as use values. Indeed, it is often argued the CVM can estimate the value of biodiversity in its entirety (whereas other methods can only capture individual components of the value of biodiversity), thereby negating the need to use other methods in the valuation exercise. It also allows for the valuation of possible future scenarios, such as hypothetical changes in environmental quality; unlike market-based and revealed preference approaches, which are generally limited to valuing the present state of biodiversity (Nijkamp et al., 2006). Although CVM has had many critiques in the past (Kahneman and Knetsch, 1992; Diamond and Hausman, 1993), it is now widely accepted by both the academic and policy making communities (Arrow et al., 1993; HM Treasury, 2003) and there are guidelines for best practice (Arrow et al., 1993); although we question the appropriateness of these guidelines for application in developing countries. Alberini and Cooper (2000) provide a useful summary of CVM studies conducted in developing countries, while Whittington (1992; 1998) provide excellent critiques of the application of CVM in developing countries.

Application of the technique in countries with developing economies
The CVM method has been widely used for valuing biodiversity benefits around the world (Nunes and van den Bergh, 2001). Although most studies have focused on valuing biodiversity in the developed world, our review of EVRI identified 121 CVM studies that valued biodiversity in developing countries, while the review of the Web of Knowledge identified 74 studies. These included studies that directly valued a natural resource, such as tropical rainforest protection (Kramer and Mercer, 1997), and the Cedar Forests in Lebanon (Sattout et al., 2007). Other studies have valued recreational amenity and conservation in national parks and forest sites (Moran, 1994; Navrud and Mungatana, 1994; Shyamsundar and Kramer, 1996; Hadker et al., 1997; Shultz et al., 1998). Existence values of biodiversity have also been valued including those for the Fynbos biome in the Western Cape, South Africa (Turpie, 2003).

Methodological issues in the context of countries with developing economies
Much of the debate surrounding the validity of CVM has been addressed with the publication of the NOAA guidelines (Arrow et al., 1993), while Eftec (2006) provide an overview of some general issues relating to the application of CVM. In relation to application of CVM in developing countries, Whittington (1992) suggests that the reasons contributing to the low quality of many CVM studies in developing countries include: poor administration and execution of studies; poorly crafted scenarios; and the lack of testing of the researcher’s key assumptions about the way local people think about the environmental good. In a later critique, Whittington (1998) highlights some identified key lessons, which include:
• **Enumerator training.** The contingent valuation method and related concepts such as ‘economic value’ and ‘maximum willingness to pay’ are likely to be unfamiliar and/or confusing to both local enumerators and respondents. There will therefore be a need to provide adequate training to enumerators to ensure that the CVM study is administered properly.

• **Language issues.** In some developing countries, the words used to describe the CVM “hypothetical” scenario, e.g. "suppose" or "imagine", may either be lost in translation, or in some cases the conditional subjunctive may actually not be translatable.

• **Misleading responses to questions.** In developing countries, it is often considered impolite for people to disagree with others in authority. For example, Whittington describes a pilot study in which all respondents stated ‘Yes’ to the WTP question. During a subsequent investigation of this result, it emerged that respondents were actually stating ‘Yes, but…’, and then giving a range of qualifications was to why they might not be WTP. Further research was undertaken to identify which ‘Yes, but…’ responses actually meant ‘yes’ and which meant ‘no’. A coding list was then subsequently developed to account for this local nuance. In another study, Shultz et al. (1998) found that CVM participants in Costa Rica exaggerated their stated WTP amounts in an effort to impress the interviewers.

• **Setting referendum prices.** Whittington suggests that there has been a tendency for CVM researchers to set the highest referendum ‘choke price’ too low. The main reason for this has been to avoid potentially embarrassing situations where interviewers are required to ask people if the are WTP high prices. However, not effectively including the choke price will have consequences for the analysis of the CVM responses.

• **Administration issues.** People in the more remote areas of developing countries will often discuss surveys conducted in their village. In some villages where a discrete choice CVM study has been conducted, this has lead to confusion over why different people are being asked different bid amounts, which subsequently may affect the communities trust in the programme.

Other methodological issues include the fact that some countries have no monetary economy, or are in transition towards one. This causes problems since respondents may have less understanding / experience of the relative monetary value of goods and services, and thus will have difficulties in expressing WTP values for environmental goods. A number of researchers have attempted to overcome this issue by asking respondents to express their preferences in other terms. For example, Shyamsundar and Kramer (1996) asked respondents how many bowls of rice they would be prepared to accept as compensation for the loss of access to forest lands annexed to a national park in Madagascar. This WTA (in baskets of rice) was later found to be correlated with other measures of household wealth and with household-grown crops, therefore allowing monetary valuation. Rowcroft et al. (2004) also avoid these problems by asking focus group participants to allocate 100 thumb pins (representing the sum total of their forest values) between different types of forest values. This produced a measure of the ranked importance for each forest value.

The majority of CVM surveys conducted in developing countries have used a dichotomous choice WTP elicitation format, with one or more follow-up questions (in some cases, with an added final open-ended question). Whittington et al. (1990) argue that this "bidding game" approach is well understood and accepted by respondents in developing countries, who, unlike the counterparts in the United States or Western European countries, are used to negotiating over the price of items they purchase on a regular market. These conclusions clearly differ from the NOAA panel’s recommendations that suggest a ‘referendum’ elicitation format.
Hadker et al. (1997) suggest that protest zero responses relating to government provision of environmental goods may be a significant problem in developing countries. In their study of the Borivli National Park, the lack of trust in the government meant that an alternative payment vehicle was required, in which the environmental quality of the National Park would be delivered by ‘an honest, credible, reliable autonomous agency disassociated from the government’.

Whittington et al. (1992) have explored the influence of incorporating ‘time to think’ into a contingent valuation survey on the provision of a water supply system in Nigeria. He used a split-sample experiment, in which one sample was given a ‘standard’ CV protocol, while the second allowed respondents ‘time to think’ about their values, i.e. they were asked to go home, discuss matters with family members and neighbours before answering the WTP question. The results indicated that those respondents who had had ‘time to think’ reported systematically lower WTP amounts. The researchers ruled out strategic considerations as the reason for these findings, and concluded that giving respondents ‘time to think’ resulted in WTP bids of superior quality. Urama and Hodge (2006) also come to similar conclusions where participatory education significantly improved respondent’s perception of the environmental problem and the precision of their WTP.

Given the above observations, it would appear that many of the methodological issues associated with applying CVM in developing countries stem from the assumption that people in developing countries think in the same way as western researchers. Clearly this is not the case, so finding ways that more appropriately consider the context in which these methods are used is important. The use of local researchers and enumerators is therefore considered fundamental to ensuring that local nuances are taken into account. However, this may mean that, at best, application of many economic methods will need to be applied through local cultural practices, and at worst may become obsolete.

Practical and policy issues in the context of countries with developing economies

Although CVM has successfully been used to value a wide range of biodiversity values, Nunes and Van den Bergh (2001) argue that CVM is not appropriate ‘for those biodiversity value categories that the general public is not informed about nor has experience with [such as ecosystem functions and ecosystem services]’. He further argues that attempts to describe such services in a survey will be extremely difficult and ‘will almost certainly be too cumbersome to be utilized in a practical and effective way’. Further, these problems are likely to be particularly pertinent in developing countries, where people are less likely to be informed about environmental issues.

Whittington (1998) however argues that it can be easier to administer high quality contingent valuation surveys in some developing countries than in developed countries. He suggests that response rates are typically very high in developing countries, and respondents are often quite receptive to listening and considering the questions posed. He also argues that interviewers are relatively inexpensive, and that this allows the CVM researchers to use larger sample sizes and conduct more elaborate split-sample experiments. However, CVM studies require analysts and enumerators that are fairly well-endowed with appropriate skills and experience; which often are lacking in developing countries. Therefore considerable effort needs to be undertaken to train local researchers.

In terms of administering CVM studies, most studies in developing countries have relied on in-person interviews conducted by local enumerators, who usually need training by an international team (Alberini and Cooper, 2000). There are practical reasons for the use of in-person interview: the literacy levels in some developing countries are often too low to permit mail or self-administered surveys; telephones are often not available (especially in rural areas), and local enumerators are relatively cheap to hire.

The absence of recent / reliable official population statistics in some developing countries can cause problems for developing a rigorous sampling frame (Hadker et al., 1997). Further, this
causes problems for comparing the respondents in the sample with those of the population of the area from which the sample was drawn (Whittington, 1998).

CVM is considered to be capable of providing useful and meaningful results for policy. In particular, CVM can assess both use and non-use values and therefore provides a full assessment of the total economic value of biodiversity. Most other approaches are incapable of assessing non-use values and will therefore underestimate total economic value (Nijkamp et al., 2006).

Finally, Whittington (1998) suggests that both anthropologists and sociologists working in the field of development studies have harshly criticized economists' use of large-scale household surveys as "extractive"; meaning that researchers extract data from respondents and give them little, if anything, in return. He therefore argues for a more action research focus to CVM.

Examples of using the technique

Perhaps some of the most influential CVM studies conducted in developing countries have been undertaken by Whittington, who provides two very useful critiques of the method based on his (and others) experiences (Whittington, 1992, 1998). Shyamsundar and Kramer (1996) and Rowcroft et al. (2004) provide useful examples of how CVM can be conducted in countries with no or an underdeveloped monetary economy. Finally, Whittington et al. (1992) and Urana and Hodge (2006) provide examples of how participatory approaches may be incorporated into CVM studies to aid understanding of biodiversity issues and subsequently improve value revelation.

References:


5.4.2. Choice Modelling

Objectives and background
Choice modelling (often referred to as choice experiments) is a stated preference valuation technique. The choice modelling (CM) technique estimates economic values by constructing a hypothetical market for the non-market environmental good, e.g. biodiversity. However, rather than being given a discrete Yes / No choice (as in contingent valuation), respondents are presented with a series of choice tasks in which they are asked to choose their preferred policy option from a list of (usually) three options; one of which normally includes maintaining the status quo or a ‘do nothing’ option. Each option is described in terms of a bundle of attributes describing the good (including a price attribute) presented at various levels according to an orthogonal fractional factorial experimental design. The analysis of respondent choices is based on random utility maximising (RUM) theory (Hanemann, 1994); however, in CM preference values are estimated for a range of levels of the policy attributes (as opposed to a single policy option which is the case in CV). Louviere et al. (2000) and Hensher et al. (2005) provide a comprehensive discussion of the design, administration and analysis of CM.

Application of the technique in countries with developing economies
The systematic search identified 5 studies in the EVRI database that valued biodiversity in developing countries and 17 studies in the Web of Knowledge database.

Choice modelling has been used to value various aspects of biodiversity in developing countries. Studies of nature-based tourism include Naidoo and Adamowicz (2005) and Bienabe and Hearne (2006). Other applications include estimates of economic benefits of preserving the cultural heritage of the ‘My Son’ World Heritage Site in Vietnam (Tuan and Navrud, 2007). Evaluations have also examined how much people in developed countries value biodiversity in developing countries. For example Rolfe et al. (2000) estimate Australian’s values for rainforest conservation in Vanuatu.

The method has also evaluated genetic resources such as indigenous cattle in Kenya (Ruto et al., 2008) and ‘hairless creole pigs in Yucatan (Scarpa et al., 2003). A number of choice models have also examined the value of ecosystem services, including the valuation of hydrological ecosystems in Indonesia (Barkmann et al., 2008), and biodiversity and ecosystem services at the Central Sulawesi rainforest margin (Barkmann et al., 2007).

Methodological issues in the context of countries with developing economies
The literature provides very little insight into potential methodological issues associated with using CM to value biodiversity in developing countries. However, given that CM is a stated preference method, it is likely that many of the issues affecting contingent valuation (see Section 5.4.1) will also affect CM.

Thus, the lack of local research capacity (in terms of key researchers and enumerators) is likely to be an issue in developing countries. Indeed, the design, administration and analysis of CM is more complex than that used in contingent valuation studies (Louviere et al., 2000; Hensher et al., 2005) and thus research capacity is likely to be a more significant issue for CM.

The format of the choice task in choice models is also more complex than that used in CVM. Therefore, it is likely to be more difficult to explain this task to respondents. Enumerators will therefore require more training and language issues may be more prevalent. Given the potential complexities of CM choice tasks, more participatory approaches to the administration of the study (such as those used by Urama and Hodge, 2006) may offer an approach that helps to ensure that respondents attain a good understanding of the environmental good and therefore allow them to better reveal their value preferences. These
approaches may need to pay much more attention to applying the technique through traditional cultural or thinking practices to avoid the problem of imposing a western way of conceptualising environmental goods and services. This will inevitably require input from anthropologists and ethnographers, which also brings additional challenges when trying to bridge the epistemologically and philosophically different disciplines.

Choice modelling may, however, provide some advantages over CVM. For example, in CM the critical choice question is focused on respondent’s assessment of the relative benefits derived between bundles of environmental and monetary attributes, while in CVM the critical question is based predominantly on whether or not the respondent wishes to accept a specified monetary amount. This movement away from the monetary element in the choice decision is likely to be advantageous in countries where respondents have little experience of a monetary economy. Further, in choice modelling it is likely to be easier to incorporate other measures of value (such as bags of rice) as a proxy to the monetary attribute. Although no such studies were identified in our literature search, Christie et al. (2007a) demonstrates the potential of this type of approach in a study where he utilised travel costs as the monetary attribute in a CM study of UK forest recreation.

Practical and policy issues in the context of countries with developing economies
There are few studies that indicate the practical and policy issues affecting CM, but these are also likely to be similar to those indicated for the CV literature.

It is likely that Whittington’s (1998) arguments that it is often easier to conduct CVM studies in developing countries than in developed ones will hold true for choice modelling where response rates and receptivity to questions posed are typically high. Also, local interviewers will tend to be relatively inexpensive, allows the use larger sample sizes. However, CM tends to be more complex than CVM and therefore more training of local researchers will be required. Also, in locations with high levels of illiteracy, it may be difficult to describe the choice task using traditional interview techniques, and therefore more participatory approaches may be needed.

Finally, the results from a choice model tend to be a series of values for different levels of provision of a range of environmental attributes. Decision makers can therefore focus their decisions on the relative values of environmental attributes. This, to some extent, overrides potential problems of bias and other potential issues that might systematically affect that absolute values attained. Contingent valuation, on the other hand, tend to produce a single value for a composite change in the provision of the environmental good, and therefore the focus of decision makers is centred on the absolute values. Thus, choice modelling may be a less risky technique in that useful policy information is delivered even if absolute values are corrupted.

Examples of using the technique
There are few examples of choice models that have valued biodiversity in developing countries. Key examples include (Tuan and Navrud, 2007; Wang et al., 2007; Xu et al., 2007). However, much can be learnt from the experiences of applying contingent valuation, and a key text here is Whittington (1998).

References


5.5. Participatory Approaches to Valuation

5.5.1. Deliberative Monetary Valuation

Objectives and background

‘Deliberative Monetary Valuation’ (DMV) aims to combine stated preference valuation methods with elements of deliberative processes from political science (Spash, 2007a). The development of DMV has come in response to various observations from, and criticisms of, stated preference methods. These include the fact that focus groups and stakeholder involvement were already being incorporated (albeit informally) into stated preference valuation studies (Brouwer et al., 1999; Niemeyer and Spash, 2001) and that the inclusion of deliberation was seen as a method to addressing the combined issues of preference construction and low level of public knowledge of complex environmental goods (Alvarez-Farizo and Hanley, 2006).

DMV therefore provides an alternative, more participatory, inclusive and deliberative approach to valuation, in which emphasis is placed on the quality of the social process used in the valuation exercise (Sagoff, 1998; Niemeyer and Spash, 2001; Wilson and Howarth, 2002; Lienhoop and MacMillan, 2007). DMV attempts to draw on the advantages of both neoclassical economic valuation and political processes, and applications can be found at various points along the continuum between these two perspectives. Spash (2007b) provides some clarity to the categorisation of DMV approaches by suggesting that applications may be split in terms of whether the objective is to elicit individual values or social values, as well as whether the means of articulating that value is based upon group or individual choice.

In practice, DMV is normally administered through a small group of selected individuals, whom prior to expressing their valuations are provided with time for reflection, information gathering and group discussion (Spash, 2007b).

Application of the technique in countries with developing economies

No applications of deliberative monetary valuation were identified from our literature search. Spash (2007a) however provides a detailed review of the empirical literature on DMV as applied in developed countries.

Methodological issues in the context of countries with developing economies

Although there are no applications of DMV in developing countries, Spash (2007b; 2007a) provides a detailed critique of the method and it is likely that many of the methodological benefits / issues raised by Spash are likely to also be relevant to applying DMV in developing countries.

Given that DMV provides significant opportunities for presenting information and deliberation, the method is likely to be well suited to the valuation of complex environmental goods such as biodiversity and ecosystem services; particularly in situations where the participants are likely to have low levels of understanding of such goods or have implicit knowledge of the good which may require time to articulate. Further, the participatory approaches employed by DMV will also lend the method to valuation in countries with low levels of literacy.

DMV draws its roots from both economic valuation and political processes, and as such can be designed to elicit either individual values or social values. This is important since in some developing countries, social values may be more important than individual values.

Practical and policy issues in the context of countries with developing economies

DMV is normally administered through small group workshops. Therefore, many of the merits associated with group activities (as described in Section 5.8.1; Focus groups) will be relevant to DMV. These benefits may include: more ‘buy-in’ from participants, which in turn
can increase the quality of their contributions; and enhanced participant’s learning and capacity building through the sharing of perspectives. However, group dynamics may also induce bias into the results particularly if dominant members of the group (such as village leaders, or males) unduly influence discussions. Careful selection of group participants and good facilitation will be required to help to counter some of these negative impacts.

Examples of using the technique

Although there were no applications of DMV found in developing countries, studies by Macmillan et al. (2002) and Gregory and Wellman (2001) illustrate the range of applications possible. In the former, Macmillan follows a more standard stated preference, economic valuation approach in which the deliberation is used predominantly to obtain more valid exchange values, while in the latter Gregory and Wellman aim to elicit social values. Spash (2007a) also provide a comprehensive review of DMV applications.

References


5.5.2. Mediated modelling

Objectives and background
Computer models of complex systems are frequently used to support decisions concerning environmental problems. For such models to be effective, the models need to be developed through a consensus building process across relevant academic disciplines as well as between the science and policy communities, and the public. Mediated modelling is a process of involving these stakeholders as active participants at all stages of the modelling, from initial problem scoping to model development, implementation, and use (Costanza and Ruth, 1998; van den Belt, 2004). The process of mediated modelling can help to build mutual understanding, solicit input from a broad range of stakeholder groups, and maintain a substantive dialogue between members of these groups. Mediated modelling and consensus building are also essential components in the process of adaptive management (Gunderson et al., 1995; van den Belt, 2004).

Application of the technique in countries with developing economies
No applications of mediated modelling were identified from our literature search. However, the follow two examples have been identified from broader searches of the literature. The first is the model developed to assess the ecosystem services delivered by the fynbos landscape in the Cape Floristic Region, South Africa and to assess the value of these services to society (Cowling and Costanza, 1997; Higgins et al., 1997). The second application develops a consensus-based simulation model for the management in the Patagonia coastal zone (Van den Belt et al., 1998). Further, Van den Belt (2004) provide a useful summary and synthesis of the mediated modelling approach.

Methodological issues in the context of countries with developing economies
Mediated modelling is a very flexible in that it can easily adapt to different levels of data, detail, scope and complexity, and therefore is capable of dealing with the potential data availability issues in developing countries. However, the process of producing a credible mediated model is quite intense and will require significant resources.

To be effective, the mediated modelling process requires that a range of stakeholders volunteer their time, knowledge and energy into the process. This might be difficult to achieve without a political mandate. There may also be issues with respect to finding local experts in developing countries to contribute to the modelling process.

It is currently unclear whether a mediated process will produce consistent and repeatable results if the same problem was addressed by different groups of stakeholders.

Practical and policy issues in the context of countries with developing economies
Mediated modelling potentially could be used to assess any value that a group of stakeholders could identify and build into a model, and there is certainly scope to use the approach to assess the value of biodiversity from a stakeholder’s perspective in developing countries.

There are potential issues with respect to the political acceptance of results from mediated models. Often, and particularly in developing countries, political institutions are accustomed to controlling the outcomes of decision processes. Mediated model conversely utilises a bottom-up, consensus-building process to set the research agenda and deliver policy outcomes, thus potentially being seen as undermining the political process.

Examples of using the technique
The fynbos landscape in the Cape Floristic Region, South Africa is an extremely rich floral landscape supporting 8,500 plant species (68% of which are endemic) and is considered as being one of the World’s ‘hottest’ biodiversity hotspots (Meyers, 1990). A mediated modelling approach was used to develop a ‘fynbos ecological/economic’ model that aimed to
address the question: ‘what services do these species-rich fynbos ecosystems provide and what is their value to society?’ (Higgins et al., 1997). The model was developed during a two-week stakeholder workshop that resulted in a seven consensus-based research papers that critically assessed the practical and theoretical issues surrounding ecosystem valuation as well as assessing the value of services derived by local and regional communities from fynbos systems (Cowling and Costanza, 1997). An ‘atelier’ (or combined workshop/short course) approach was used to form multidisciplinary, multicultural teams, breaking down the traditional hierarchical approach to problem solving. Open space (Rao, 1994) techniques were used to identify critical questions and allow participants to form working groups to tackle those questions. Benefits and costs of management scenarios were addressed by estimating values for harvested products, tourism, water yield, and biodiversity. The model was considered to be a valuable tool, resulting in the implementation of many of the model’s recommendations.

References


5.6. **Benefit Transfer**

**Objectives and background**
Benefit transfer uses economic information captured at one place and time to make inferences about the economic value of environmental goods and services at another place and time (Wilson and Hoehn, 2006). Value estimates may be transferred as monetary values (e.g. mean or median monetary values) or as value functions conditioned on explanatory variables. These values functions may be based on either original valuation data, estimated using meta analysis of summary values functions, or derived from a process of econometric calibration as in structural benefit transfer (ibid.).

**Application of the technique in countries with developing economies**
The systematic search of the Web of Knowledge identified only two studies that had utilised benefit transfer to transfer biodiversity values in a developing country context.

Benefit transfer was utilised in north western Belize to produce spatial ‘economic value maps’ of the Rio Brave Conservation Area. The spatial analysis was undertaken using Geographical Information Systems (GIS), in which values from other sites were calibrated to the site under investigation based on the relative "strength" and / or "quality" of the donor sites (Eade and Moran, 1996).

Benefit transfer has also been incorporated into an assessment of the economic costs of climate change impacts on protected areas in Africa. Taking results, downscaled from Global Circulation Models (GCMs), ecosystems are classified under the Holdridge Life Zone (HLZ) system (Velarde et al., 2005). A benefit transfer is then incorporated, introducing economic value to predict the change to ecosystems in protected areas under climate change predictions by the Intergovernmental Panel on Climate Change (IPCC), for the middle and end of the 21st century. Twenty HLZ were identified within the study and only three of these were predicted to remain unchanged due to climate change. The estimation of the potential economic losses under various climatic scenarios were also modelled (Velarde et al., 2005).

**Methodological issues in the context of countries with developing economies**
Over the past two decades, benefit transfer has matured into a viable approach for estimating the value of environmental goods and services (Wilson and Hoehn, 2006). There now exists a distinct theoretical framework for benefit transfer and innovative methods have been developed to statistically control error and bias (Loomis and Rosenberger, 2006; Rosenberger and Stanley, 2006; Spash and Vatn, 2006). A state-of-the-art review of the theory and practice of benefit transfer was published in 2006 in a special edition of *Ecological Economics* (Wilson and Hoehn, 2006). A general issue from this review was that benefits transfer is ultimately dependent on the quality of the original studies and that these studies are adequately reported. This is likely to be a significant hurdle for effective benefit transfer in developing countries.

It is likely that any specific theoretical and methodological issues affecting benefit transfer in developing countries will be similar to those encountered in developed countries. A discussion of these issues can be found in the 2006 special edition of *Ecological Economics* (Wilson and Hoehn, 2006). A key issue, however, for future benefit transfer is the need conduct high quality empirical studies that have been designed specifically with benefit transfer in mind.

**Practical and policy issues in the context of countries with developing economies**
Based on our review of EVRI and the Web of Knowledge (Sections 4.1 and 4.2 above), it is clear that there have only been a limited number of original biodiversity valuation studies undertaken in developing countries and that these studies certainly do not cover the range of possible biodiversity and ecosystem service impacts. Thus, finding relevant valuation studies to feed into benefit transfer is likely to be a significant issue in developing countries. A
further compounding issue is the quality of many valuation studies undertaken in developing countries, and that any errors or biases found within these studies will affect the validity of value transfers. Iovanna and Griffith (2006) show that, even in developed countries, the lack of high quality empirical studies often results in important ecological services being neglected in policy analysis.

A possible solution to the lack of empirical studies from developing country could be to transfer values from empirical studies undertaken in another country. Ready and Navrud (2006) provide a useful review of international benefit transfer, and highlight some of the unique issues and challenges. These issues include: how should values be converted from one currency to another; how to account for differences in measurable characteristics when those can vary markedly between countries (especially income); and how to account for differences between countries in culture and shared experiences that are difficult to quantify. They, however, conclude that these challenges are not that different from those encountered in transfers between regions within a country, and transfer errors are comparable to those seen in intra-country transfers. However, Barton (2002) found transfer errors of 87% to 130% when they transferred values derived in Portugal to avoid ill health episodes caused by contaminated seawater to a Costa Rica case study.

Examples of using the technique

The Benefit Transfer technique has been undertaken in the Rio Brave Conservation Area in north western Belize. This particular example incorporated the use of Geographical Information Systems (GIS) to calibrate economic values from other sites for transfer to the site under investigation. The primary step was the mapping of the natural capital assets in the Rio Brave, based on the "strength" or "quality" of the sites, then re-calibrating the transferred benefit estimates from other sites. The results provided “economic value maps”, showing the benefit value attributed to the natural capital assets investigated. The integration with GIS providing a spatial element to this technique (Eade and Moran, 1996).

References


5.7. Non-economic Consultative Methods

5.7.1. Questionnaires

Objectives and background

Questionnaires are a structured process of inquiring into and recording people’s perceptions on particular topics or issues, which can be used to explore knowledge, feelings, attitudes, opinions, past experiences and expectations.

They may be delivered by post, fax, e-mail, telephone, or personally. Questionnaires may be completed independently by the intended respondent/s or by means of interview where the researcher records the response (Fink and Kosecoff, 1998). They may include a variety of question ‘types’ and can elicit qualitative and / or quantitative information such as ‘open ended’ and ‘close ended’ questions (Weladji et al., 2003).

The value of the outcome relies on a number of variables relating in particular to the quality and rigour with which the questionnaire is designed, delivered and analysed; and the characteristics of the target population which influence their responsiveness to the technique (Kish, 1995).

Use of questionnaires is widespread within the development, natural resource management and conservation arenas, and is usually delivered through face to face interviews (avoiding problems of low literacy and education levels). Questionnaires are often employed as part of wider package of tools e.g. in Participatory Rural Appraisal.

Although questionnaires may provide useful information on what, how and why people value biodiversity, the method does not provide a direct means of estimating economic values of biodiversity. However, questionnaires (and in particular in-person interviews) are the main survey instrument used to collect data for many of the economic valuation techniques (and in particular stated preference techniques).

Application of the technique in countries with developing economies

There were 48 studies relating to questionnaires within the literature review covering a range of topics relating to biodiversity. This figure reflects the flexibility of the technique and its use within other techniques in addition to the variety of components of biodiversity to which it could be applied. Examples of the diverse range of issues questionnaires can address are: the genetic diversity and distribution of yams (Tamiru et al., 2008); the monitoring of population declines (Ratcliffe and Crowe, 2001), (Chepstow-Lusty et al., 2006); ethnobotanical surveys (Gemedo-Dalle et al., 2005; Suneetha and Chandrakanth, 2006); identify links between consumption of fish and mercury poisoning in indigenous populations (Boischio and Henshel, 2000) and ecosystem management (Terer et al., 2004) and (Struhsaker et al., 2005).

Methodological issues in the context of countries with developing economies

Well administered questionnaires can provide consistency across a large number of responses in a study. The information generated can be either qualitative or quantitative or a combination of both and is considered one of the more “scientifical valid” qualitative social surveys techniques.

A high degree of adaptability allows for inquiry relative to the degree of investigation required. This adaptability allows for design specificity such as: structured or semi-structured questionnaires (Tamiru et al., 2008), implementation in local dialects and the use of sampling frames, which can help identify individuals, stakeholders and other key users groups through sampling methods (Aguilar-Stoen and Dhillion, 2003). The element of human interaction involved with most questionnaires allows for the collection of personal data and application at both the individual and household level and across a range of locations.
The level and quality of response is dependent on the quality of the questionnaire design, where ambiguous or vague questions will result in ambiguous or vague answers. Questionnaire design may lead to responses which may be open to inconsistency, falsification, tactical responses, bias or poorly considered responses, whilst questions relying on memory may be inaccurate (Oppenheim, 1996; Weladji and Tchamba, 2003).

The relative inflexibility inherent within structured questionnaires may leave issues under investigated where insight and issues are revealed, which cannot be readily probed within the structured format.

However, a good questionnaire survey, well prepared and well organised in terms of design, delivery, analysis and reporting can generate very valid and powerful information for a variety of purposes.

**Practical and policy issues in the context of countries with developing economies**

Structured questionnaires allow for a high degree of consistency even when different people administer the questionnaires. Members of the local population can be trained to implement them, thus circumnavigating dialect and language issues and cultural nuances, thus allowing for broader application and lower cost inputs.

Culturally the technique may be inappropriate with: access to female respondents inhibited; village elders may act as gatekeepers with respondents providing potential bias by answering what the village chief/elder wishes to hear or men wish to hear (Weladji et al., 2003). In addition, there is a risk of respondents answering based on what they believe the interviewer wants to hear. The questionnaire design should consider cultural aspects to avoid offense and negation of the whole process.

A degree of literacy (for written questionnaires) and articulacy is required whilst questionnaires implemented through external researchers may miss out on cultural nuances (Bourque and Fielder, 1995).

However, the quality of any survey is dependent on good organisational skills throughout and the scope and quality of the sampling frame. Careful design, administration, analysis and pre-testing, can provide lots of information at the individual and household level, particularly if used in combination with a package of measures, thus providing lots of quantitative and statistical information to help build a strong platform for policy development (Rawlins et al., 2007; Ssegawa and Kasenene, 2007)) Rigour, combined with appropriateness and quality of design are key components of good questionnaire design, helping to avoid inaccurate and misleading outcomes and the subsequent development of inappropriate policies based on poor surveys and unreliable data.

Local infrastructure may provide logistical problems to application and questionnaire interviews may be difficult to administer due to seasonal or diurnal work schedules of respondents. Within humid environments, papers will go soggy and electronic equipment can fail easily, making response recording challenging.

Transparency should be sought to avoid the manipulation of specific outcomes by policy makers to present a case that may be out of context and misleading.

Good questionnaire survey material can provide a very clear picture of a situation and provide a very sound basis for good policy making.

**Example of using the technique**

Questionnaires were used to determine the value of native and exotic trees to inhabitants of six local villages in Gombe National Park, Western Tanzania. The results identified the 10 most important tree species to each interviewee and subsequently the 25 most important tree species to the communities as a whole. Existing understanding of chimpanzee ecology highlighted that many of the trees most highly valued in the study, played a major dietary role within the chimpanzee population. As an aid to this conflict, recommendations were
developed stating the need to maintain native tree usage outside of the park boundary and the managed planting of exotics to meet local requirements (Chepstow-Lusty et al., 2006).

References:


5.7.2. In-Depth Interviews

Objectives and background
In-depth interviews aim to capture the words people use and the interpretations they make of how they value or understand something. They are often conducted on a one to one basis and can be structured to varying extents from using specific questions and prompts to using unstructured open-ended interviews that minimize direction by the investigator facilitating emergence of issues and interpretations most pertinent to the interviewee. In-depth interviews are qualitative methods that are employed by investigators with very different philosophical positions which influence what is captured, the precise methods used, and the way the results are analysed (Minichiello et al., 1995). Data from interviews are usually transcribed and analysed using a range of methods that involve coding statements in transcripts, then comparing coded statements within and across data from different interviewees (Strauss and Corbin, 1998). Data analysis is time consuming and complex, but can be enhanced by computer aids that assist investigators to focus thinking, improve rigour, and cross-reference data (e.g. NVIVO). In-depth interviews can theoretically be used to capture any concept or value. They are particularly useful for identifying questions and qualifying statements by interviewees.

Although in-depth interviews may provide detailed information on what, how and why people value biodiversity, the method does not provide a direct means of estimating economic values of biodiversity. However, some of the economic valuation methods (and in particular the Deliberative Monetary Valuation approach) may use in-depth interviews to collect data. Further, in-depth interviews are often used to aid the development of economic valuation protocols.

Application of the technique in countries with developing economies
There were 13 studies identified in the literature survey through the Web of Knowledge database. This low number is probably a reflection of lack of use of interviews as an isolated technique for valuation rather than a general lack of use in issues relation to environment and development in developing countries per se. Interviews are, for example, often used in conjunction with other approaches, especially in earlier stages of research and have been used extensively as part of participatory rural appraisal and participatory action research. Examples of the use of in-depth interviews include assessing the impact of values and behaviour of people living in and outside of protected areas (Lynagh and Urich, 2002; Gareau, 2007), values of components of biodiversity (Kaplowitz, 2001; Altrichter, 2006), effect of invasive species on rural livelihoods (Siges et al., 2005), economic values of wildlife (Gustad et al., 2004), and sustainable forest management (Herrmann, 2005).

Methodological issues in the context of countries with developing economies
In-depth interviews are a flexible method that can be adapted to a wide variety of circumstances enabling deep probing through iterative questioning and capture of information that is often missed by more structured or quantitative techniques. The effectiveness of the technique is, however, dependent on skilled researchers as there is much potential for the results to be influenced by the way in which questions are asked and analysed. This causes significant difficulties as local researchers fluent in local languages are usually lacking in sufficient training to conduct and analyse in-depth interviews. At the same time, researchers from outside the study area often lack the local language and translators are often ineffective in capturing the detail that makes in-depth interviews useful. Because interview data can reveal much about the interviewee, stringent measures to ensure confidentiality are also required.

While some researchers with positivist views may argue that the technique lacks scientific rigour, this is usually a misinterpretation of the aim of much of qualitative or social research. Subjectivist views of social research, for example, often aim to capture peoples’ perceptions
of reality rather than ‘reality’ itself because it is a person’s perceptions that influence their interaction with others and their environment (Dyson and Brown, 2006). The emphasis by many social researchers is therefore maintaining reliability and validity for understanding reality as perceived by an individual rather than reliability and validity in understanding the world external to individuals. Techniques like in-depth interviews are therefore often applied by social researchers to capture and express the wide variety of values, ascertain the meaning of those values, and how they influence behaviour rather than necessarily trying to determine ‘average’ values or commonalities for a large population sample. In-depth interviews are therefore highly applicable in developing countries for capturing and understanding the variety of values, how they are embedded and expressed within cultural norms, and how those values give rise to certain behaviours.

**Practical and policy issues in the context of countries with developing economies**

In-depth interviews can be very inclusive providing opportunities for marginalised or minority groups to participate and speak out and express views that they may be uncomfortable raising in groups. However, the reverse can also be true if there is little trust in the researcher or where there are significant cultural divides between the investigator and interviewee. Much can be done, however, to build trust and present a more relaxed atmosphere in which interviews are conducted, such as conducted interviews in a context in which the interviewee feels comfortable, such as while they are working.

The technique can also be time consuming, especially during transcription and analysis phases, which reduces ability to get a wide cross-section of interviewees with different background and interests.

Interviews can elicit socio-psychological information that is not accessible through less ‘probing’ techniques leading to deeper and more profound understanding of a situation and more meaningful policies that better reflect local views. However, lack of quantitative aspects of interviews may mean that the results are not easily expressed in a ‘language’ suitable for policy makers. That is, without concise quantitative data that can be rapidly summarized and absorbed, policy makers may find it difficult to absorb and use the results.

**Example of using the technique**

The effect of the invasive shrub *Piper aduncum* on rural livelihoods in Papua New Guinea used in-depth interviews. Qualitative information was obtained from three villages where clan ownership of land is the norm (Siges et al., 2005). In the first village, older men were interviewed separately from their wives, as women are supposed to remain silent when men communicate with visitors. In the second village, an open village meeting was held and then people were interviewed individually. In the third village many people spontaneously told stories related to the shrub. The interviews revealed that the communities use piper for many different purposes: from fire wood to fencing; soil erosion control to medicinal purposes. In addition, the interviews also revealed gender differences in the use of the shrub which in some cases provided alternative sources of income for women.

**References:**


5.8. **Non-economic Deliberative and Participatory Approaches**

5.8.1. **Focus Groups**

*Objectives and background*

Focus groups generally aim to discover the positions of participants regarding a pre-defined issue or set of related ideas and/or how participants interact during discussions. In-depth groups are a related technique where participants may meet on several occasions but where much greater emphasis is placed on how the group creates discourse on the topic.

Work in focus groups can be grounded in a variety of theoretical frameworks (Dyson and Brown, 2006). Importantly, however, most of the theoretical frameworks recognize that many underlying understandings, preferences, and values are unlikely to be expressed when people are questioned individually using interviews. That is, without the social interaction that enables participants to discuss and respond to the perspectives of others, much of their implicit knowledge and values do not surface (Fazey *et al*., 2006) issue is recognized by in-depth group techniques that derive principles and practice from Group Analytic Theory, which aims to give maximum freedom to participants to define and develop their own discourse. Nevertheless, for natural resource valuation, focus groups and individual interviews each provide different and useful information (Kaplowitz, 2001; Kaplowitz and Hoehn, 2001).

In theory, focus groups can be used to encapsulate any concept of value, although monetary valuation is often not the objective and groups will most likely be used to help participants choose between conflicting objectives or make decisions for certain circumstances. More often, focus groups contribute to monetary valuation research by helping contextualize work and identify questions. They can also be useful as part of a deliberative process in which the participants use the focus group to understand their own and other’s attitudes before taking part in other aspects of group work (e.g. citizen’s juries).

*Application of the technique in countries with developing economies*

The review found only 11 studies relating directly to valuing biodiversity using focus groups in the Web of Knowledge database. This probably reflects the generally low number of valuation studies using focus groups rather than the specific use of focus groups in relation to biodiversity in developing countries. Focus-groups have been used to understand how individuals in groups frame and understand different issues and policies (e.g. local ecological knowledge of fishers, (Baird and Flaherty, 2005); provide the basis of other valuation methods (e.g. choice experiments, (Bienabe and Hearne, 2006); and are often used within a broader suite of participatory research methods (e.g. (Danielsen *et al*., 2000; Ormsby and Kaplin, 2005) and participatory methods used to promote learning and capacity building (see Solomon Islands case study; Section 6.4).

*Methodological issues in the context of countries with developing economies*

Focus groups are versatile, and can make use of the opportunities provided by group discussions to increase motivation and input from participants. For example, the value of discussions can be captured in structured ways (e.g. using checklists, (Giuliani and Padulosi, 2004) or in less structured ways (e.g. collecting open-ended qualitative information, (Kaplowitz, 2001) with each method of data capture having merits and disadvantages similar to that of structured versus open interviews. Focus groups enable organisation of data according to interest groups; facilitate interest-based information gathering; are useful for identifying the nature and range of issues as well as eliciting ideas about solutions; and are a useful tool for analyzing institutional linkages, relationships, and areas of consensus. They are not particularly effective for gathering quantitative data, but are likely to be useful for capturing many of the complex spiritual and cultural values that are often lacking in valuation studies.
Focus groups can increase contributions from those most marginalized because of the confidence gained by working in groups and can contribute to learning and capacity building by promoting sharing of perspectives. There is, however, a danger that focus groups can contribute to greater polarization between stakeholders by promoting consolidation of ideas of particular groups or result in unreliable data through excessive input by powerful individuals within a group.

Careful selection and management of participants is also important to ensure inclusivity, and skilled facilitators and researchers that understand cultural nuances are required to manage groups, record, and analyse data. To capture the depth of information provided by focus groups, detailed qualitative analysis is required. One respondent from Papua New Guinea commented that there were major demands from participants wanting direct benefit from involvement (e.g., payment). This is a common issue and sometimes difficult to avoid, however, participatory approaches to research that emphasise local ownership and responsibility of the research and its results can help deal with these problems. This sometimes requires a researcher to walk away from circumstances where payment is demanded to avoid reinforcing aid dependencies.

Focus groups are an integral part of a wider package of measures that will inform biodiversity policy. Provided all groups are engaged and the process is well implemented, outcomes can be very informative, presenting overview of interests, positions, relationships between groups, and key issues of concern.

**Example of using the technique**

An example of use of focus groups was in Masoala National Park, Madagascar, where individual interviews and focus groups highlighted the broad lack of understanding by local people of the aims of the Park (Ormsby and Kaplin, 2005). Focus-groups were also used to great effect to assist development of choice-modeling surveys to determine public preferences for biodiversity conservation in Costa Rica and were essential for: Selection of attributes; identification of mechanisms for presenting choice scenarios; development of the scenarios to be presented to the participants; and development of appropriate sampling procedures. (Bienabe and Hearne, 2006).

**References:**


5.8.2. Citizen’s Juries

Objectives and background
Citizens’ juries are used to obtain carefully deliberated and informed opinions of members of the public regarding a single issue or alternative scenarios. Through a process of rational discussion similar to a court scenario, decisions can be made based on equity and sustainability (Kenyon et al., 2001). The commissioning of such projects is usually undertaken by an organisation with the power to act upon their recommendations and includes presentation of evidence from a number of experts and other stakeholders to 12-24 jury members. The process allows for cross examination of witnesses and the discussion of different aspects of the issue being addressed. The final outcome of the process is generally a report on the findings of the jury (Blamey et al., 2000; Othman et al., 2004).

Theoretically, citizen’s juries can capture all values and occurs through a process of deliberation and the building of informed preferences through the process of dialogue between the public, experts and politicians. It is particularly important because of the way in which managed deliberation can result both in the emergence of a range of values, but also in a consensus report at the end of proceedings. Emphasis is usually on capturing societal rather than personal values which are expressed qualitatively rather than quantitatively. Some studies have, however, integrated jury-like activities with economic valuation using stated preference techniques (Kenyon et al., 2001).

Application of the technique in countries with developing economies
No studies were found relating to the use of citizen’s juries in developing countries in relation to valuation within the Web of Knowledge.

Methodological issues in the context of countries with developing economies
The approach offers considerable potential for strong democratic decision-making that is conducted in an open and transparent way, with jurors allowed to call for expert witnesses (O’Brien, 2003) and is particularly relevant for addressing issues where there may be significant conflicts between participants and reducing inequality of power between experts and jurors (Kenyon, 2007). The effectiveness of the approach, however, is dependent on the ability of the jury to maintain focus on societal values rather than privately held values to ensure the range of values are captured (Rowe et al., 2005). Further, selection of jurors and witnesses requires careful consideration of equity in representation of diverse groups and inclusion of those most marginalized. Skilled facilitators are also needed to balance discussion and coerce jurors during proceedings which can be difficult to achieve (Smith and Wales, 1999). For valuation, application of citizen’s juries requires considerable skill and ability, which is likely to be lacking in countries with developing economies. External investigators may therefore be required, who may have problems following the proceedings if they are not familiar with the language, such as in recent application of the technique in Indonesia (Straton, 2006).

Practical and policy issues in the context of countries with developing economies
Extensive attention to design and planning is required to identify key stakeholders and witnesses, to maintain balance in proceedings and to minimize risk of the final results being questioned. Within the context of a developing country, alongside the high input costs of time and money, low national capacity may mean lack of skilled expert witnesses and facilitators will reduce ability to apply citizens’ juries. However, the capacity for discursive participatory groups or processes may already exist within some communities and may be embedded within cultural practices. Levels of education and lower literacy levels may influence and limit the degree of technicality covered (Niemeyer and Spash, 2001) and can introduce bias towards over-representation of more wealthy sectors in a jury. There is, however, potential for
novel application of techniques that have already been developed in community participatory processes for dealing with lack of literacy in the presentation and discussion of information.

The high degree of specificity, informative, and the consensus building nature of the technique provides immediate and meaningful results to feed into policy. However, potential for transferability of results to other locations is limited.

Example of using the technique
Citizen’s juries were used consider in North Sulawesi, Indonesia to consider whether more resources should be allocated to support conservation and cleanliness (Straton, 2006). The process aimed to increase community input into decision-making about the Bunaken National Park and build understanding among researchers and NGOs of how opinions and values change as people hear information from a range of experts and community representatives. The jury heard presentations from national park representatives, mangrove users, fishers, scientists, NGOs, and dive tour operators and agreed that financial and human resources should be allocated to the conservation and cleanliness as soon as possible and that a multi-stakeholder approach was essential to implementing the outcomes of the citizen’s jury. The Bunaken citizen’s jury independently decided to form a local group to organize similar workshops on issues that residents believed to be important for North Sulawesi.

References
5.8.3. Health-based valuation methods

Objectives and background
Health-based valuations measure the combined outcomes of health related factors on the quality and length of a human life. The approach is predominately used within the medical sciences and uses a range of techniques to measure the value of health technology purchasing decisions that may result in improvements in quality of life. The most readily used measuring techniques are: (i) quality-adjusted life years (QALYs), which combines the degree of improvement or deterioration in health and the timescale over which this will occur and also includes any resultant increase or decrease which may subsequently occur (Doctor JN et al., 2004); (ii) disability-adjusted life years (DALYs), which focuses on the estimates of the total amount of loss of healthy life due to premature death, disability or impairment (Briggs, 2003); and (iii) healthy-years equivalent (HYEs), which includes the entire health profile of a life under different health states, which may alter over time (Dolan, 2000).

The techniques are based on measuring the benefit of health interventions and the idea that healthy years are of more value than unhealthy ones. It can be used to determine how people value the health benefits of interventions aimed at improving environmental quality (e.g. air and water pollution) (Hubbell, 2004.; Freeman, 2006.) and possibly for understanding how people’s values might change over time as the quality or quantity of a particular environmental resource declines.

Application of the technique in countries with developing economies
Application of the technique in environmental contexts is limited, and the literature review of the Web of Knowledge identified only one study, which related to health impacts of poor air quality in Mumbai, India (Srivastava and Kumar, 2002).

Methodological issues in the context of countries with developing economies
There are a number of methodological issues relating to the use of each health-based valuation technique, particularly when attempts are made to value entire health profiles over time as opposed to a discrete health state. There are also issues regarding the values placed on certain groups of people across the demographic spectrum, such as lower value placed on the reduction of mortality for elderly populations with lesser levels of quality of life (Hubbell, 2004.). Difficulties can also arise when trying to determine whether environmental impacts are directly related to health over short time scales.

Practical and policy issues in the context of countries with developing economies
Implementation of the techniques requires a number of key skills in the design and administration of questionnaires and an understanding of statistical analysis for the calculation of weightings and collation of results. A high level of data is required. While there are existing indices for the weighting for some of the techniques, the suitability of transferability of these indices to developing countries is likely to be limited (Kanavos et al., 2000). Potential application of the technique in developing countries is likely to be very limited.

Example of using the technique
The costs associated with health impacts of poor air quality were studied in Mumbai, India (Srivastava and Kumar, 2002). Dose-response relationships of ambient air quality index and human health were investigated based on the time spent by an individual in different microenvironments during one day. The results found that the costs associated with avoiding the pollution amounted to only 29% of the costs associated with the total health damage of not avoiding the pollution.

In other research the global burden of disease and the contribution posed by environmental pollution was estimated (Briggs, 2003.). The results incorporated both developing and
developed countries within the study, and helped to identify the distribution of major diseases across geographic regions. Results were significantly hampered by the impoverished state of monitoring and reporting in many developing countries, resulting in high degrees of uncertainty in the findings. The lack of accurate monitoring and reporting of health conditions and other data will severely limit the applicability of the technique in most developing countries.

References:
5.8.4. Q-Methodology

Objectives and background

Q-methodology aims to classify beliefs and preferences of a group of people. It was originally developed by psychologists for the scientific study of subjectivity (McKeown and Thomas, 1988). While the method can potentially capture any kind of value, the process is not explicitly focused on quantifying or distilling these values. Instead it is concerned with how individuals understand, think, and feel about environmental problems and their possible solutions. It has been used in rural studies to study views on farming (Fairweather and Keating, 1994; Walter, 1997) and is becoming increasingly popular in studying perspectives on environmental conflicts (Visser et al., 2007) and broader environmental and democratic societal issues (Webler et al., 2001; Clarke, 2002; Salazar and Alper, 2002).

Q-methodology includes four main steps. First, a large set of statements about a particular issue are identified from qualitative data sources (often semi-structured interviews or existing written work). Second, a smaller number of statements (usually 20-50) are selected from the initial set. Third, participants (sometimes those already interviewed) sort or rank the reduced set of statements according to what they believe to be most and least important. Finally, the data is analysed using factor analysis. This enables the identification of key dimensions that best represent the total responses of a particular participant in relationship to the responses of others. For example, statements by farmers and conservationists on converging EU agendas of Natura 2000 and CAP were scored by participants and separated along different dimensions using principle components analysis. The study concluded that perspectives of the two groups were much less opposed than expected, indicating considerable potential for turning conflict into compromise (Visser et al., 2007).

Application of the technique in countries with developing economies

Only one study was identified in the Web of Knowledge search that used Q-methodology within a developing country (Cruz et al., 2007). Using both photography in conjunction with Q-methodology, the study identified criteria which local shepherds and administrators used in undertaking grazing management decisions.

Methodological issues in the context of countries with developing economies

Q-methodology does not necessarily require large sample sizes, and in many cases the first stage of data collection (e.g. interviews) is often collected for other purposes and requires relatively little modification for it to be useful for generating statements for sorting in a later stage. The method also has considerable potential for sorting the variety of qualitative views and values of participants and representing these along quantitative dimensions. This could, for example, be very useful for identifying the differences or similarities between groups about their views of complex spiritual and cultural values that are important in understanding people’s preferences for biodiversity (Schachenmann, 2006) and are usually only adequately elicited using qualitative methods. Q-methodology does have issues regarding the transferability of the results to different contexts, because the outputs represent where a particular individual’s view lies in relation to other individuals in the sample rather than correlating attitudes with individual characteristics that enable wider extrapolation of the results.

Practical and policy issues in the context of countries with developing economies

Successful application of Q-methodology is dependent on the familiarity of the investigator with the original data, the skill of the investigator in engaging subjects in discussion, and the way in which individuals are selected for interviewing. Both local knowledge and technical skill in interviewing and data analysis is therefore required. The method can be relatively time-consuming because of the two sets of interviews and analysis involved. Importantly, however, the method is well suited to modification using participatory techniques that enable
participants with limited formal education to take part, such as asking participants to rank images rather than qualitative statements (Cruz et al., 2007). The method also has elements of participation where an investigator is required to consult closely with participants. Thus, provided that the outputs are carefully explained and interpreted by participants, the method has potential to be incorporated into broader community participation and their goals.

Q-methodology has potential for assisting policy development by enabling assessment of the public’s views of biodiversity which can then be used to construct mass surveys and more in-depth testing of hypotheses, particular views of participants about environmental policies or implementation strategies, identification of stakeholders and subtle areas of commonality between them in relation to environmental goods and services.

**Example of using the technique**

Q-methodology was used in the central mountain region in Peru to investigate the criteria and preferences that shepherds and local administrators apply in making grazing management decisions (Cruz et al., 2007). The technique innovatively used photographs of different mountain areas rather than statements and participants ranked images according to the suitability of the area for grazing sheep. The results showed that shepherds and local administrators have different preferences and that the methodology provided different results to that of qualitative semi-structured interviews. The results have implications for understanding how the stakeholders make daily-decisions, which are not always commensurate with grazing management plans developed by the local administrators.

**References:**


5.8.5. Delphi surveys

**Objectives and background**

Delphi surveys elicit and refine group judgements of a set of experts. It is particularly useful when existing knowledge is limited. By using the technique, significant improvements are considered to be gained from relying on the collective knowledge of experts who are given opportunities to consider the issue over a number of iterations (Curtis, 2004). In the Delphi process, a question is set and the opinions of experts sought relating to the question. Responses are collated into a report and in a process of controlled feedback, the findings returned to the experts for subsequent deliberation and evaluation. This is an iterative process involving a series of rounds of deliberations and refinement (Taylor, 2003.). The technique has been used extensively, particularly in the field of health and prediction of future scenario building and forecasting.

Delphi surveys are not necessarily directly used for valuation and are more a means of summarizing information and knowledge and opinions of experts. However, this does not mean that the approach cannot be used to create iterative cycles of capturing values then asking more detailed questions from the respondents about the summary of the results obtained from all individuals included in the survey. That is, an iterative valuation questionnaire could be considered to be a form of Delphi survey. In general terms, however, Delphi surveys are extremely useful for the development of models, questionnaires and have considerable applicability to valuation of biodiversity (Christie et al., 2008).

**Application of the technique in countries with developing economies**

Only one study was identified in the Web of Knowledge review which used a Delphi survey to improve planning approaches to agroforestry in developing countries (Ndour et al., 1992).

**Methodological issues in the context of countries with developing economies**

The anonymity which is attached to Delphi allows for a range of viewpoints to be openly expressed, with the review procedure allowing modification and extreme views to be brought onboard minimising the risk of individuals being marginalised or vilified. However, there is bias associated with experts and non-experts being systematically over-confident and the narrow background with most experts having read the same material or speculating (Morgan et al., 2001; MacMillan and Marshall, 2005.). This is partly due to misunderstandings of the nature of expertise, and can be better dealt with by more careful selection of experts who have extensive experience that is directly related to the question being addressed (Fazey et al., 2006). A variant of Delphi, known as contributory Delphi, attempts to bring together informed individuals from across different disciplines, thus potentially addressing complex issues such as those often occurring in relation to human-environment relationships in developing countries where little information is available (Curtis, 2004). Delphi surveys are also adaptable, and if implemented well, can incorporate a wide range of stakeholders which can help break down barriers based on perspective, prejudice, or language and can be used for a range of geographical or ecological scales (MacMillan and Marshall, 2005.).

**Practical and policy issues in the context of countries with developing economies**

The Delphi rounds may be seen to be a time consuming process, but does provide relatively efficient inclusion of expert knowledge, such as that of practitioners, that is generally less well presented in the literature (Mendoza and Prabhu, 2000). There are no set guidelines for the number of experts, but 10 has been suggested as an acceptable norm, provided there is a good representation of specialists from relevant areas (Crance, 1987). The information can elicit technical detail, generally built on the basis of consensus, and thus is useful to policy makers. They are also particularly useful for helping design valuation tools such as Biodiversity Indexes (Kangasa and Pekka Leskinenb, 2005) that can be later used with a much wider group of people. The technique requires measured and careful research input.
during the summarizing and collation of data before it is then returned to the experts. Many developing countries will not have the time and resources or access to many people with these skills. Nevertheless, employing greater number of iterations in research generally will both increase the reliability and validity of the values captured and enables much deeper insights to be made about the true value of biodiversity and thus contribute to formulation of more effective policies.

Example of using the technique

Within Mumbai, India, Delphi has been used to evaluate options and develop strategies to improve the urban environment. A range of key stakeholders were consulted including: environmental agencies and activists; local government officials and other NGOs. Ten professionals were identified for the four rounds of Delphi; with the first three being iterative rounds involving a survey and a final round of in-person group discussions. The results allowed the ranking of nine key urban environmental concerns, providing the outline for the development of a framework to address the issues raised (Gokhale, 2001).

References:
5.8.6. Rapid Rural Appraisal (RRA)

Objectives and background

RRA first emerged in the 1960s and 70s as a tool for agricultural extension and rural development in the developing world. It was a response to: (i) the widespread failure of more traditional research methods in developing countries; and (ii) the failure of many ‘top-down’ development initiatives imposed upon communities by governments and development agencies. Decision-makers often used funds without making reference to local circumstances and imported technologies from the north rather than utilize and enhance locally conceived and more sustainable approaches (World Commission on Environment and Development, 1987). RRA therefore aimed to be a rapid, expert-led data collection method and a means of ensuring that local knowledge and circumstances were taken into account, and was widely endorsed by international agencies such as the Food and Agriculture Organisation (FAO) (Crawford, 1997).

RRA draws on the insights of field-based social anthropology and ethnography prevalent in the 1930s to 50s, emphasizing the importance of local situational knowledge but also of getting big things broadly right rather than focusing on achieving spurious statistical accuracy (IISD on-line (undated)). However, unlike its ethnographic forerunners, RRA was designed to elicit as much local information as possible in as short a time as possible. Thus was established an externally-driven - albeit participatory - research process, carried out by a skilled, multi-disciplinary team over a very short period (up to 5 or 6 days), with the purpose of providing new information and hypotheses (World Bank, 2008). The technique uses a range of ‘participatory tools’ in common with PAR and PRA, but in this case participants do not have ‘ownership’ of the process and the agenda is essentially that of the researchers. Furthermore, the limited timeframe of the process ignores the need for the researchers to establish trust and rapport with the target group beforehand. While the values encapsulated through the approach depend on the specific techniques used, in the case of developing countries, it can be useful for capturing direct-use values in a relatively short time.

Application of the technique in countries with developing economies

Despite RRA being a common method for research in developing countries, the review found only 5 studies in relation to valuation and the environment in the Web of Knowledge database. This is likely to be partly because of the relatively low number of peer-reviewed papers in the area compared to grey literature reports, but also probably because it has had relatively little exposure in valuation studies. Examples of the use of RRA include targeting conservation-development initiatives in the Amazon (Coomes et al., 2004) rapidly assessing trends in biodiversity in Mexico (Hellier et al., 1999), understanding transhumant behaviour in Bhutan (Moktan et al., 2008), understanding relationships between livelihoods, fire, and policy in Indonesia (Tacconi and Ruchiat, 2006), assessing asset possession for wealth assessments in the humid tropics (Takasaki et al., 2000) and the role of RRA in catalyzing community-based management in Venezuela (Zanetell and Knuth, 2002).

Methodological issues in the context of countries with developing economies

RRA can be adaptable and flexible in its approach, offering a range of simple techniques to elicit information from participants. It can capture a variety of data types, levels of information (individual, household, community, focus group etc.), qualitative or quantitative data, and information on both tangible and intangible issues. Some techniques enable in-depth ‘probing’ although the approach focuses on the broader picture rather than the fine detail. The range of tools also allows for triangulation of results. Yet, while the range of techniques can be effective, the process remains a fundamentally extractive, externally-driven one. The process itself is therefore not an empowering one for the participants (as it is in the case of PAR and PRA) and fails to capture the kind of subtle information and cultural nuances, ‘silent networks’ and so on, that can be highly influential in shaping participant attitudes and behaviours.
Practical and policy issues in the context of countries with developing economies

The approach incorporates a range of techniques making it adaptable to different local circumstances and research agendas. These enable participants to articulate their views on issues that are relevant to them, feed information into the research process and thereby influence its outcomes at a relatively superficial level. RRA makes use of local materials in its implementation, does not need sophisticated facilities or resources, and can be implemented in remote and inaccessible areas. The range of techniques applied also provides opportunities for cross-referencing and triangulation. The process is fast, enabling early reporting on critical issues. However, by the same token it is often heavily criticised for being 'quick and dirty' and as such, RRA can generate error, misinterpretation and possible failure to address important issues or the concerns of marginalised groups. RRA is therefore best suited to helping decision-making in emergency situations where speedy analysis and rapid response is needed, or as basic, preliminary research exercise in a longer-term programme of investigation rather than formulating sound policies. Effective implementation also requires a multi-disciplinary team of experts to lead the process, which is often difficult to achieve and costly. Inaccurate reflection of values may result in inappropriate actions that impact negatively on the community, its environment, and resources. RRA is generally case specific, and not designed as a tool to influence policy 'per se'. However, systematic analysis of a number of RRA reports in any region can contribute to policy formulation, and the short time span required to conduct RRA means that with caution, it can more quickly inform policy makers about how to respond to rapidly changing circumstances.

Example of using the technique

Furze et al. (1997) describe an RRA undertaken by a partnership of Charles Sturt University, Australia and the Inner Mongolian Grasslands Ecosystem Research Station (IMGERS) in China’s first grassland reserve - the Xilingol Biosphere Reserve in the Inner Mongolia Autonomous Region. The purpose of the RRA was to establish an information base to assist reserve management planning, suggest policy reform and establish a longitudinal research programme to explore and establish more sustainable approaches to the use of the grasslands. The RRA was seen as the first step of a lengthy journey – a rapid, multi-disciplinary data gathering exercise undertaken by ‘experts’ but drawing heavily on local knowledge, to establish a basic profile of the area and the issues facing it, including the values of local people.

References:


5.8.7. Participatory Rural Appraisal (PRA)

Objectives and background

Participatory Rural Appraisal includes a family of approaches and methods designed to emphasize local knowledge and enable local people to make their own appraisal, analysis, and plans. Like PAR and RRA, PRA is not a technique ‘per se’ but uses a variety of techniques to facilitate information sharing, analysis, and action among stakeholders. The key purpose is to enable practitioners, government officials and local people to work together to plan context appropriate projects and programmes (World Bank, 2008).

PRA emerged from RRA in the 1980/90s and is distinguished from RRA in the way that it advocates data collection and analysis by local people, with outsiders facilitating rather than controlling the process (Chambers, 1992). In its early years, PRA was viewed very much as an approach that was much more applicable to developing countries than to the developed world, but is now used in the developed world and in urban contexts. The approach is mostly implemented through facilitators, who enable local people to undertake their own analysis and identify their own plans for action. Participant empowerment is a basic principle of the technique. An underlying assumption is that local people are capable of carrying out their own investigations, analyses and planning. Extensive mentoring, training and other support may be necessary as preparatory work to ensure adequate capacity within the community to achieve this. Given this, the process itself is as important in terms of capacity-building and empowerment as the end product. Thus the quality of facilitation is of central importance and the potential value of the overall PRA process is much greater than the sum of its parts (i.e. its techniques). Many practical manuals have been produced to explain the process and describe the techniques available for its implementation (National Environment Secretariat (Kenya) et al., 1991; Borrini-Feyerabend, 1997; Jackson and Ingles, 1998; Asia Forest Network, 2002).

Questionnaires, semi-structured interviews, and focus groups are often used within PRA, but are also complemented by a range of other participatory exercises including:

- Participatory mapping: creation of maps of resources, activities, problems and opportunities in or around a community, which help to identify the dimension and scope of issues to be researched. A facilitator helps participants to draw a sketch map of their community as they perceive it to be, incorporating all the features, problems and opportunities that can be illustrated. In the context of biodiversity values, this exercise can reveal clearly where the community accesses natural resources or ecosystem services, to what end and how important these are to them.

- Ranking exercises: Identification, quantification and comparison of priorities and preferences. The technique may generate insights into the criteria through which different ‘actors’ make decisions, and can potentially be used to elicit values of biodiversity. For example, drawings on the ground can be used to represent items to be ranked. Participants then compare the importance of natural resources by giving them a score. Values may be recorded by placing numbers of stones (for example) in the matrix. The facilitator records reasons for priorities and preferences and confirms these with the participants.

- Transect walks and diagrams: Provides resource mapping information such as data on farming patterns; natural vegetation clearance; collection and use of natural resources; ecosystem services etc; and provides a clear picture of the community’s relationship with its environment. A facilitator takes an observational walk along a transect with a representative group of the community to capture the greatest diversity of ecosystems, topography, land-use etc. A large and highly variable community may require more than one transect. The facilitator discusses and records the local conditions along the route as well as the community’s problems and opportunities in respect of its
resources. The method aims to use the elements passed along the transect as a prompt for the local knowledge.

- Trend analysis: aims to learn how a community has experienced change over time in order to inform the planning process. Participants are asked to identify the most important changes that have occurred in the community. A time line is drawn in respect of each change, illustrating for example the availability over time of specific natural resources or environmental services. Discussions about the trend lines serve to probe more deeply for explanations for the changes and scenarios for the future.

- Seasonal Calendar: aims to present large quantities of diverse information in a common time-frame. It compares community activities, month by month, across sectoral boundaries. It identifies cycles of activity that occur on a regular basis and helps determine whether there are common periods of excessive environmental challenges or opportunities over the course of the year. It can, for example, identify periods of excessive resource use (for example over-fishing) or alternatively periods of traditional protection measures in respect of valued resources (e.g. ‘tabu’ areas). The calendar thus helps to relate community activity to the state of the environment over time and aids planning for more sustainable resource management.

Application of the technique in countries with developing economies

Eleven studies were found in the literature review of the Web of Knowledge. The technique is very common in developing country contexts, but has not been widely applied directly in valuation studies. Examples include use of PRA for developing management plans for natural resource management in Burkina Faso (World Bank and Agriculture Technology and Services Division (AGRTN), 1994) and for community based marine management in Samoa (King and Faasili, 1999).

Methodological issues in the context of countries with developing economies

PRA is flexible and adaptable and can capture a range of data types, levels of information (individual, household, community, focus group etc), and qualitative or quantitative data. The process allows for in-depth ‘probing’ where necessary. The range of techniques allows triangulation of results to strengthen the validity of outcomes. Participants have ‘ownership’ of both the process and the outcomes and are therefore more likely to support and sustain both, but this may mean that the results are less transferrable. The methodological focus of PRA on community participation can result in neglect of the need to bring together all levels and sectors of stakeholders for more ‘consensus’ participation (Warner, 1997). The strengths and weaknesses of the approach are also a product of the particular techniques that are used.

Practical and policy issues in the context of countries with developing economies

PRA can be very inclusive and action focused. Participants have ownership of the process and its outcomes which are therefore more likely to be supported and sustained. The process itself can build capacity and empower the participants and bring long term benefits through skills development and attitudinal change. It has the capacity to engage even marginalised groups and to ‘dig deep’ into sociological issues to help explain behaviours and relationships. The resource action plan that is commonly the outcome of the process can provide the foundation for community planning and activity for years to come. Having been established essentially for the developing country context, PRA techniques do not require access to costly or sophisticated materials (the approach encourages the use of readily available and familiar resources). PRA, however, can be time and resource intensive for both facilitator and participants alike. It can be disruptive of the daily social and work routines of participants, which may itself reduce and create bias in participation. Skilled facilitation is necessary to ensure integrity of the approach. Lack of sufficient preparation and contextual understanding by the facilitator may lead to the use of inappropriate techniques thereby generating invalid or unreliable data.
In practice, participants may identify unachievable priorities (for example resource action plans that potentially reduce biodiversity) and create conflict with policy-makers. Failure to meet desired outcomes can be counter-productive and actually ‘dis-empower’ the community. Likewise, political and administrative barriers may make the exercise counter-productive if participants are unable to translate their plans into action. Finally and importantly, in practice, many cases that are described and promoted as PRA are actually RRA, such is the ‘soft’ definitional boundary between them. Inappropriate implementation of the process by outside bodies according to ‘standard’ processes and promoting ‘quick fixes’ is a risk, especially where resources are scarce and understanding of the concept limited.

That aside, Resource Action Plans from PRAs have provided the basis for government and NGO support for numerous communities in developing countries. In some instances such as community forestry in India and Nepal legislation and policy endorse the approach as a vehicle for democratic decision-making at the local level and its role and impact in the arenas of natural resource management and local development have been considerable.

Example of using the technique
King and Faasili (1999) report the use of PRA in the development of community-owned Fisheries Management Plans in the case of some 65 villages in Samoa. Increased population, over-exploitation, the use of destructive fishing techniques and environmental disturbances have led to a serious decline in inshore and reef fisheries and the PRA process enabled communities to define their key problems, discuss causes, propose solutions and take appropriate actions. At the time of writing, 44 of the communities had completed their fisheries management plan and as a direct result many had gone on to establish community-owned marine protected areas.

References:
Participatory Action Research (PAR)

Objectives and background

Participatory Action Research (PAR) emerged in the 1990s out of recognition for the need to integrate understanding and practice in many ‘development’ arenas ranging from health to agricultural extension, urban planning to natural resource management. Since its emergence, it has been used extensively to plan, implement, monitor and evaluate many kinds of projects relating to community organization and development, natural resource management, health and nutrition programmes, education initiatives and more.

The key distinguishing feature of PAR as a participatory approach is that it is intended to contribute simultaneously to knowledge and understanding in social science and to social action, through active engagement of the target population in the research process and its outcomes (Barton et al., 1997). Its key features include: orientation of the research towards the needs and aspirations of local stakeholders; a strong link with locally generated initiatives; a direct feeding of research results into planning and action; and the involvement of non-local actors in the process (i.e. the researchers) as partners in the learning process. In this regard, PAR is now often referred to instead as ‘Participatory Action Learning’ and its outcomes are for the purpose of theoretical or conceptual development as much as for practical purposes. Wadsworth (1998) argues that PAR represents a ‘new paradigm science’ in the social sciences. She describes the conventional social science research process as a simple linear model wherein the researcher establishes and hypothesizes; undertakes fieldwork and analysis to test the hypothesis; and draws conclusions. The new paradigm is more complex, inclusive and cyclical where research is not just perceived to be a process that will be followed by action. Instead, it is action which is researched, changed and re-researched, by the participants. It also tries to be a genuinely democratic or non-coercive whereby those to be helped determine the purposes and outcomes of their own inquiry without being dominated by a particular group or the interests of an outsider.

The applicability of the approach to valuation, like in RRA and PRA, depends on the particular techniques used. It can therefore theoretically be used to capture any value. Further, the inclusivity and cyclical nature of PAR are key factors that increase the reliability of the research because participants become committed, see it to be relevant to their livelihoods (Lawrence et al., 2006), and the approach provides much scope for in-depth valuation studies, especially if a range of other techniques can be incorporated into the process (e.g. economic techniques). This does raise issues, such as how local participants can maintain control over the process when external technical expertise is required, but these are not insurmountable.

Application of the technique in countries with developing economies

Ten studies were identified by the review of the Web of Knowledge. Application of PAR has been more common in developing countries than in developed countries. Examples include involving communities in assessments for conservation, forest management, livelihoods (Mendoza and Prabhu, 2005; Toderi et al., 2007) and for understanding perceptions of protected areas (Ormsby and Kaplin, 2005), and integrating catchment, ecosystems and community health (Parkes and Panelli, 2001).

Methodological issues in the context of countries with developing economies

PAR is highly flexible and adaptable and comprises a number of techniques enabling it to capture a range of data types; levels of information (individual, household, community, focus group etc), qualitative or quantitative data; and on tangible and intangible issues. Incorporating a number of techniques also allows triangulation of results to strengthen the validity of outcomes. The approach therefore has the potential to provide a powerful evidential foundation for project planning at the local or national level, whilst also contributing readily to conceptual and theoretical development. The high level of participation associated with PAR, and the linkage it makes between understanding and practice, enable
different interest groups to reflect upon and compare perspectives (different ‘realities’) and by doing this the approach can help to resolve conflicts and build consensus within the community. As an iterative process, feedback from participants can and should be fed into the cyclical research process thereby strengthening its validity. PAR also allows in-depth ‘probing’ where necessary. The key difficulty is that PAR is extremely difficult to implement well and is inherently complex, lengthy, and resource-intensive. It therefore requires considerable skill in leadership, research and facilitation, a mix of which is rarely available, even in the developed countries. Thorough pre-planning and preparation before implementation is required to avoid generating unbalanced, unreliable or erroneous outcomes, and careful consideration given to how data is to be collated and analysed is essential of the results of the process are to be effectively communicated to policy-makers.

Practical and policy issues in the context of countries with developing economies

The flexibility, adaptability, trans-disciplinarity and scope are all important practical as well as methodological benefits of this process, as is the iterative nature of the process which allows for reflection and change. The process itself is empowering of participants. It can help to raise awareness, generate understanding, develop skills and build capacities of individuals and groups within a community. Its widespread use by researchers across the developing world reflects its benefits in this regard as well as its role in theory / concept development. PAR does not require sophisticated facilities or resources but makes use of local and familiar materials. PAR, however, is resource intensive and relies heavily on intellectual and technical know-how. Any single project is likely to demand a multi-skilled, trans-disciplinary research team. Researchers need to be fluent in local languages and to understand cultural norms and nuances. Any weaknesses inherent in the individual techniques adopted also apply and the validity and reliability of the outcomes rest heavily on the selection of techniques and quality of their implementation within the overall research process.

Good quality PAR provides a wide range of qualitative and quantitative information about its target group. It generates factual data as well as information on attitudes and perceptions, and it identifies alternative scenarios and relevant courses of action. The high level of participant engagement and the integration of understanding and practice that is key to the process, should ensure valid and reliable results. Its value to practitioners therefore is considerable in terms of improving their understanding of community perceptions, needs, problems and opportunities; of building community capacities; and thus as a strong foundation for sustainable development. For policy makers, the practical outcomes of specific projects may be useful in informing policy but so too are the more ‘academic’ outcomes of the research in terms of conceptual development and transferability of the process.

Examples of using the technique

German et al (2008), describe the use of PAR in the field of integrated watershed management in rangelands of eastern Africa. They illustrate the value of the approach in identifying problems and trends relating to water resources and in understanding the linkages between natural resource degradation and livelihoods. The PAR findings point to the nature of interventions required to ameliorate trends and generate alternative outcomes in the study area. The research also draws broader conclusions about the need for recognition of linkages between property regimes, user groups, and disciplines and about the relevance of collective action theory to solving problems of this kind.

Lawrence et al (2006), describe the use of PAR as a “multi-dimensional conceptual framework” for eliciting stakeholders’ values of biodiversity and their implications for forest conservation in the Baglung District of Nepal. The authors describe the framework and its use in exploring participants’ awareness of their own values, knowledge and goals in relation to biodiversity. The techniques they adopt within the PAR included workshops, reflective meetings, semi-structured interviews and ‘field activities’, conducted over an eight month
period. The outcomes demonstrate new insights into the participatory monitoring process, the kinds of values that forest users have in relation to biodiversity and the contribution that institutional and social factors make to such values.

References:


5.9. **Methods for Reviewing Information**

5.9.1. **Systematic Reviews**

**Objectives and background**

Systematic reviews are a rigorous way of assessing and reviewing scientific evidence of the likely outcomes of various actions and, if the evidence is unavailable, to highlight areas where further original research is required (CEBC, 2008). The methods were originally developed in clinical medicine and public health in response to increasing demands for health care interventions to be based on thorough and objective reviews of all the available evidence (Sackett et al., 2000). This led to the development of evidence-based approaches and the formation of the Cochrane Collaboration (http://www.cochrane.org/), which includes a widely accessible database of reviews and methodological studies that aim to improve the conduct and application of the reviews.

There are strong arguments for conducting systematic reviews in environmental contexts (Pullin and Knight, 2001; Fazey et al., 2004; Pullin et al., 2004; Sutherland et al., 2004) and they are now being applied through the Centre for Evidence-Based Conservation (http://www.cebc.bangor.ac.uk/) and published through the Collaboration for Environmental Evidence (CEE) (http://www.environmentalevidence.org/index.htm). They are considered to be more rigorous than traditional narrative reviews because they use explicit methodologies to: (i) search for all relevant studies; (ii) determine whether a study should be included in a review; and (iii) integrate and analyse the information using various meta analysis techniques (Clarke and Oxman, 1999; Fazey et al., 2004; Pullin et al., 2004). A key aspect of systematic reviews is that both the protocols before the systematic reviews are conducted and the final reviews are peer-assessed. This increases rigour, assists identification of studies through the review groups, and helps avoid duplication. Practitioners are also often involved in formulating review questions.

Systematic reviews are best applied to summarizing the effect of interventions conducted over multiple studies. Specific questions are formulated, such as asking whether tunnels under roads reduce amphibian mortality. There are, however, significant problems applying systematic reviews and in relation to biodiversity/environment because of the nature of the evidence available and the variety of contexts in which studies are conducted (Fazey et al., 2004; Pullin et al., 2004).

Systematic reviews are not directly concerned with valuation but they do provide many useful methodologies that could significantly improve the rigour of reviews of multiple studies, e.g. to feed into benefits transfer. The greatest contribution that systematic review methodologies are likely to make is through methodologies that reduce bias associated with identification of studies and when determining whether a study is to be included in a review / benefits transfer. Application of at least some of the ideas from systematic reviews would therefore be useful for reviews that aim to compare values from different studies conducted in different regions, or for developing more rigorous protocols for studies of benefits transfer. Further, knowledge of ecosystems and the services they provide need to be better understood in order to value them (Haines-Young et al., 2007). Systematic reviews will be able to contribute to this process by providing better summaries of such knowledge, improving the ability to value biodiversity.

**Application of the technique in countries with developing economies**

The systematic search found no systematic reviews in relation to valuation of biodiversity. Of the 23 completed reviews in the CEE library, only one refers to biodiversity in a developing country context (Brooks et al., 2006). This was not related to valuation.
Methodological issues in the context of countries with developing economies

Systematic reviews can be complex, and require time, effort and resources. They require considerable skill and are particularly difficult where statistical meta-analysis is involved. However, they do generate much more reliable results than traditional reviews.

Practical and policy issues in the context of countries with developing economies

Given resource limitations within developing countries, systematic reviews are unlikely to be appropriate for researchers in those regions. Nevertheless, systematic reviews aim to support decision-making by providing independent, unbiased and objective assessments of evidence, and are therefore highly relevant to policy-makers. Such methods will therefore be most relevant to larger international organizations wishing to develop more effective, evidence-based policies.

Example of using the technique

Systematic reviews have not been used in biodiversity valuation studies in countries with developing countries.

References:


6. **Case Studies of biodiversity valuation in developing countries**

In this section, five case studies (written by practitioners and researchers working directly in developing country contexts) are presented to provide further insights into the methodological problems that practitioners may experience at first hand in applying the economic and non-economic techniques in a developing country, and to gain insight into where the application of the techniques can be improved or where there is potential to combine different techniques within valuation studies. The five case studies presented are:

2. Total Economic Valuation of the Centre Hills Forest in Montserrat;
3. Valuing local direct benefits from protected areas in Uganda;
4. Valuing Biodiversity in the Solomon Islands: participatory research;
5. Cultural Considerations in Mapping Biodiversity Values, Agatti Island, Lakshadweep, India.

This case study reflects on the experiences gained in the Southern African Millennium Ecosystem Assessment (SAfMA); (Biggs et al., 2004). This assessment was one of approximately 30 sub-global assessments of the Millennium Ecosystem Assessment (MA), a four year global effort to provide decision makers with information on the consequences of ecosystem change for human well-being (MA (Millennium Ecosystem Assessment), 2005b). The case study highlights the importance of ecosystem services in determining human well-being and future human development possibilities in the Southern African sub-region.

Context: a nested multi scale assessment

SAfMA was undertaken at 3 spatial scales in a fully nested design including: the region; two major drainage basins within the region; and five local government areas within the basins (van Jaarsveld et al., 2005). Due to the novelty of a multi-scale assessment in the region, an experimental approach was adopted where contributing studies tested and adopted assessment approaches they deemed appropriate at their scale of assessment. This resulted in a combination of participatory approaches to data collection at the local scale and quantitative models at the basin and regional scale. All studies assessed core ecosystem services (water, food), other ecosystem services specified by scale specific stakeholders, as well as biodiversity.

The place of biodiversity in an ecosystem service assessment

Biodiversity received a significant amount of attention in the MA and its component sub-global assessments (including SAfMA). This attention included reviews and assessments of the links of biodiversity to ecosystem services, as well as of the condition of biodiversity globally and sub-globally (Albers et al., 2005; MA (Millennium Ecosystem Assessment), 2005a; Mace et al., 2005; Scholes and Biggs, 2005; Biggs et al., 2006). In the MA it was highlighted that biodiversity plays a dual role in the provision of ecosystem services: both as a necessary condition for ecosystems to function and deliver ecosystem services, as well as in some instances a service in its own right.

The SAfMA study region contains an enormous amount of biodiversity relative to its size. In SAfMA this biodiversity was clearly linked to the cultural services of nature based tourism (an important source of income in the region), contributions to the diet of rural people (especially with respect to protein and micronutrients), and traditional medicines (used by the vast majority of Southern Africans). In addition, many people, in the region and outside, across all cultures and socio-economic conditions, regard biodiversity as having a non-financial intrinsic value, related to spiritual, aesthetic and ethical considerations.

While recognising these direct ecosystem services of biodiversity, SAfMA follows the MA guidelines in treating biodiversity not as a service itself, but as an underlying condition necessary for the sustained delivery of most other ecosystem services, such as food and clean water. These links between biodiversity and other services are more complicated. This is due to the complexity of biodiversity which exists at several levels (from the gene to the landscape) as well as in several measures (quantity, quality, distribution etc). Mace et al. (2005) provide a useful table which links levels and measures of biodiversity with particular services in an effort to clarify these relationships.

Considering these links between biodiversity, ecosystem services and human wellbeing, SAfMA and the MA adopted the human-centred ‘ecosystem services’ approach to biodiversity valuation. This approach allows one to quantify the importance of biodiversity to human wellbeing (through ecosystem services).
Valuing biodiversity through ecosystem services

The value of ecosystem services can be expressed in both flow and underlying stock terms. The significance of a particular flow is relative to the size of its stock, while a stock by itself seldom says much about the service flows that actually (or potentially) could be derived from it. Stocks and flows can be expressed in quantitative and qualitative terms. In SAfMA, physical quantities of stocks and flows (e.g. calories, litres of water) were often used. A variety of measures including: ecosystem integrity, supply: demand ratios, and drivers of change, were used to assess the condition of the service (stock and/or flow). These stocks and flows can also be expressed in economic (monetary) terms instead of physical terms.

There was much debate throughout SAfMA as to how to quantify the value of biodiversity and ecosystem services to human well-being. This debate was driven both by the data and expertise available in the SAfMA technical advisory group, as well as by the teams’ own perceptions on the intrinsic value of nature. In some cases this quantification was simple - e.g. in the case of nature based tourism where the regional study estimated the aggregate value of nature-based tourism in Southern Africa in the year 2000 to be US$ 3.6 billion (Scholes and Biggs, 2004). This estimate was based on direct tourism expenditures (i.e. what tourists spend in the country rather than what they are willing to pay for this experience) and represents approximately half the total tourism income in the region, the other half being contributed mostly by business travel and visits to family and friends. The travel and tourism economy contributed 9% of the total GDP in SADC in the year 1999 (Krug et al., 2002), varying from 5% in large, highly industrialised economies like South Africa, to 30% in Tanzania. Furthermore, tourism arrivals and revenues have been growing at rates between 10 and 30% per annum during the 1990s (Fillion et al., 1992).

In the case of provisioning services like water and food, the value of the service was not expressed in monetary terms, but rather in physical quantities (which with some effort could be converted into monetary values). Although this was not deemed necessary in the assessment – the tons of food, number of calories or litres of water were simply compared to demand and basic need levels to assess the human wellbeing consequences of the service supply.

At the local scale very little quantitative information on ecosystem services and their values were available. In fact in these studies measures such as “sense of belonging”, “self determination” and “not being vulnerable” were often more important than cash. Here participatory approaches were used to rank and value a broad variety of natural resources and ecosystem services. The criteria used to rank these resources included cultural and utilitarian values.

What is the value of biodiversity in the Southern African Region?

SAfMA, like the MA, did not set out to calculate the ‘total value’ of nature. Since all life depends on it, the total value is by definition infinite. Instead, the assessments demonstrate that even taking a partial, conservative view, the value of nature is so immense, at all scales and across all sectors of society, that it warrants much more careful management. Of relevance to this case study is also the issue of double-accounting. Biodiversity itself was not valued economically as SAfMA considered this a form of double-accounting – where the economic (and physical) value of biodiversity is already embedded in the service being assessed.

Using ecosystem services as the link between nature and human wellbeing played a key role in raising decision maker awareness of the value of nature / biodiversity. The actual amounts (tourism dollars, litres of water, calories of food) were perhaps less important than communicating the concept of ecosystem services and their links to nature.
Conclusions and future directions

This raised awareness of the importance of biodiversity in supporting human wellbeing also brings with it a heightened awareness of the tradeoffs between food, water and biodiversity (and other services) which are so crucial: they represent not just choices between different proportions of a ‘buffet’ of ecosystem services, but impact on the productive base on which some of those services depend in the long term. Climate change raises significant additional concerns in this respect.

SAfMA played a valuable role in raising awareness on the links between nature and people, and was also useful in collecting baseline information on the condition of biodiversity, ecosystem services and human wellbeing. It also included a large degree of stakeholder involvement in the construction of future scenarios and responses for the region (Bohensky et al., 2004; Bohensky et al., 2006). As the MA gears itself up for the next round of assessments, it is important to flag the gaps in SAfMA, especially in the context of biodiversity and its role in supporting ecosystem services. Of these gaps, two are of relevance to this case study. The first gap is around understanding the relationships between biodiversity, ecosystem services and human wellbeing. Although SAfMA did a good job at highlighting these relationships it failed to answer questions on how they work. For example how much biodiversity can we lose before our services suffer, and consequently how much change in ecosystem services can we tolerate? We know that change is seldom linear and can often be abrupt, how does this play out across ecosystem services?

The second gap is one around valuation. Although SAfMA did not attempt to value biodiversity or ecosystem services, the pressures of development in the region, the growing capacity of economists in the countries and questions from newly informed decision makers on the value of nature, make it important that we begin to quantify these values in an appropriate fashion.

References


6.2. Case study 2: Total Economic Valuation of the Centre Hills Forest in Montserrat

Summary
The Centre Hills forest in Montserrat provides a number of valuable ecosystem services, including recreational opportunities, aesthetic enjoyment, habitat for endangered species, water supply, hazard protection, and non-timber forest products. These services have been valued using a variety of valuation methods, including a choice experiment (choice model), replacement cost, damage cost avoided, and benefits transfer. Challenges were faced in applying all of these methods (McCauley and Mendes, 2006; van Beukering et al., 2007). Limited data availability was an issue for most methods. Missing data does not only refer to economic data but also information on ecological and hydrological relationships underlying the ecosystem services being valued. Only the choice model did not rely on existing data, but was also the most time consuming and expensive method to implement. The fact that Montserrat is largely dependent on the UK for financial support may influence residents’ attitudes to public financing, which made assessing willingness to pay for public goods problematic. All of the valuation results presented in this study rely on a number of assumptions. The values generated should not therefore be interpreted as precise estimates but as indicative of the economic importance of each service under consideration. The assumptions and uncertainties need to be communicated well to policy makers and others that use the value information.

Context
The Centre Hills are under increasing pressure from alternate land uses as Montserrat’s infrastructure is being rebuilt in the North due to volcanic dislocation in the South. The Centre Hills comprise the largest intact and accessible forest area remaining on Montserrat. Given the recognised importance of the Centre Hills in providing numerous environmental goods and services to Montserrat and the presence of threats that may reduce their provision, there is a need for quantitative information on the value of these services to guide decision making regarding management and conservation of the area.

Through a process of consultations with stakeholder groups, the key management issues and potential policy solutions for Centre Hills were discussed. One of the conclusions of this process was that the estimation of the total economic value (TEV) of goods and services from the Centre Hills in its current state would be the most useful form of economic valuation information for the future management of Centre Hills. The TEV provides a quantitative measure of how important the Centre Hills are to Montserrat in monetary terms, and functions as a reference point with which to compare possible alternative ecological states and land uses. The TEV of services from the Centre Hills therefore provides a basis for future economic valuation studies on specific impacts as they arise.

Method review
This study used a number of different valuation methods to estimate the various goods and services derived from the Centre Hills forest. The selection of specific valuation techniques to be applied depended on the ecosystem services to be valued, the budget available for implementing the valuation studies (e.g. to cover survey costs), and the availability of required data. The following section describes, for each valuation method, the aim of the valuation; methodological and practical issues; and provides an overview of results.

Choice Experiment
A choice experiment was utilised to elicit the preferences of the local population for forest recreation, species abundance, and aesthetic quality of the forest. In addition, the method is used to assess local people’s preferences for controlling invasive species such as pigs and rats in the Centre Hills.
The choice experiment survey was developed through a series of discussions with experts and pre-tests in the field. The main purpose of these activities was to identify the hypothetical scenario on which to base the choice experiment, and the most relevant attributes and levels associated with local recreation, aesthetic quality, and species abundance. These activities were also important in order to design the questionnaire in such a way that local respondents could understand each of the questions and their task during the choice experiment. The hypothetical scenario described a future situation in which invasive species and/or human developments could result in varying impacts on the Centre Hills, depending on several management options for the area. Based on this hypothetical scenario, five different attributes were defined: forest cover, wildlife abundance, control of invasive species, trail maintenance, and income tax. These attributes were represented graphically to respondents in the choice sets in order to communicate the alternative options as easily as possible, particularly to respondents that might be semi-literate.

We faced several difficulties in defining attributes for the choice experiment. Firstly, it was problematic to define independent attributes and attribute levels. For example, forest cover (representing aesthetic quality) and species abundance are clearly functionally linked. Similarly, control of invasive species may be linked to forest cover, species abundance, and recreational opportunities. It was immediately obvious to respondents in the pre-tests that some combinations of attribute levels did not make sense. In order to avoid generating choice sets with highly contradictory attribute levels (e.g. high forest cover and low species abundance) we introduced prohibitions into the statistical design.

A second difficulty in the definition of attributes was in identifying a viable payment vehicle. During discussions on the design of the questionnaire, income tax was considered by some key informants to be a highly sensitive issue. In addition not all respondents pay income tax (if retired, unemployed etc.). Alternative payment vehicles such as an environmental levy were, however, considered to be unrealistic or vague. An additional problem to the generally observed unpopularity of additional taxation is that in Montserrat the population has become used to financial dependency on the UK government. As such, they may see the UK government as the obvious source of funding for environmental protection rather than it being something they should pay for themselves.

From the end of November to the middle of December 2007, the ‘choice experiment’ survey was conducted among 342 local respondents. Interviews were conducted by four local interviewers. The interviewers were trained prior to data collection on the basic principles of the choice experiment, how to properly administer the choice experiment without introducing bias to the results, and to provide assistance to respondents in understanding the task.

Doubts about the consistency of the interviewing did arise, as it appeared that some interviewers finished the questionnaires in less than 10 minutes when a research assistant was not present. As the estimated time for completing a questionnaire was 15-20 minutes, this might imply that rapidly conducted questionnaires did not provide respondents with sufficient explanation of the choice tasks or enough time to consider their responses. In the analysis of the data, we did indeed find evidence of serious interviewer effects. In particular, one interviewer produced significantly higher opt-out rates and different estimated coefficients on attributes. The solution to this problem was to exclude all data collected by this interviewer. This is obviously detrimental to the sample size but improved our confidence in the reliability of the responses.

The estimated coefficients on the attributes in the choice experiment were statistically significant and with the expected signs. The estimated WTP for given changes in attribute levels are presented in Table 3.
Table 3. Willingness to pay for changes in forest characteristics and management

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Change</th>
<th>Annual WTP per household (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of forest cover</td>
<td>Medium to high cover</td>
<td>16.77</td>
</tr>
<tr>
<td>Species abundance</td>
<td>Threatened to abundant species</td>
<td>44.66</td>
</tr>
<tr>
<td>Control of invasive species</td>
<td>No control to control</td>
<td>58.26</td>
</tr>
<tr>
<td>Trail maintenance</td>
<td>Medium to high maintenance</td>
<td>37.93</td>
</tr>
</tbody>
</table>

Replacement costs

The value of the water supply service provided by Centre Hills in its current state is estimated as the cost of replacing this service with man-made infrastructure (i.e. using the replacement cost valuation method). The steps involved in this valuation are:

1. Quantify the volume, quality, and reliability of supply of water currently provided from Centre Hills. This data was provided Montserrat Utilities Ltd.

2. Quantify the volume, quality, and reliability of supply of water that would be provided if the Centre Hills were heavily deforested. A thorough assessment of future possible changes in spring water yield as a result of deforestation in the area is very difficult as there is very limited climatic and hydrological data available to carry out such an assessment. To make a rough estimate of changes in spring water yield as a result of deforestation of the Centre Hills catchment, a water balance approach is adopted. Values of decreased soil infiltration and evapo-transpiration under different land use conditions are taken from the literature to calculate a new future water budget for the area. A conversion of land use within the Centre Hills catchment to pasture or cleared land will most likely cause an increase in surface run-off and a decrease in spring water aquifers, leading to a decline in spring fluxes up to 75% in the case of complete clearing of the watershed.

3. Identify the least cost investment option for returning to the current level of water provision (in terms of quantity, quality, and reliability) from the degraded level. The replacement technology (desalination) is used on neighbouring islands and so represents a realistic replacement option if water supplies from Centre Hills become degraded.

4. Estimate the costs of constructing and operating the replacement infrastructure. This estimate was made using secondary data. Younos (2005) provides a summary of desalination costs from 23 separate studies. The unit costs range from 0.45 to 6.56 US$ per 1,000 litres. Taking the average of these cost estimates gives a unit cost of 1.16 US$ per 1,000 litres. Using this figure and the estimated loss in water supply from the Centre Hills under the deforestation scenario gives an annual replacement cost of US$ 423,000.

Damage cost approach

The damage cost approach was used to value avoided damages from landslides. Limited data was available on the probability of landslide damage and costs of damage but this approach provided the only feasible means of estimating this service value.

From the literature, it was estimated that clearing of the forest for alternative land use like agriculture could lead to an increase in landslides of 10% and an increase in suspended...
sediment in the water of around ten times that of the current situation. On the basis of expert interviews, we assume that the maintenance costs and landslide occurrence are more than proportionally linked. In other words, with an increase of landslides of 10%, the maintenance costs will increase by 20%. On the basis of this assumption, we calculate the Centre Hills currently perform a hazard protection role of around US$34,000 per year.

**Benefits transfer**

The value of non-timber forest products (NTFPs) was estimated using benefits transfer. Since extraction volumes and quantities of NTFPs from the Centre Hills are not available, it is difficult to estimate total use values of these products. A rough estimate can, however, be given using the generalized NTFP values presented in literature. These values in the relevant literature vary between $50 and $100 per hectare (including all NTFPs such as fruits, medicinal plants and animals).

To derive a total use value of fruits, flowers and medicinal plants from the Centre Hills, several aspects need to be considered. First, it is assumed that actual use and extraction of NTFPs from the Centre Hills is relatively limited compared to other tropical forests where people’s livelihoods often depend on the use of forest products. Second, the difficult access to (parts of) the Centre Hills make the costs of transport and access to and from the area relatively high. This also means that NTFPs are probably not extracted from all parts of the Centre Hills. Finally, these generalized values also include values for the extraction of animals, but in this study we are able to use more accurate information to calculate the value of animals hunted in the Centre Hills. Taking these aspects into account, we scale down the NTFP value of US$50 per hectare derived from Pearce (1998) by 50%, using an annual value of US$25 per hectare. This value lies within the lower range of values suggested by Balick and Mendelsohn (1992) (for medicinal plants only). This generates a NTFP value of the Centre Hills of US$ 28,250 per year. The adjustment that we made to the transferred value is rather arbitrary but gives a rough approximation of the value of NTFPs from the Centre Hills.

**Conclusions and recommendations**

Data availability was a serious constraint in implementing most of the valuation methods employed in this study (e.g. hydrological implications of deforestation for replacement cost, landslide probabilities for damage cost valuation). In some cases, even where data were available, the Montserrat Statistics Department was frustratingly slow at providing it. The choice experiment was relative free of data availability problems because all data was collected through a household survey. This valuation method did, however, consume most of the research time and budget.

An issue that was evident in Montserrat, that may affect preference elicitation through stated preference methods was the dependence on external finance. In a situation where many public services are funded by an external source, people seem to develop different attitudes to public budgets and perhaps become less aware of budget constraints. Stated preference methods, such as choice experiments, generally require respondents to consider the allocation of their own income to pay for public goods, usually through a contribution to a public fund. This approach may run into problems in cases where people do not expect to pay for public services themselves.

Market prices for some environment related services are distorted by public subsidies. For example, the water supply in Montserrat is heavily subsidised. The price of water does not therefore reflect consumers’ marginal value of water and the quantities consumed are likely to be greater than if consumers paid the full costs of water supply.

There are substantial uncertainties regarding the estimated economic values of environmental changes. There are, however, perhaps even greater uncertainties regarding the hydrological and ecological impacts that underlie the economic valuation. For example, there is very little known about the impact of invasive species on native species and forest cover, or the impact
of deforestation on water supply. Further research in these fields would also strengthen the economic valuation results.

It is recognised that all of the valuation methods applied in this case study rely on a number of assumptions and in some cases on very large assumptions. The values generated should not be interpreted as precise estimates but merely as indicative of the economic importance of each service under consideration. It is important that the assumptions are made explicit and the associated uncertainty is communicated clearly to policy makers and others who will use the information.

References
6.3. Case study 3: Valuing local direct benefits from protected areas in Uganda

Summary
This study evaluates the ability of integrated conservation and development projects (ICDP) to affect change in an equitable manner under different institutional arrangements and the need to evaluate local social and economic values towards protected areas (PA). The study utilises a contingent valuation (CVM) survey to value local welfare for direct benefits from a variety of PA under different management regimes in Uganda. The study was conducted within the broader framework of a four country (Uganda, Kenya, Thailand and Philippines) participatory action research (PAR) programme on costs, benefits and equity in protected area management conducted by CARE International. The PAR techniques also included focus group discussions about local cost benefits issues as well as feed back an evaluation sessions with communities about the findings. We highlight important practical and technical considerations in the design and implementation of CVM studies in a developing country context and propose some methodological and practical considerations in CVM design to cope with the different socio-economic and institutional context.

Background
Typically rural households around the study sites exists in a peasant/subsistence farming economy, with only partial integration into the market economy and consuming most of what they produce. Despite national legislation that precludes hunting of wild animals and in the case of national parks use of other non-timber forest products (NTFP), poor enforcement by under resourced management authorities means there is de facto open access which local communities exploit. Without sustained access to forest resources many rural households may face high levels of impoverishment, thus the protected areas play an important role in poverty alleviation (Bush et al., 2004). Use of PA resources such as fuel wood in Uganda has increased dramatically in recent years (National Environmental Management Authority, 2001; Bush et al., 2004) partly the cause is due to increasing populations around PA and poor enforcement of regulations. Exclusive management practices tend to create tension between local people and protected area authorities as local people see the regulations as unfair (Hulme and Murphree, 2001; Plumptre et al., 2004).

Measurement of the actual impacts from different ICDP scenarios is possible once schemes are in place; however implementing ICDP without knowing the minimum level of social and economic impact necessary for success is a risky gambit. Whilst the level of qualitative and quantitative detail obtained in a household income and social surveys is extremely useful, there are weaknesses in that it is difficult to capture in financial terms the social value of the direct benefits from PA exploitation. This study used a one shot open ended CVM format to elicit local peoples direct use values of protected areas under different management arrangements with particular reference to the determinants of PA use and the impact of various social and economic parameters on stated preferences. The sample was stratified by different management approaches and income.

Methods
A CVM survey was administered alongside a community level participatory survey of social, economic and equity issues in conservation and a household survey of social and economic costs, benefits and impacts to park adjacent households.

Sampling of households was on a random stratified basis of wealth categories within a community (identified through a participatory wealth ranking exercise). Data were collected on 690 households in communities around each of three different PA, and included not only the CVM bids, but various social and economic household data. The protected areas are ecologically different (tropical closed canopy rainforest, afromontane forest and savannah woodland) which means different ranges of goods and services and therefore utility derived
by local households and under different management arrangements from strict protected area to community owned and managed.

The CVM scenario set up a framework for the implementation of a hypothetical novel community based PA management scheme in collaboration with different government authorities. It stipulates direct payments for conservation as an incentive to provide benefits to the local community and to enforce non-use regulations and reinforce the link between the benefits and conservation of the resource. The bidding is open-ended and respondents were asked to state their maximum level of compensation required to forgo access to timber and non timber forest products from their local protected area for a period of one year.

Methodological issues
Despite the fact that CVM surveys are frequently applied in developing countries, the results must be critically evaluated. Many studies have been conducted without better prior knowledge of their correct application in developing countries and most have followed the NOAA guidelines (Arrow et al., 1993) devised in the context of litigation in an industrial marine setting in a developed economy. After numerous applications of CVM in the developing world, it must be concluded that those guidelines often do not fit the specific circumstance encountered in developing countries and, hence, the result of CVM surveys may biased, faulty, or simply wrong (Whittington, 1998). For example, local contextual knowledge was essential in thinking about how best to develop the CVM tool. In terms of plausibility and reducing bias, the choice of payment vehicle in a CVM is very important. In Uganda, there is a great deal of suspicion regarding the payment of income tax. Nearly a decade ago the government of Uganda made an attempt to apply a form of stratified income tax mainly focused on getting rural households to make contributions. This resulted in widespread protest and sometimes violent conflict between rural people and government authorities resulting in the tax programme being dropped. The use of tax based payment vehicles although not directly relevant to this study, might cause biased or protest responses. This is contrary to the NOAA guidelines which recommend taxes as the main payment vehicle to elicit values in CVM surveys.

Mekonnen (2000) regards posing hypothetical questions to low-income, perhaps illiterate respondents as potentially too overwhelming. This is perhaps an extreme conclusion as illiteracy does not necessarily infer low intelligence, but the institutional context is of great importance. People operating in peasant economies (Ellis, 1993) are often mainly subsistence producers, only partially integrated into market economies and have varying needs for money. In addition, they are often operating in highly risk prone environments with high levels of vulnerability to environmental change and will have developed their own conventional wisdom and institutions to cope with life in such conditions. Although we were dealing with a largely subsistence, peasant farming economy, the use of money is widespread and most people engage in some sort of monetary market transactions on a regular basis.

Practicalities of conducting rural household surveys in Uganda
The household interview approach to measuring welfare from protected areas is a difficult and arduous endeavour in a developing country context. The basic lack of infrastructure and seasonal stresses and strains that rural communities face are similar for the field team. Poor communications routes required the use of four wheel drive vehicles and often lengthy walks. Conditions are physically demanding due to extremes of weather such as tropical rain storms and high heat. Accommodation for field teams is often rudimentary or completely lacking requiring a high level of self sufficiency on the part of the team. At times the work can be physically insecure due to the presence of large wild animals, especially when camping. Generally a survey in such conditions requires much careful planning and forethought regarding the basic housing and accommodation of the survey team, in addition to the technical details of administering the survey itself.
The survey was administered using a team of field assistants (enumerators) to conduct interviews in the local languages of the region. The survey team undertook an extensive and detailed period of training in the survey methods including a pretesting and review period prior to starting the field data collection. Their work was reviewed every day by senior research staff to ensure compliance with the data protocols and to assess how to cope with anomalous responses and unusual situations. A high level of research supervision by the lead researcher was essential in understanding how to interpret findings and cope with contextual problems in data collection.

The questionnaires were in English, and verbally translated into the local language during interview with responses translated and recorded in English directly on to the data sheet. Translation into local languages of the CVM hypothetical scenario also required a great deal of consideration and debate regarding the meaning in translation of the English terms, to avoid ambiguity and to ensure consistency in what the respondents valued.

Usually it took the team of five enumerators about three days in each community to complete the interviews and community level participatory surveys with the survey team camped within the community. The extended period of contact with local people allowed the team to develop a high degree of familiarity with the social and natural environment of each community. This often gave opportunities to discuss responses and triangulate on any issues to highlight discrepancies. For example, amongst some of the diverse local cultures in which the survey was administered, it was culturally taboo to tell strangers how many children or livestock the household has for fear of bringing bad luck and the possible loss. However, it is not a social taboo for neighbours or other local key informants to divulge information about one another’s situation, so a point of triangulation of the accuracy of information was available.

Execution of the CVM exercise was significantly aided by the lengthy household social and economic study, being in a sense a warm up exercise, with the respondent to explore local cost benefit issues in depth. This may have helped to produce a more considered response to the CVM question and avoid confusion in responses. In general, there was consensus from enumerators that the scenario was believable by respondents and results show that there were few zero bids recorded; an encouraging sign. Importantly, the scenario addressed both a real conservation issue (illegal use) and an appropriate response to resolving it (direct payment for conservation) with an enforceable set of rules, as such it was plausible and policy relevant.

**Policy Implications and Impacts**

Determining what social and economic parameters affected bid value revealed three interesting results. Access to agricultural land had a marked negative impact on the bid value. This indicates that households with more agricultural land for cultivation valued PA resources less than those with less land. This is an indication that PA dependency is linked to the lack of access to other livelihoods means. This is especially interesting when compared to the result that levels of household income were not seen to have an impact on bid value indicating that the value of the PA goods available to households may be similar. This is a strong indication that wealthier households are using the PA because they can, whilst poorer households are using the resources because they have few other choices, irrespective of the legality of the use.

Access arrangements are also an important determinant of bid value. Whilst community involvement in managing and protecting biodiversity and environmental resources can be effective in terms of enforcement of regulations, the significance of the parameter for community owned and managed PA showed that attempts to formalise the management of natural resources in communities can also have a short term negative impacts on household welfare. In light of forest dependency issue this raises concerns of equity related to poverty alleviation; where poorer households are more dependant on PA resources, they will be hit hardest if reductions in the availability of those resources are imposed upon them.
This is important when thinking about ICDP approaches and efforts to promote community based approaches to conservation. Any alternative activities to PA use must be designed to offset the local welfare loss (economic loss) rather than simply the financial loss. This is a minimum requirement, in that imposition of welfare losses must to be met with similar welfare gains from other sources in order to effect equitable change in local behaviour and perceptions towards PA. In addition, a quantitative understanding the scope and nature of costs and benefits helps realistic planning in terms of understanding the investments required to implement successful ICDP.

CARE Uganda has a long standing programme of work on Rights Equity and Protected Areas, which both work with local community based organisations, networking them and providing technical back stopping in the implementation of community conservation programmes, as well as a strong policy, training and extension role at the national level. Thus the results from this research have fed directly into an established programme of lobbying and advocacy at the national level. The results have also been subject to community review regarding relevance of their interpretation. Having this type of scrutiny is an important part of their validation and gives more weight to the findings when working at a policy level with local and national government.

Conclusions
The central approach to achieving the study objectives was a thorough evaluation of methodological issues surrounding CVM and its application in a developing country context.

- The researcher must make a great effort to understand local contextual social, economic and institutional issues when designing the CVM scenario in order to make it plausible to the respondent, policy relevant and reduce bias in the responses. This may mean significant departures form the NOAA guidelines.

- Implementation requires a great deal of enumerator training and supervision in the field. The conduct of other social and economic inquiry along side the CVM study is important for triangulation and meaningful interpretation of results.

- Interpretation of findings can be verified through consultation with the respondent’s through PAR approaches, giving the findings a greater weighting with government and policy makers.

- Participation in existing policy processes is an important consideration in terms of finding a platform to voice the findings. Finding appropriate partners in country is essential to ensure successful delivery of the research messages.

References
6.4. Case Study 4: Valuing Biodiversity in the Solomon Islands: a participatory research approach

Summary
This case study is based on past and current collaborative sustainability research between Aberystwyth University and a local grass roots organization, the Kahua Association (KA) in an isolated region of the Solomon Islands. The case study uses experience gained from participatory research conducted over a 10 week period in 2007 that elicited local perceptions of change to indicate ways in which future studies to value biodiversity can overcome some of the significant challenges of working in the region (Fazey et al., 2007; Fazey et al., In Preparation-a; Fazey et al., In preparation-b).

Participatory research in Kahua
The KA represents 40 communities and the 4500 people living in Kahua and was established by local people to provide a collective approach to sustainable development and natural resource management and improve decision-making (Fazey et al., 2007). Being located in a region that has some of the highest species endemism in the world, Kahua has high biodiversity value (Lees, 1999; Green et al., 2006; Lamoreux et al., 2006). Unfortunately livelihoods and biodiversity are threatened by a rapidly rising population and Kahua is located in one of the most economically poor regions in the Solomon Islands (Bourke et al., 2006). Due to steep topography, very little land is suitable for major agricultural development (Allen et al., 2006). People are therefore turning towards income generation as a solution, but this has not reduced the underlying pressures on resources and has increased risk of people cashing in their resource-ownership rights to logging and mining companies. Initial participatory research has been conducted to identify perceptions and drivers of change and future work will concentrate on using the approaches to elicit biodiversity values to assist communities to think about resource management.

Challenges to working in the area include: (i) very low levels of formal education and literacy and a total lack of trained research capacity; (ii) language barriers (only around 9000 people speak the Kahua language); (iii) significantly large groups of people who are marginalized from decision-making (e.g. women, youths, highland villages); (iv) no scientific research or inventories of existing biodiversity in the region; (v) need for immediate action given the rapidity of social and environmental change; and (vi) strong beliefs by local people that external assistance is required to deal with their problems. This latter challenge stems from a history of top-down decision-making and development which has led to inertia and lack of motivation to effect positive change in the region.

Expert-led approaches to research and development are likely to perpetuate aid-dependencies, and it is important to find ways of maximizing opportunities for learning at local levels that can occur through research. Participatory methods to research that are embedded in local decision-making and that promote dialogue and deliberation are therefore important to foster local ownership and responsibility of problems; promote learning and awareness; and build local capacity to analyse problems and make more effective collective decisions. Participatory research can also increase the validity of the results because they: provide greater freedom for respondents to engage and express their ideas; rely less on detail and more on comparative data; provide responses from groups after they have discussed and deliberated issues; have greater emphasis on visual techniques (e.g. mapping) that allows others to engage and comment on; promote the research process as one that should be fun increasing motivation and attention (Chambers 1997).

To increase participation, the research approach included training 12 local research assistants (RAs) to conduct 38 broad-scale community surveys (including participatory mapping through discussions with all members of a community and household surveys to collect census data, levels of education, and basic indicators of wealth) and 76 detailed focus-group discussions (2 per community, with males and females separate) about perceptions of change.
In addition, 18 interviews were conducted by the primary researcher to produce conceptual diagrams and other qualitative data that explained the inter-relationships of different components affecting different parts of the Kahua social-ecological system (e.g. social cohesion, causes of land disputes, resource use etc.). Following data collection, preliminary analyses were conducted and discussed at a large four day workshop with representatives from each community (about 80 people). The workshop was used to facilitate discussion of the results and identify future goals. Finally, members of the KA travelled to the capital to present their findings to representatives of government and non-government organizations.

The research approach aimed to address key issues that were considered essential for improving the effectiveness of the research outcomes (Table 4). A number of lessons were learned about increasing the validity of the research results and improving the contribution of the research to local decision-making.

Table 4: Issues considered essential for improving the validity and effectiveness of research to elicit values and perceptions in Kahua (see Fazey et al. (2007) for more detail).

<table>
<thead>
<tr>
<th>Issue</th>
<th>Examples of how the issue was dealt with</th>
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<tbody>
<tr>
<td>1. Need to foster local ownership and responsibility of problems</td>
<td>• Direct inclusion of RAs in design of the research process, data collection, preliminary analysis, design and facilitation of workshops; • Facilitatory rather than expert-led approach by the primary researchers to discussions and data collection; • Wherever possible, opportunities for community-led discussions were provided and facilitated discussions with local RAs to maximize their learning about techniques and problems facing Kahua were continuously held throughout the data collection process.</td>
</tr>
<tr>
<td>2. Need to make use of learning opportunities</td>
<td>• Wherever possible, data collection in village surveys and focus groups were based around deliberation and discussion; • Using directed questions (e.g. about what is changing) as a focus for promoting discussion; • Using reflective questions to promote more effective learning in community discussions and for local RAs (e.g. at end of focus groups people were specifically asked what they had learnt and what their role was in that learning).</td>
</tr>
<tr>
<td>3. Need to build local capacity to analyse problems and make more effective decisions</td>
<td>• Training local RAs in data collection, interpretation, presentation; • Training local RAs to facilitate the discussions with others; • Encouraging use of their own knowledge to carefully consider the problems; • Participatory workshops to strategically identify broad goals for the region.</td>
</tr>
<tr>
<td>4. Need to improve participation to increase validity of research results</td>
<td>• Conducting focus group discussions separately with males and females; • Carefully managing discussions and workshops to deal with dominant individuals; • Emphasizing the need for gender balance in discussions and continuously liaising with local RAs to find better ways of increasing inclusivity; • Demonstrating the value of participation in decision-making during workshops;</td>
</tr>
<tr>
<td>5. Capturing values embedded in cultural and spiritual beliefs</td>
<td>• Using traditional knowledge of local RAs to help identify appropriate questions and interpret results; • Use of in-depth interviews and focus group discussions to ensure capture of detail; • Use of local RAs to facilitate discussions in the local language.</td>
</tr>
<tr>
<td>6. Ensure results are meaningful to local communities</td>
<td>• Focus on learning in communities as an intended outcome of the research; • Wide participation in the research process to identify appropriate questions and interpret results; • Workshops, village surveys and focus groups that provided significant opportunities for discussion and deliberation; • Interview process that specifically required interviewees to clarify their ideas and statements; • Training KA members to present their results to government and non-government organizations.</td>
</tr>
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</table>

Validity of the perceptions and values elicited

The most significant challenges to eliciting perceptions and values were language and low literacy and education levels. Language problems were largely overcome by using local RAs, but they could not write in the Kahua language as it is very rarely used in written form. Further, the RAs had variable translation and English writing skills. Thus, wherever possible, use was made of mapping and survey style sheets to collect basic data. To collect more in-depth information in focus-groups, questions were structured in ways that assisted the RAs to capture the data. For example, those aspects that people thought were changing were first listed, followed by a brief explanation of why people thought the change was occurring. Methods common to PRA and PAR techniques were used to focus discussions, such as using piles of stones to provide focus for deliberation about the speed, direction and significance of change. Finally, the primary researcher continuously checked data recorded by RAs from
focus group discussions for inconsistencies and to clarify results. Overall, the level of data collected was appropriate for a broad scale assessment of perceptions of change, but language limitations meant that detail and breadth of focus group discussions could not be captured.

Interviews enabled the collection of more in-depth data, particularly about the inter-relationships between different aspects that were considered to be changing. Because interviewing is a highly skilled process, they were conducted by the primary researcher who only spoke Solomon Island pija, and not the local language. This limited the pool of people who could be interviewed, biasing the results to those who had received a better education. Thus, to capture in-depth and complex values of biodiversity in ways that reflect the general views of the population, considerable training of RAs would be required in English language skills for translation of material and so that appropriate research guidance could be given and/or use of in-depth ethnographic approaches that involve a primary researcher learning the local language. While a number of participatory techniques, such as forest walks and focus-groups, will elicit direct-use values, significant challenges therefore still remain with regards to capturing cultural and spiritual values associated with biodiversity that are very difficult to make explicit. To meaningfully capture such values, more in-depth ethnographic techniques will be required.

The validity and reliability of the perceptions and values elicited in the study was greatly improved by the participatory and deliberative research process. First, the locally-led research meant that there was a much greater ability to manage local issues, such as conflicts and misunderstandings that arose in and between communities as the research process progressed. Second, direct involvement and ownership of the research by the KA meant that the questions were targeted more closely to the needs of the local communities. Third, participation increased the validity of the values and perceptions elicited because the research included processes that actively managed elements that were likely to hinder inclusiveness and because the deliberative processes promoted more careful consideration of the values being expressed. These aspects were achieved by actively reducing the impact of factors affecting the attendance and willingness of people to contribute, such as through careful arrangement of meeting times, management of the input of dominant individuals or groups, separating people into groups in which they felt more comfortable to speak out including use of local RAs which allowed western researchers to remove themselves from discussions. The workshops, for example, used a number of prioritization exercises that enabled everyone to contribute, sometimes anonymously.

Embedding research in local decision-making processes

By the end of the research process, the views of a range of people were being included and accepted in decisions about future directions of the KA (Fazey et al., 2007). This was only possible because of attention given to ensuring the research was a designed learning process that gradually increased the ability of people to work with each other and carefully consider the issues facing their communities. The research processes therefore directly contributed to increased capacity of community members to think about and analyse problems. Because the KA were presented as the leaders of the research, this also enhanced their credibility as an appropriate organization to facilitate collective decision-making about development in the region.

While the approach increased the relevance of the result, it was limited in its capacity to deal with all of the factors that reduced inclusivity. Future work therefore needs to concentrate to a much greater extent on neutralizing subtle influences of power if the research process itself will contribute to more effective decision-making at local levels. This may require additional investigations on the power dynamics of the communities. A second important issue was that the research process concentrated on perceptions of change, and not on values of biodiversity. Engaging people to elicit values of biodiversity is likely to require greater innovation.
Conclusions and recommendations

The key to the approach used in this case study was that it viewed the research as being just as important for local capacity building as for capturing the values and perceptions themselves. This focused attention to managing a range of issues that may otherwise have reduced inclusiveness with the outcome that a greater range of perceptions and values were elicited and with greater reliability and validity. Nevertheless, significant issues remain to participatory valuation research in both countries with developed and developing economies including:

- If research is to be effectively embedded in local decision-making, learning outcomes for researchers and community members need to be made explicit so that they can be incorporated into the design of the research process. There is also a knowledge gap about appropriate methodologies for evaluating outcomes of participatory valuation research;
- If valuation research is to effectively contribute to livelihoods and wellbeing of local communities, integration of valuation research with action-oriented research on factors influencing the capacity for individuals and communities to modify behaviour and adapt to change is required;
- There is a distinct lack of skills, knowledge and attitudes in both countries with developed and developing economies in facilitation, which is key to effective participatory research (Hogan 2002);
- Investment in local capacity for research, especially in facilitation skills, is urgently required in countries with developing economies;
- Despite compelling arguments for using participatory methods (Chambers 1997), they are not highly valued, especially in academic circles. Current incentive and reward mechanisms hinder the development of approaches in this area.

References


6.5. Case Study 5: Cultural Considerations in Mapping Biodiversity Values, Agatti Island, Lakshadweep, India

Summary
The case study shares insights gained during a three-year biodiversity and sustainable livelihood project in the Union Territory of Lakshadweep, India, a collaborative conservation and research initiative between LEAD International, UK and the Bombay Natural History Society, India funded by the Darwin Initiative, DEFRA (2005-2008). The case study highlights the importance of cultural awareness in designing and/or selecting biodiversity valuation research techniques, and suggests visual arts based approaches that can bridge certain cultural differences through ontological and epistemological conversions.

Context: Agatti Island, Lakshadweep, India

The Lakshadweep archipelago, the smallest of India’s seven union territories, is the only atoll formation in India, one of the least researched and least protected coral reef systems in the Arabian Sea. Lakshadweep forms the northern most segment of the Chagos-Maldivian-Laccadive oceanic ridge. It lies about 450 km from mainland India and comprises 32 km² of land spread over 36 islands (of which 11 are inhabited), 12 atolls and 5 submerged sand banks. The biodiversity of Lakshadweep’s coral reefs is still remarkably high, despite being severely affected by the El Nino event in 1997–98, which caused severe coral bleaching (Arthur, 2004).

The population – directly but not exclusively dependent on their marine resources - is 60,650, exponentially growing which is a serious issue given the limitation of available land, and the islands’ vulnerability to sea level rise (average height is 1-1.5 meters above sea level) and other manifestations of the global change. The main economic activities include traditional pole-and-line tuna fishing, coconut production and tourism. The islands depend on basic resources – including food, fuel - traded from mainland India. Lakshadweep has India’s second highest literacy rate of 86.7%, after Kerala (the Indian average is 64.8%).

Inhabitants of Lakshadweep are designated as ‘scheduled tribes’ by the Indian government who are granted special rights to support their integration into Indian society. People in Lakshadweep are entitled to various government subsidies, such as free education, including higher education, subsidized energy, and other rationed commodities. Land ownership is an exclusive right of people born in Lakshadweep. The ownership of all seas of Lakshadweep belongs to the Indian Government.

Because of Lakshadweep’s status as a scheduled tribe region, access to the archipelago is strictly controlled. Permits are compulsory for all outsiders, including both Indians and foreigners. The entry restrictions are designed to protect the unique culture where matrilineal Muslim traditions prevail and women have significant status in the community.

Participatory planning of India’s first co-managed marine protected area in Agatti

In three years the Darwin project has successfully initiated a new marine protected area in the Agatti atoll of the Lakshadweep archipelago to protect unique biodiversity values and ecosystem goods and services, the basis of Agatti’s livelihood. The proposed ‘Agatti

2 Seven union territories includes Delhi http://goidirectory.nic.in/stateut.htm (Accessed: 15 June 2008)
Conservation Reserve” – when gazetted - will be India’s first co-managed marine protected area (Deri, 2008; Deri et al., 2008).

Over 54% of the adult population of Agatti island (total population: 7,072 in 2001⁶, 50% assumed adult) were engaged in the participatory process of setting up the marine protected area (MPA) through community consultations, household surveys and focus group discussions. Most of the interactions were facilitated by ten trained islanders who used the island’s own dialect for communication (‘Jassery’, a language which is only spoken, does not have its written form); only a few initial meetings were facilitated by an Indian researcher who could speak Malayalam, the official language of Lakshadweep.

The participatory MPA planning process has given islanders opportunity to share information about their natural resource use patterns, local knowledge, suggestions and concerns about the proposed protected area through a set of standard questions. The results revealed an invaluable set of information on islanders’ perception of their natural environment, geo- and biodiversity, and of the interaction between their society and their environment which formed the basis of the draft MPA management plan. The results, however, also revealed some important limitations of discussion-based techniques.

The challenge

Two limitations of discussion-based techniques are discussed here. One is related to power relationship in a collectivist, high power-distance culture (Hofstede, 2003), the other refers to the issue that discussions can most effectively exchange only one type of knowledge, namely explicit knowledge. Being a collectivist, high power-distance culture, individuals with lower social status agreed (had to agree) with the dominant speakers which concealed for the research – and also for the community’s development - the marginalized but potentially important emerging views, observations. Using only verbal expression of ideas, knowledge codified only in language, has made vast amount of procedural and other forms of implicit knowledge, critical to biodiversity valuation, ignored. Techniques were therefore needed to overcome these limitations.

The response

One technique we tested worked as follows. Individuals of a small group were asked to take a set of digital photos of their selected environment: photos of something they ‘liked’, and photos of something they ‘would have liked to change’. Having collected the photos, the small group watched all the ‘positive’ (‘likes’) images mixed into a series of slides, commented on their similar features, emerging patterns, surprises, then had a similar discussion on the ‘negative’ (‘would like to change’) images.

In our particular case the ‘like’ images mostly represented healthy, living, actively moving creatures in a harmonious, aesthetic setting, while the ‘would like to change’ images portrayed perturbed landscapes with the signs of anthropogenic stress.

Implications

This technique when systematically applied can make sure that each individual regardless of her/his social status has equal chance of contributing to the visual expression of the group’s perception of their environment, adding her/his - perhaps marginalised, otherwise silent - view. Even if the images create unsettling surprises, the group discussion nevertheless restores the harmony, ensures that due respect is paid to the group as a collective entity, allowing speakers to confirm their status.

Through the ‘would like to change’ images this technique provides a non-threatening way of surfacing potentially controversial information which is otherwise difficult in a collectivist,

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medium or high risk-avoiding culture where criticism is considered a threat to social cohesion which is of survival value in a low-lying highly vulnerable small island community. The ‘would like to change’ images may also act as catalysts to acknowledge need for a change which would be otherwise less emphatic, e.g. biodiversity conservation-based livelihood development.

Images offer a different (but complimentary) way of communicating perceptions and values than verbal language. Images allow the communication of complex patterns (‘Gestalt’), trends that are most of the time intuitive, part of the implicit knowledge domain.

Using images also acknowledges the diversity of intelligences (Gardner, 1983) which is encouraged in traditional societies where community-based learning prevails or co-exists with school based learning. Community-based learning by default nurtures a diverse pattern of intelligences as it contributes to the collective adaptive capacity. In contrast, conventional school-based learning is biased towards only selected intelligences (logical-mathematical, linguistic).

Sharing and discussing images has an important epistemological aspect: it is a process that first converts implicit knowledge to explicit knowledge, and then exchanges information between different explicit knowledge bases. By doing so it may contribute to the innovative capacity of the community (Nonaka and Takeuchi, 1995). Converting implicit knowledge into explicit knowledge is a key process in adaptive conservation management (Fazey et al., 2006).

Taking and blowing up still images may also allow the viewers to discover information which she/he was not even conscious of but had an intuition that ‘something unusual was out there’. Intuitive pattern recognition is a characteristic of indigenous knowledge which should have the attention of researchers and community members mapping biodiversity values.

Using short films, made of individuals’ clips adds additional value – and complexity in interpretation – to researching and applying biodiversity values to local sustainable development. Comparative studies of collective (community-based) image sets over time may provide the community with a powerful visual biodiversity monitoring tool which being visual may be more suitable to their learning preferences, and have better chance to be used in conscious social change process.

**Lesson learned**

The case study highlights the importance of the diversity and cultural appropriateness of techniques used in biodiversity mapping and conservation in traditional societies. Ecologists need to be also good anthropologists if they want to study indigenous knowledge (Sillitoe, 2002) related to biodiversity values. The cultural or disciplinary bias of the most often used conventional research techniques may result in only partial outcome in mapping biodiversity values in traditional societies, and thus compromises development opportunities.

**Recommendations**

- Cultural idiosyncrasies need to be considered when ‘values’ are researched let they be biodiversity, social or economic values.
- Research techniques, especially in participatory research, need to be culturally sensitive.
- The process and outcome of research are equally important in participatory research.
- Researchers, both indigenous and external, need to raise their inter-/cross-cultural awareness and to develop their capacities in creating and adapting research.

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7 C.f. M. Antonioni: Blow-up.
techniques according to the local culture for effective and valid data collection on biodiversity values.

- There is a need for a new training approach that prepares researchers to be comfortable and effective in applying inter- and trans-disciplinary techniques, including the integration of scientific approaches with various approaches of arts.

References


Acknowledgement

The local community facilitators in Agatti – especially Babu Idrees K.K. - were invaluable in all aspects of the community consultations and participatory conservation and resilience research in Lakshadweep. Without their advice, wisdom and cultural translation the project could not have succeeded.
7. **Discussion**

In this review, a range of data sources have been utilised to feed into the evaluation of economic and non-economic techniques to assess the importance of biodiversity to people in developing countries. In this discussion, we provide both a critique and synthesis of the information gathered. First, we provide a critique of the search protocols used to gather data for this review (Section 7.1). Next, we make some general observations relating to the level of use of economic and non-economic methods to value biodiversity in developing countries (Section 7.2). Section 7.3 then provides a synopsis of the key methodological, practical and policy issues associated with applying these methods in a developing country context and highlight possible solutions to these issues.

7.1. **Critique of search protocols used to gather data for the review**

Data for this review was collated principally through systemised searches of two databases (EVRI and Web of Knowledge). Supplementary data was also collated through five in-depth case studies, as well as a questionnaire survey of practitioners and policy-makers to ascertain data relating to their own experiences of applying the techniques in a developing country context.

The systemised searches of the EVRI and WoK databases were utilised to identify studies that have valued biodiversity in developing countries. The systemised component of the searches involved the use of consistent search criteria across all economic and non-economic methods found in the databases. The use of consistent search criteria was considered desirable as it enabled analysis of the relative uptake of the different methods, as well as achieving an element of scientific rigour in terms of the repeatability of the searches (Fazey et al., 2004; Pullin and Stewart, 2006).

The use of a restricted number of search criteria, however, meant that the searches were unlikely to pick up all relevant studies. For example, the search criteria used failed to identify studies that utilised mediated modelling, citizen juries, Delphi studies and systematic reviews; although a more general search of the literature identified a small number of relevant application that had utilised these techniques.

A further limitation of our systematic searches was that the two databases reviewed comprise predominantly academic, peer-reviewed publications. The implication of this is that our review largely failed to identify material from the gray literature (e.g. government / quango / NGO reports etc.). It was evident from more general searches that much of the research undertaken in developing countries is reported in the gray literature; this appears to be particularly the case for research that utilises the non-economic techniques. However, attempting to systematically review the gray literature would be problematic. The gray literature lacks strict bibliographic control and is often not collated into a single, easy access database. In addition, the gray literature often lacks the quality control assurances that are an integral element of peer-reviewed publications.

The focus of the systematic searches on peer-reviewed publications also influences the type of information collated. In particular, the majority of papers reviewed address either methodological or policy issues, while only a handful of studies discussed the practical issues associated with applying the techniques in developing country context.

To address some of the above limitations of the systematic searches, two further data gathering protocols were adopted. The first drew on five case studies which provided detailed accounts of research that valued different aspects of biodiversity in developing countries using a range of valuation methods. These case studies allowed much more detailed information to be presented on the methodological, policy and (importantly) practical issues associated with valuing biodiversity in developing countries, as well as possible solutions to these issues. Much of the insights from these case studies focused on issues that would generally not be published in peer-reviewed papers. Likewise, the responses from the
practitioners and policy-makers survey provided useful evidence on the practical issues, challenges and solution associated with applying the methods in a developing country context; many of which would generally not be found in the published literature.

In conclusion, we are aware of some of the limitations of our systematic searches. However, we argue that the approach adopted does represent a rigorous and systematic approach that maintains consistency across the methods reviewed. Further, data gathered in the case studies and practitioner’s survey provided useful supplemented evidence, allowing a comprehensive review to be achieved.

7.2. Overview of the level of use of economic and non-economic techniques in developing countries

The search of the EVRI (which comprises economic studies only) identified 195 studies, while the search of the Web of Knowledge (comprising both economic and non-economic methods) identified 284 studies. A comparison of the papers identified from the two searches indicates that although there was a large degree of consistency in terms of actual papers identified, there were also some disparities. This disparity appears to be a result of differences in the way the databases are constructed, as well as slight differences in search terms used in the two database searches.

Notwithstanding the above, it is clear from the searches that there is currently only limited application of economic and non-economic methods to value the importance of biodiversity to people in developing countries. In particular, the EVRI search highlights the fact that developing country studies only account for 11% of all biodiversity valuation studies. Further, our search of the WoK indicates that only half of the papers identified had authors from within developing countries. Clearly, there appears to be a lack of research capacity and / or funds in developing countries to undertake biodiversity valuation studies.

Our systematic searches also examined where the studies were being conducted. Of the 195 studies identified in the EVRI database, half were undertaken in ‘lower middle’ income countries and half in ‘lower’ income countries. Of note is that fact that no studies were identified in countries with ‘transition’ economies. There were also disparities between continents in which the studies were undertaken, with half the studies being conducted in Asia, 18% in Africa and 5% in South America.

There are also significant differences in terms of the extent to which different methods have been utilised. The most commonly used methods include contingent valuation, opportunity costs and questionnaires, while the searches used failed to identify studies that utilised mediated modelling, citizen juries, Delphi studies and systematic reviews (Table 5).

7.3. Synopsis of the methodological, practical and policy issues associated with valuing biodiversity in developing counties.

This review aims to provide an assessment of the issues, challenges and solutions to applying the economic and non-economic techniques in a developing country context. A significant observation from the review is that valuation studies administered in developing countries face many of the methodological and practical challenges faced by researchers in developed countries. It is not the intention of this report to dwell on these general methodological and practical issues. The reader is instead directed to the Eftec (2006) report (also commissioned by Defra) which provides an comprehensive overview of these general issues and challenges.

This report, alternatively, aims to focus principally on those issues and challenges that are specific or more prevalent in developing countries. Table 5 below provides a synopsis of the key issues and challenges identified in this review. It should be stressed that the information presented in Table 5 represents our best-guess analysis of the merits of the alternative methods based on the review of literature. However, there is a great variability in both the methods and their applications and therefore there are likely to be instances where specific
methods do not adhere to our analysis. Further detail of these issues and possible solutions are presented below.

Table 5: Comparative summary of the merits of economic and non-economic methods to value biodiversity in developing countries.

<table>
<thead>
<tr>
<th></th>
<th>Economic techniques</th>
<th>Non-economic techniques</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Production Function</td>
<td>Opportunity Cost</td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of papers identified in our systematic searches</td>
<td>36</td>
<td>12</td>
</tr>
<tr>
<td>Web of Knowledge</td>
<td>12</td>
<td>56</td>
</tr>
<tr>
<td>Type of value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elicits economic values</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Elicits use values</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Elicits non-use values</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Values are based on TEV</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Values are based on proxy prices / costs</td>
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<td>✓</td>
</tr>
<tr>
<td>Quantitative descriptions of benefits</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Qualitative descriptions of benefits</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Capable of addressing a wide range of biodiversity issues</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Capable of evaluating provisioning services</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Capable of evaluating regulating services</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Capable of evaluating cultural services</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Can readily be used to value environmental change</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Methodological issues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generally requires literate respondents</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Can be adapted for use with illiterate respondents</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Allows respondents time to consider and reflect on values</td>
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<td>✓</td>
</tr>
<tr>
<td>Requires a fully developed market economy</td>
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<td>✓</td>
</tr>
<tr>
<td>Values can readily be aggregated to the affected population</td>
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<td>✓</td>
</tr>
<tr>
<td>Specific methodological issues relating to the application of the method in a developing country context</td>
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<td>✓</td>
</tr>
<tr>
<td>Practical issues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requires collection of new data</td>
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<td>✓</td>
</tr>
<tr>
<td>Uses existing data</td>
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<td>✓</td>
</tr>
<tr>
<td>Data availability may be an issue</td>
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<td>✓</td>
</tr>
<tr>
<td>Requires trained enumerators</td>
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<td>✓</td>
</tr>
<tr>
<td>Requires highly trained facilitators</td>
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<td>✓</td>
</tr>
<tr>
<td>Requires advanced research skills</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Requires use of local language</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Relative quick to implement</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Involves significant time and effort from respondents</td>
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<td>✓</td>
</tr>
<tr>
<td>Involves an iterative process of data collection</td>
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<td>✓</td>
</tr>
<tr>
<td>Administered on individuals</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Administered through groups of individuals</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Administered on stakeholders</td>
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<td>✓</td>
</tr>
<tr>
<td>Potentially affected by local nuances</td>
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<td>✓</td>
</tr>
<tr>
<td>Flexibility of technique to adjust to account for local nuances / issues</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Policy issues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Empowers local communities to engage in policy</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Engages stakeholders</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Data can be readily conveyed to policy makers</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
### 7.3.1. Types of values addressed

Table 5 provides a summary of the types of values that can be elicited from the alternative methods. A clear distinction is that only the economic techniques are capable of eliciting economic values for biodiversity; the non-economic methods alternatively can only provide a quantitative and / or qualitative indicator or description of how people might benefit from biodiversity. However, it should be recognised that many of the non-economic techniques are utilised in the administration of the economic techniques (Bienabe and Hearne, 2006) and therefore although they do not directly elicit economic value, they make an important contribution to the valuation process.

There are important differences between the economic methods relating to which components of value can be measured. Only the stated preference methods have the capacity to assess all components of ‘total economic value’ (e.g. use and non-use values), while revealed preference methods can only capture use values. Market-price and market-cost based approaches do not address ‘total economic value’, but alternative captures proxies for direct use.

The methods also have different capacities to value different aspects of biodiversity. Some methods, for example the market-price approaches, will tend to focus on specific components of biodiversity such as soil erosion (Moller and Ranke, 2006), while other approaches such as choice modelling will be capable of valuing a broad range of biodiversity issues. Further, some methods will be more suited to evaluating the different types of ecosystem services associated with biodiversity such as provisioning, regulating and cultural services (Table 5). Finally, the stated preference methods will be most suited to valuing environmental change related to biodiversity (Rolfe et al., 2000).

A key conclusion is that alternative valuation methods have different capacities to address the various types of values and the various components of biodiversity. The researcher therefore needs to be discerning in terms of his / her choice of method to ensure that it is the most appropriate for the task in hand.

### 7.3.2. Methodological challenges

The majority of methods reviewed in this report have their roots in developed countries; the exceptions being RRA, PRA and PAR (Chambers, 1992). Application of valuation methodologies in a developing country context is thus likely to presents a number of additional challenges. Some of these challenges will be general across most methods; while others will be specific to a particular technique or group of techniques. Below we highlight some of the key methodological challenges identified in our review and where possible propose solutions to these challenges.

**Literacy, language and articulacy:** People in developing countries often have low levels of literacy and in the poorest countries many are illiterate. This creates significant problems for administering both economic and non-economic techniques since these methods often rely on respondents being able to read material and perhaps complete a questionnaire. Face-to-face methods such as in-person interviews (Bourque and Fielder, 1995) and participatory techniques (Fazey et al., 2007) have often been used to circumvent literacy problems. However, there may still be language issues. For example, in most instances, the study will need to be administered in the local language (Bush et al., 2004). This will require the use and training of local enumerators; which could be an issue in some areas with low levels of education. There may also be issues relating to the capacity of some local languages to express complex issues. For example, Whittington (1992) highlights problems encountered in expressing hypothetical scenarios in contingent valuation studies where the terms ‘imagine’ or ‘suppose’ are lost in translation or in some cases the conditional subjunctive is not translatable. Participatory approaches (such as participatory mapping, ranking exercises, transect walks / diagrams, trend diagrams and seasonal calendars) appear to present the best solution to overcoming literacy and language issues (Jackson and Ingles, 1998; Asia Forest
Further, participatory approaches tend to better engage respondents and therefore are likely to produce better results (Barton et al., 1997). However, to date, there appears to only have been limited use of participatory approaches in economic valuation studies (Spash, 2007a).

**Scientific knowledge and education:** The link between biodiversity, ecosystem services and human welfare is complex. Scientific understanding of these relationships is likely to be poor in many developing countries. Further, despite a wealth of traditional ecological knowledge, public understanding and knowledge of biodiversity concepts and relationships as they are used in the scientific literature will be low; particularly if there are low levels of literacy (Fazey et al., 2007). It is therefore difficult to employ methods which require respondents to have developed a good understanding of the environmental change (such as stated preference techniques). Ways of incorporating existing traditional ecological knowledge, which is often embedded in cultural and spiritual values, will therefore be required (Fazey et al., 2007). Further, given that people in developing countries are unlikely to have previously considered how biodiversity affects their livelihoods, it will be important to allow them to have ‘time to think’ about and deliberate these ideas (Whittington et al., 1997). Thus, deliberative, participatory approaches which allow respondents ‘time to think’ about and reflect on their values are likely to offer the best approach to address new and complex issues such as biodiversity (Whittington et al., 1992; Urama and Hodge, 2006).

**Subsistence economies:** Many developing countries have informal or subsistence economies. Under such circumstances, market prices may be absent or poorly defined, thus making market-price and market-cost based approaches meaningless or distorted (McCauley and Mendes, 2006). Further, if local people are not used to dealing with money, stated preference methods, which ask people to state their maximum willingness to pay, become obsolete. Some researchers have attempted to address this issue by assessing willingness to pay in terms of other measures of wealth, e.g. number of bags of rice (Shyamsundar and Kramer, 1996; Rowcroft et al., 2004). Although this might be valid within a local context, it does not allow values to be readily transferred beyond that economy.

**Low incomes and distorted markets:** People in developing countries tend to have much lower levels of income (and therefore ability to pay) than people in developed countries. The consequence of this is that indigenous people’s monetary values for biodiversity may often be significantly lower in absolute terms than the values placed on that resource by people from a developed country (e.g. as tourist to that natural resource). Thus, traditional approaches to economic valuation / benefits transfer may lead to undervaluing indigenous values (which is clearly an issue if the indigenous population is heavily reliant on biodiversity for survival). Although there has been some research into international benefits transfer (Barton, 2002; Ready and Navrud, 2006) there are still significant issues that need to be addressed in terms of comparing and transferring values across countries and continents.

**Inappropriate best-practice guidelines:** Most of the methods reviewed in this report have some sort of guidelines of best practice. However, since most guidelines have been formulated for a developed country context, it is unclear as to whether these guidelines are appropriate in developing countries. To illustrate this issue, consider the case of contingent valuation. The NOAA guidelines for contingent valuation (Arrow et al., 1993) were developed in response to an oil damage assessment in the USA. There is evidence suggesting that elements of these guidelines are not appropriate in a developing country context. For example, the NOAA guidelines recommend that the WTP elicitation question should be posed as a dichotomous choice referendum in which payment is made through taxes. In many subsistence economies, however, people often do not pay taxes, and may not trust the government to deliver policy(McCauley and Mendes, 2006). Further, a bidding game payment vehicle may be more appropriate than a dichotomous choice question in countries where people tend to barter over the price of goods and services (Whittington et al., 1990). Clearly, the way people think about and do things in developing countries is different to the way people do things in developed countries. Valuation methods should reflect these
differences, and importantly new guidelines for state-of-the-art applications in developing countries need to be developed.

An exception to the above observation is participatory approaches to research (e.g. RRA, PRA and PAR). These approaches were specifically developed to address the challenges of social research in developing countries (Chambers, 1992). A practical solution to inappropriate guidelines might be to incorporate participatory approaches into the administration of economic valuation techniques, such as in the deliberative valuation methods (Spash, 2007a).

7.3.3. Practical challenges

In addition to the methodological issues outlined above, it is likely that there will also be some additional practical issues and challenges associated with the administration of valuation studies in developing countries. These challenges may include:

**Local environmental conditions:** Many developing countries are subjected to extreme environmental conditions ranging from very hot, dry conditions to wet and humid conditions. Not only are such conditions often uncomfortable to work in, but may also cause problems such as soggy questionnaire papers or malfunctioning computers. Further, many of the more remote areas may be inaccessible during different parts of the year, for example, during the rainy season. In both the Solomon Island (Fazey et al., 2007) and Uganda (Bush et al., 2004) case studies, the field researchers had to ensure such conditions and develop contingencies to account for them.

**Local research capacity:** In many developing countries, there is often a lack of local research capacity to undertake valuation research. For example, our review of the Web of Knowledge indicated that only one-third of the papers identified were led by researchers from developing countries and that half of the studies involved no researchers from the developing country (Section 4.2). There may also be issues with respect to finding local researchers who can both speak the local language and have the capacity to act as enumerators or facilitators (Fazey et al., 2007). Training of local researchers will therefore be essential for most valuation studies in developing countries (Whittington, 1998; Alberini and Cooper, 2000).

**Spiritual and cultural values and nuances:** In many indigenous communities, there may be strong cultural and/or spiritual values of biodiversity, as well as a range of local nuances which need to be adhered to. It will often be difficult for outside researchers to fully appreciate and account for these in the design of their studies (Bourque and Fielder, 1995). Further, in some instances, the researcher may be completely unaware of such values or nuances; which may completely undermine his / her study. The use of trained, local researchers is therefore often essential to ensure that the study is designed to account for these local values / nuances.

**Gaining access to marginal groups of individuals:** In many developing countries, there are significant groups of people who are marginalised from decision making such as women, children, people in remote villages (Fazey et al., 2007). Further, individuals in authority (e.g. village chiefs) may assert undue pressure / influence on how people respond to questions. A rigorous sampling frame is required to ensure the inclusion of all relevant individuals. Also, the method used to collect data, e.g. questionnaire, interviews, focus groups etc., need careful consideration to ensure that it maximises inclusivity and minimises external influences.

Although there are clearly some practical challenges to administering valuation studies in developing countries, experience would suggest that the involvement of local researchers and enumerators at all stages of the research process (from design to implementation) will go a long way to addressing many of these challenges. Whittington (1998) goes further and argues that it can often be easier to administer high quality valuation studies in some developing countries than in developed countries: response rates are typically higher; respondents are receptive to listening and considering questions posed; interviewers are relatively inexpensive.
(allowing larger sample sizes). Further, incorporating participatory approaches (which were developed to address social research needs in developing countries) into valuation would also help to address some of the practical challenges associated with applying valuation in a developing country context.

7.3.4. Policy challenges

Biodiversity provides a range of ecosystem services that are important to people’s welfare and livelihoods. However, economic markets often fail to account for these services, and therefore some form of government intervention is normally required to protect and maintain biodiversity and associated services. Valuation is recognised as an important tool to help policy-makers better understand, and therefore account for, all of the ways in which people utilise and value biodiversity. However, there are often obstacles to ensuring that policy-makers in developing country take full account of the values of biodiversity. These barriers include:

Lack of awareness of, or commitment to, protecting biodiversity: Historically, policy-makers in developing countries were often unaware of the wide range of benefits delivered by biodiversity. However, research programmes such as the recent Millennium Ecosystem Assessment (MEA, 2005) has played a valuable role in raising awareness on the links between nature and people; as illustrated in the Southern Africa MA case study (Biggs et al., 2004). There is, however, still some naivety and scepticism relating to the use of valuation methods in developing countries; which appears to stem from the lack of local expertise and experience of these methods in both the research and policy-making communities. A further confounding issue is that, in many developing countries, there may be more pressing political issues to deal with: such as war, famine, etc. The consequence of this is that biodiversity protection is often low on the political agenda. Whatever the reason, the level of use of biodiversity valuation research within policy decisions in most developing countries appears to be limited. There is therefore a strong case for the establishment of capacity building programmes that raise policy-maker’s and research’s awareness of the range of benefits that biodiversity can have to people and of the methods to capture these values.

Benefits transfer: Empirical valuation studies are often expensive to conduct and therefore impractical in many developing countries. Benefits transfer offers an alternative approach for biodiversity valuation (Wilson and Hoehn, 2006). However, as noted in Section 5.6, there are only a limited number of empirical studies that have valued of biodiversity in developing countries which could currently feed into benefits transfer. International benefits transfer (that is, transferring values from studies undertaken in another country e.g. a developed country) is an alternative option (Ready and Navrud, 2006); although Barton (2002) warns about potential transfer errors. Benefits transfer thus offer a possible solution to avoiding the costs of empirical valuation studies in the future. However, to be effective, new empirical studies will be required. Further, to address methodological issues affecting benefits transfer, these new studies should be designed to (i) take account of the specific needs of valuation in a developing country context and (ii) collect sufficient data to allow for successful benefits transfer.

Action research: Evidence presented in Section 4.2 of this report indicates that half of the valuation research undertaken in developing countries did not involve local researchers or policy-makers. Such research is often extractive and has little or no local policy influence (Barton et al., 1997). The incorporation of Participatory Action Research (PAR) techniques into the valuation process will help to: promote dialogue and deliberation with local people and decision-makers thus fostering ownership and responsibility of problems; promote learning and awareness; and build local capacity to analyse problems and make more effective collective decisions (Wadsworth, 1998). The Solomon Islands case study (Section 6.4) provides a useful illustration of how the use of participatory and action research methods can aid the adoption of research output by policy-makers.
8. Conclusions and recommendations

This report aims to provide an evaluation of both economic and non-economic techniques for assessing the importance of biodiversity to people in developing countries. In this final section, we draw conclusions on the key research objectives (Section 2.2), before providing recommendations for future research.

8.1. How do people in developing countries think about the natural environment?

People in developing countries tend to have much closer links to their natural environment than those in developed countries. This is particularly the case in countries where there is a heavy reliance on subsistence farming; where individuals need to be aware of and respond to environmental conditions. The Millennium Ecosystem Assessment (MEA, 2005) provides a useful overview of the range of ecosystem services that people in developing countries might obtain from the natural environment. It is worth highlighting here that many of the MA ecosystem services (such as food, fuelwood) will have more direct relevance to and therefore impact on people in developing countries than those in the developed world (where the link to the natural environment is more blurred).

Much of the knowledge that people from developing countries have on the natural environment will be attained through personal experience (experiential knowledge) and will often be implicit or tacit (which means it may be difficult or impossible to elicit) (Fazey et al., 2006). The knowledge is often passed down through generations and sometimes linked to spiritual values. Low levels of literacy and education suggest that this knowledge will generally not be considered or expressed in scientific terms.

In many of the poorest countries, people may be heavily reliant on the natural environment for the basic necessities of life. Pressures, such as high rates of population growth, may mean that meeting these short-term needs lead to an over-exploitation of the natural environment. Further, the struggle to meet these short-term needs often means that these people do not consider (or are unable to respond to) the long term impacts of over-exploitation, or consider how this might affect their and future generation’s welfare and livelihoods.

Another important consideration for researchers wishing to value biodiversity is the way in which people in developing countries use and think about money. Many people in the poorest nations (particularly those heavily reliant on subsistence farming) will have little or no use money: instead, these people will often exchange goods and services through an informal bartering mechanism. This lack of experience in monetary markets will have significant implications for valuation: people with little or no experience of expressing values for conventional goods and services will find it extremely difficult to express monetary values for complex, non-market goods such as biodiversity.

The above examples illustrate that people in developing countries often think about their surroundings in ways which are very different to people in the developed world. Researchers, therefore, need to be aware of and account for these differences when designing valuation studies that are to be administered in developing countries.

8.2. How can we reveal the complex relationships between people and their natural environment?

As outlined above, people in developing countries often have implicit, experiential knowledge of their natural environment. The consequence of this is that it may be difficult for them to articulate their relationship with the environment. Low levels of literacy and education will further compound this problem (Bush et al., 2004; Fazey et al., 2007). In addition, there may be important local nuances and spiritual values that external researchers may be unaware of (Bourque and Fielder, 1995). All of the above will make the task of revealing the complex relationships between people in developing countries and their environment challenging.
Evidence from this review has highlighted two approaches that should improve the success of attempts to reveal the complex relationships between people and their natural environment.

**Use local researchers / enumerators.** Almost half of the biodiversity valuation research identified in this review failed to include local researchers in the design and administration of surveys (Section 4.2). Whittington (1998) argues that the failure to utilise local researchers is a significant concern for developing country research as it increases the risk that the research will miss important local cultural and spiritual values, which in turn may compromise the validity of the research findings. The use of local enumerators is also important to account for local languages. However, it is recognised that there is often limited or no local research capacity, and therefore an extensive training programme for local enumerators will be essential (Alberini and Cooper, 2000). Further, experience has demonstrated that it will also be important to monitor and validate data collected by local enumerators (McCauley and Mendes, 2006; Fazey et al., 2007). Local researchers / enumerators also tend to be cheaper to employ than external researchers, which in turn may allow research to be undertaken more cheaply or larger samples to be attained. Finally, by embedding local people into the research programme, it is more likely that the research outcomes will be incorporated into local policy.

**Use qualitative, deliberative and participatory methods.** Biodiversity and their related ecosystem services are complex concepts. For many people in developing countries these concepts will be new and unfamiliar, and few will have thought in detail about how biodiversity affects their lives. Attempts to use economic and non-economic techniques to reveal the importance of biodiversity to people will be challenging. Simple structured quantitative approaches, such as in questionnaires that comprise close-ended questions, are unlikely to effectively uncover the range of ways people relate to biodiversity. More qualitative approaches, such as in-depth interviews and focus groups, provide greater flexibility to probe deeply into people’s underlying preferences (Baird and Flaherty, 2005). Given the complex nature of biodiversity, researchers may also need to present background information on biodiversity and related ecosystem services. This information will need to be presented in an unbiased format that is both understandable and meaningful to the respondents. Often, participatory approaches will be required to effectively present this information in a developing country context (Jackson and Ingles, 1998; Asia Forest Network, 2002). Respondents may then need ‘time to think’ about and deliberate this information to consider how it relates to them (Whittington et al., 1997). Evidence of the potential benefits from incorporating deliberative and participatory approaches into valuation can be found in recent DMV studies (Spash, 2007b, 2007a)

**8.3. How can we reveal meaningful preference revelation?**

In this report we have provided an extensive review of the potential of a range of economic and non-economic techniques to meaningfully reveal preferences and values for biodiversity and related ecosystem services. Details of the merits of individual techniques can be found in Section 5. Below, we provide some general observations.

**Eliciting economic values:** Of the methods reviewed, only the economic techniques have the capacity to elicit the economic value of biodiversity: the non-economic methods are limited to providing descriptive assessments of people’s preferences for biodiversity. The economic techniques, however, differ in terms of their ability to capture different elements of value. Stated preferences methods (such as contingent valuation and choice modelling) have the capacity to capture all elements of total economic value, while revealed preference methods (travel cost and hedonic pricing) are limited to capturing use values. Market-based approaches, on the other hand, are not directly related to the concept of ‘total economic value’, but alternatively use directly observed prices or costs are a proxy to value. The choice of which technique to use in a particular application will depend on: the research objectives; the context in which the technique is to be applied; and the skills of the researcher. However, it should also be stressed that no one technique can be considered superior, but rather that each technique has its own merits and limitations and these need to be considered when...
selecting the technique for an application. Further, given that different techniques have different merits, it may be appropriate to adopt a range of techniques within a study to cover the range of biodiversity benefits; as illustrated in the Montserrat case study (Section 6.2).

What can non-economic techniques tell us about biodiversity values? Although non-economic techniques do not have to capacity to directly estimate the economic value of biodiversity, they can provide useful and detailed information on the ways in which people use and relate to biodiversity. In particular, qualitative approaches (such as in-depth interviews and focus groups) provide opportunities for the researcher to probe more deeply into people’s preferences than could be achieved using either quantitative or economic techniques. Such detailed insights may be extremely useful for uncovering local cultural and spiritual values which might not be directly transparent to external researchers. Further, the insights gained from qualitative research may provide important supplementary information that might be useful to help understand the reasons underlying people’s economic values.

Can non-economic approaches be used to improve economic methods? Many of the economic techniques utilise non-economic methods in the design stages (e.g. interviews, focus groups to identify research questions or attributes), and in the administration of the surveys (usually in-person interviews or questionnaires). However, there is often very little emphasis placed on the rigour with which these non-economic aspects are applied in economic valuation studies: only a handful of the economic valuation studies identified in this review provided any detail on how the non-economic techniques were utilised in the design and administration of the valuation studies. The consequence of this that any flaws / errors in the initial qualitative assessments can result in compounded effects of error as the analysis of the research progresses. Such effects are likely to be more prevalent in developing countries where local research capacity may be low (Kaplowitz, 2001; Kaplowitz and Hoehn, 2001). It is thus argued that much more rigour and transparency needs to be undertaken when using non-economic methods in economic valuation studies.

Many of the economic valuation approaches utilise questionnaires and surveys to collect information on people’s values. The review of non-economic techniques, however, questioned the appropriateness of these approaches in a developing countries context: low levels of literacy mean that people may not be able to read questionnaires; language barriers may mean that it is difficult to articulate complex concepts; restricted time during interviews may limit people’s ability at develop and express value preferences (Whittington, 1998; Urama and Hodge, 2006). Participatory and deliberative approaches may offer an alternative approach to the design and administration of valuation studies, in which information is presented and collated in a way that is suited to a developing country context. Indeed, participatory approaches such as PRA were developing to meet the needs of social science research in developing countries (Chambers, 1992). Such approaches also provide respondents with ‘time to think’ about their preferences, which has been demonstrated to improve the accuracy of valuation surveys (Whittington et al., 1997). Participatory approaches will also aim to apply valuation through traditional, cultural or thinking practices which will help to avoid the problem of imposing a western way of conceptualising environmental goods and services. Taken to its logical endpoint, this would suggest that valuation draws on the practices of anthropologists and ethnographers, which also brings additional challenges when trying to bridge the epistemologically and philosophically different disciplines. The recent research effort into deliberative valuation methods (DMV) aims to incorporate some of the ideas from deliberative and participatory methods into valuation (Spash, 2007b). However, this area of research is still in its infancy and has rarely been applied in a developing country context. We argue that approaches such as DMV has the potential to significantly improve the way in which the preferences of people from developing countries are revealed, and suggest that further research is undertaken to explore opportunities for incorporating deliberative and participatory methods into economic valuation.

Local knowledge and research capacity. As outlined earlier, meaningful preference revelation will be greatly enhance if local researchers and enumerators are used in the design
and administration of valuation studies in developing countries. Local researchers will be aware of local values and nuances which might be over-looked by external researchers. They will also allow the research to be conducted in the local language.

**Are methods developed in developed countries suitable for use in developing countries?**

Most of the economic and non-economic methods reviewed in this report have been developed by researchers in developed countries; the exception being some of the participatory approaches such as RRA, PRA and PAR. However, there is some evidence that approaches developing in developed countries might not be directly suitable for application in developing countries. For example, we have highlighted above that participatory approaches to data collection may be more appropriate in developing countries than standard questionnaire. Whittington (1998) provides further examples relating to the inappropriateness of some of the NOAA guidelines (Arrow et al., 1993) for best-practice in contingent valuation. Valuation in developing countries is currently in its infancy, and currently there are no clear guidelines exist with respect to how best to apply valuation methods in a developing country context. We therefore argue that strategic, new research is undertaken to develop such guidelines.

**8.4. How can we best produce results that are meaningful to policy-making?**

Over half of the valuation studies reviewed for this report did not involve local researchers. The consequence of this is that the research is likely to be extractive and have no link to local policy-making. To produce results that are meaningful to policy-making, the research needs to include local researchers in the design and administration of the study, and well as utilise participatory and action research methods. Participatory and action research approaches tend to increase motivation, engagement, ownership and responsibility of the research process and often focuses on managing power relationships within communities that may affect the results obtained. However, there is considerable misunderstanding of what real participatory research actually entails. It is not a consultative exercise where research is extracted by external investigators and then analysed elsewhere. Instead, effective participatory research is a process that is embedded within communities and decision-making processes in ways that promote sharing of information and learning. By focusing on participation as an end in itself rather than seeing it as a means to which values can be elicited, much greater consideration is given to the cultural aspects that influence the ability of those most marginalized to speak out. Overall, participation in the research results not only in better uptake of the results, but can also be more cost effective (Danielsen et al., 2007).

As outlined earlier, there is much scope for developing methodologies that more effectively integrate participatory approaches into economic valuation. This will require a perceptual shift in the way economic researchers view valuation research in countries with developing economies and the relevant funding agencies. Projects will need to recognize the difficulties of working effectively with local communities, the need to build capacity of local researchers with existing local and traditional knowledge to execute research, and the timeframes required to conduct the work effectively. From a policy perspective, much greater emphasis could be placed on research that actively contributes to capacity building through requiring more rigorous ways of involving communities in the research, rather than simply using traditional dissemination methods.
8.5. **Recommendations**

This report has aimed to provide a systematic and rigorous review of the potential of economic and non-economic methods for revealing the importance of biodiversity to people in developing countries. In this final section, we outline some concluding comments and recommendations on how valuation research might be better designed to value biodiversity in developing countries in the future.

- **The valuation of biodiversity is clearly an important step to recognising the importance of biodiversity to people and bringing biodiversity into the realm of decision-making and politics. However, research into the valuation of biodiversity in developing countries is in its infancy and further research effort is required to develop clear guidelines of best-practice.**

- **Many of the economic and non-economic techniques have been developed and refined for use in a developed country context. Often, best-practice in a developed country context might not be appropriate in a developing country context. Further research is therefore required to develop best-practice guidelines for valuation research in a developing country context.**

- **Deliberative, participatory and action research approaches appear to provide useful avenues for improving valuation research in developing countries. Further research is required to assess ways in which these approaches might best be incorporated into economic valuation.**

- **Valuation research will be more effective and valid if local researchers are utilised at all stages in the design, administration and analysis of valuation studies. However, there is often a lack of local research capacity in many developing countries. A research capacity building programme is therefore seen as essential if we wish to effective value biodiversity in developing countries.**


10. Appendix
Table 6: Analysis of the type of biological resource valued by economic and non-economics techniques as sources from the Web of Knowledge

<table>
<thead>
<tr>
<th>Technique</th>
<th>Number of papers</th>
<th>% of total</th>
<th>BIOLOGICAL RESOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ecosystem</td>
</tr>
<tr>
<td>Production Function</td>
<td>12</td>
<td>4.2%</td>
<td>7</td>
</tr>
<tr>
<td>Opportunity Cost</td>
<td>56</td>
<td>19.7%</td>
<td>41</td>
</tr>
<tr>
<td>Damage Cost</td>
<td>9</td>
<td>3.2%</td>
<td>5</td>
</tr>
<tr>
<td>Replacement Costs</td>
<td>4</td>
<td>1.4%</td>
<td>3</td>
</tr>
<tr>
<td>Travel Cost Method</td>
<td>7</td>
<td>2.5%</td>
<td>1</td>
</tr>
<tr>
<td>Hedonic Price Method</td>
<td>2</td>
<td>0.7%</td>
<td>0</td>
</tr>
<tr>
<td>Contingent Valuation</td>
<td>73</td>
<td>25.7%</td>
<td>34</td>
</tr>
<tr>
<td>Choice Experiment</td>
<td>17</td>
<td>60.6%</td>
<td>9</td>
</tr>
<tr>
<td>Deliberative Valuation</td>
<td>1</td>
<td>0.3%</td>
<td>1</td>
</tr>
<tr>
<td>Benefits Transfer</td>
<td>2</td>
<td>0.7%</td>
<td>1</td>
</tr>
<tr>
<td>Questionnaires</td>
<td>48</td>
<td>16.9%</td>
<td>27</td>
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<tr>
<td>In-Depth Interview</td>
<td>13</td>
<td>4.6%</td>
<td>7</td>
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<tr>
<td>Focus Groups</td>
<td>11</td>
<td>3.9%</td>
<td>5</td>
</tr>
<tr>
<td>Health Based Approaches</td>
<td>1</td>
<td>0.3%</td>
<td>1</td>
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<tr>
<td>Q-Methodology</td>
<td>2</td>
<td>0.7%</td>
<td>2</td>
</tr>
<tr>
<td>Rapid Rural Appraisal</td>
<td>5</td>
<td>1.8%</td>
<td>5</td>
</tr>
<tr>
<td>Participatory Rural Appraisal</td>
<td>11</td>
<td>3.9%</td>
<td>10</td>
</tr>
<tr>
<td>Participatory Action Research</td>
<td>10</td>
<td>3.5%</td>
<td>8</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>284</strong></td>
<td><strong>167</strong></td>
<td><strong>19</strong></td>
</tr>
</tbody>
</table>
Table 7: Analysis of the context in which techniques were employed to value biodiversity as sources from the Web of Knowledge

<table>
<thead>
<tr>
<th>Technique</th>
<th>Number of papers</th>
<th>% of total</th>
<th>CONTEXT</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Park management</td>
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<td></td>
<td></td>
<td></td>
<td>Agriculture</td>
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<td>Natural Resource</td>
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<td></td>
<td></td>
<td></td>
<td>Management</td>
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<td></td>
<td></td>
<td></td>
<td>Other</td>
</tr>
<tr>
<td>Production Function</td>
<td>12</td>
<td>4.2%</td>
<td>0</td>
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<td>6</td>
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<td></td>
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<td>2</td>
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<tr>
<td>Opportunity Cost</td>
<td>56</td>
<td>19.7%</td>
<td>1</td>
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<td></td>
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<td></td>
<td>10</td>
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<tr>
<td>Damage Cost</td>
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<td>3.2%</td>
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<tr>
<td>Replacement Costs</td>
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<td>1.4%</td>
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<tr>
<td>Travel Cost Method</td>
<td>7</td>
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<tr>
<td>Hedonic Price Method</td>
<td>2</td>
<td>0.7%</td>
<td>1</td>
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Table 8: Analysis of the Continent in which techniques were employed to value biodiversity as sources from the Web of Knowledge

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ACKNOWLEDGEMENTS

We would like to thank the following individuals and organisations for their time and input in responding to the expertise questionnaire:

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DR. ABUID KASWAMILA, Senior Lecturer, College of African Wildlife Management-Mweka, Tanzania

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Ms. NGUYEN THI YEN, Forest Programme Manager, Forest Conservation, Vietnam Country Programme, Vietnam.

JOHN ERICHO, Research and Conservation Foundation, Papua New Guinea

CATHERINE HANEKOM, Resource Use Ecologist Zululand, Ophathe Game Reserve, South Africa

ARTURO MORA, Programme Officer, Red List Species, IUCN Regional Office for South America, Ecuador.

PRABHU BUDHATHOKI, County Director, IUCN, Nepal

RICHARD MCNALLY, WWF Greater Mekong Programme, Vietnam Programme Manager, Vietnam

PROF. MOSES OKELLO, Centre for Wildlife Management Studies, Kenya.

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