The "Ménage-à-Trois" of Biodiversity, Human Welfare and Developing Countries: Can Valuation Techniques Reveal the True Nature of this Relationship?

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"Though this be madness, yet there is method in't" (Hamlet, Act 2, Scene 2)

Abstract

The Millennium Development Goals explicitly recognise "sustainable development" as a target. A step towards this is a greater understanding of the significant role of biodiversity in rural communities of developing countries who depend most on the ecosystem goods and services and who as a result may suffer most from its continued degradation. Understanding the input of biodiversity in developing countries to the provision of the ecosystem goods and services (EGS) that are essential to their human well-being is seen as a significant first step in sustainable development, and environmental valuation is a necessary tool for achieving this objective. However, valuing biodiversity in a developing country context can be an intricate affair. While economic valuation literature yields a range of tried and tested methodological techniques for measuring biodiversity, the question remains as to whether these generalised techniques are capable of revealing the complexities of local environmental use in developing countries. A heterogeneous group, "developing countries" can be characterised by a range of factors existing in different intensities that can (1) impact the ways in which local communities interact with their environmental resources (2) impact the efficacy of the methodological and data collection process (3) impact the values obtained from the application of valuation techniques and (4) impact the implementation, success and sustainability of policy and management prescriptions. This paper attempts to address these issues by discussing the main characteristics of developing countries that can impact the biodiversity valuation process and, with specific reference to Small Island Developing States (SIDS), discussing how knowledge of these characteristics can assist the valuation process to better reveal the complex interaction between biodiversity and human welfare in a developing country context.

1. Introduction

It is now a truth universally acknowledged that biodiversity is fundamental for the sustainability of current and future human livelihoods (Perrings *et.al* 1995, Heywood 1995, Daily 1997, Levin and Pacala 2003, Millennium Ecosystem Assessment 2005 [1], Aronson *et.al* 2006, Gatzweiler 2006). By ensuring proper functioning of ecosystems that generate a stream of ecosystem goods and services, biodiversity is seen as essential to human well being. Notwithstanding these recognitions, changes in biodiversity continue (Watson *et.al* 1995, Curtis 2004, Baumgartner *et.al* 2006, Costanza 2007). Biodiversity loss has been termed the "central environmental challenge of our time" (Levin 1999, Polasky *et.al* 2005, Millennium Ecosystem Assessment 2005 [5]).

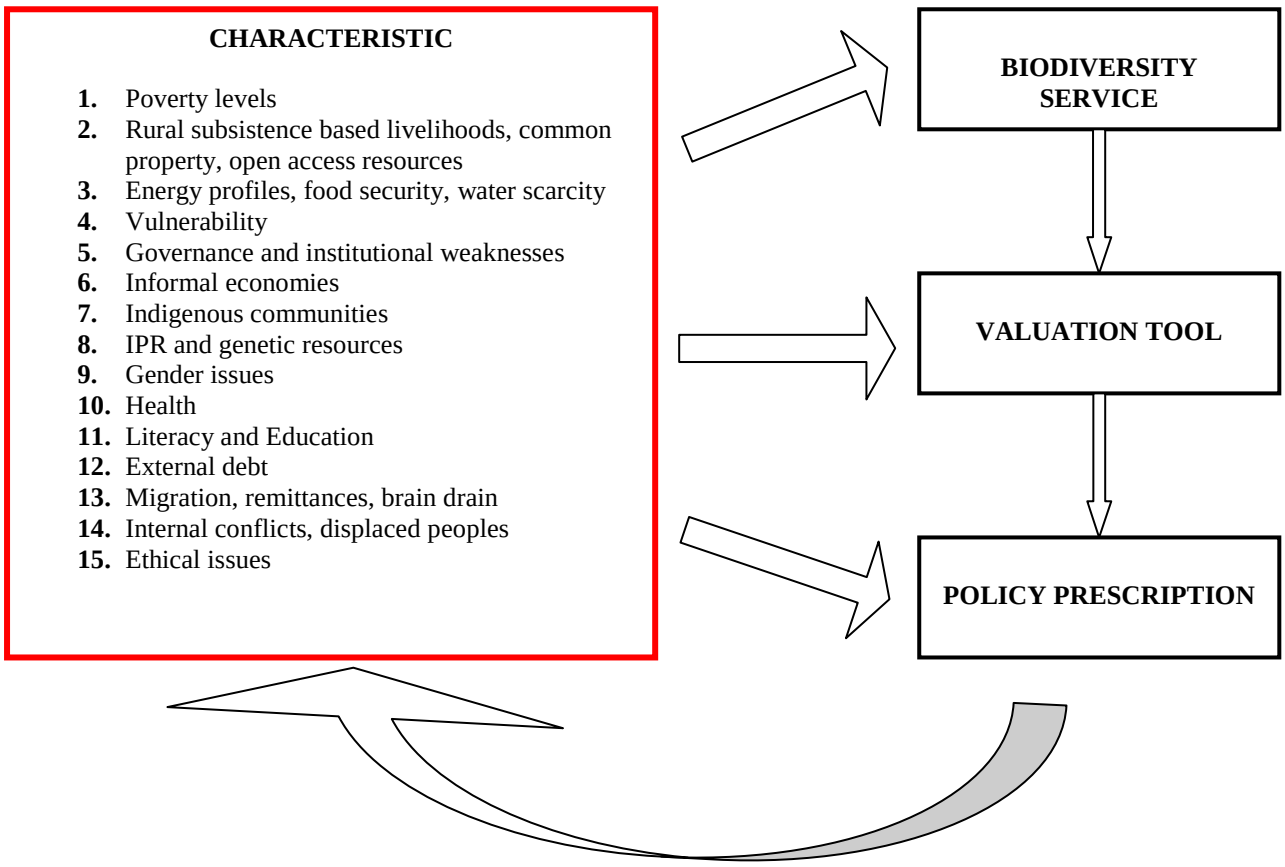
The Convention on Biological Diversity states as its three objectives the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources (OECD 1999). The realisation of these objectives depends on the ability to place a value on welfare changes associated with the loss of ecosystem goods and services into which biodiversity plays an integral role. However, valuing biodiversity is itself an intricate affair. With a variety of available definitions and value perceptions spanning scientific disciplines and levels of aggregation, an insufficient knowledge of the mechanisms of transfer between biodiversity and human welfare, the existence of direct and indirect drivers of change at varying spatial and geo-political levels, and an inevitably broad range of stakeholders with often conflicting objectives, the multi-dimensionality of biodiversity is synonymous with its complexity (OECD 1999). Notwithstanding this it is essential that, as the foundation of effective environmental management, we attempt to assess the relationships between biodiversity and human well-being – and there exists a multiplicity of economic valuation tools that have risen to accept this challenge.

Any valuation technique must be seen in the context of the component of the biodiversity service being measured. The concept of Total Economic Value (TEV), which compartmentalises biodiversity value into use values and non-use values (Nijkamp et.al 2008), has now given way to the MEA methodological approach of Ecosystem Goods and Services (EGS), where values are now disaggregated into provisioning, regulating, cultural and supporting services (Millennium Ecosystem Assessment 2005). The standard valuation exercise is to disaggregate environmental resources into the different types of services that they provide. From this, it is possible to adopt various valuation tools and techniques (both economic and non-economic) in an attempt to monetise these services. Once this is complete, policy prescriptions, and implementations, must follow.

Whichever methodological approach is adopted, some of the techniques are more capable of revealing the values of some of these service subsets rather than others (Nunes and Van den Bergh 2001). Furthermore, it is undeniable that, no matter the technique, some of these values themselves in the context of human welfare are by definition notoriously difficult to reveal. For this reason many scientists have despaired of valuing biodiversity and many criticisms surround the ones who have made the attempt (Nunes and Van den Bergh 2001, Wilson and Howarth 2002, Howarth and Farber 2002, Brito 2005, Hoffman and Hoffman 2008).

The picture becomes further complicated by the context in which valuation efforts are attempted. Much of the world's biodiversity "hotspots" are located in the developing world (Gossling 1999, Myers *et.al* 2000, O'Connor 2008). The Millennium Development Goals explicitly recognise "sustainable development" of developing countries[1] as a target, with valuation viewed as a fundamental aspect of this notion (Georgiou *et.al* 1997). While the methodological techniques of valuing and managing biodiversity have largely been created context-free, and their applications are to be found mainly in the developed world (Christie *et.al* 2008), the relative richness of biodiversity in the developing world and its unprecedented rates of loss mean that research focus must be intensified on these countries (Ninan and Sathyapalan 2005, Christie *et.al* 2008). It is essential that we understand and assess the interactions between biodiversity and human well-being in the very countries and regions that are both directly determining its loss by explicit economic decision-making and may also bear the brunt of the consequences of such loss. However, it is increasingly accepted that environmental management practices, and the environmental valuation that necessarily precedes this, cannot be imported wholesale from the developed to the developing world (Turnbull 2004).

Figure 1: Developing Country Characteristics and Biodiversity Valuation



[1] Paran and Williams (2007) provide a thought-provoking discussion on the validity of even the categorisation of countries into "developed" and "developing", given that most countries in the world face problems with "development".

The usual practice of biodiversity valuation can be disaggregated into four general steps. Given the particular type of ecosystem service to be valued, it is possible to adopt various valuation tools and techniques (economic and non-economic) in an attempt to monetise these services (Appendix 1 gives a summary overview of these methods). Once this is complete, policy prescriptions, and implementations, must follow. If properly implemented, this leads to a feedback to the biodiversity service in terms of the better resource management that results (see Figure 1). The underlying objective of the exercise is to ensure that the policies that are implemented result in an improvement of the characteristics which, by affecting how biodiversity is viewed and utilised, can in increments lead to the sustainable use of the biological resources.

However, any valuation and management exercise should always be cast within the mould of the economic, sociological, political and cultural characteristics and peculiarities of the study site within which it is located. Such characteristics determine the interactions between the local populations and the environment, can affect the use of valuation tools, and can hinder the efficacy of policy outcomes based on such measurements; in other words, they affect every stage of the valuation exercise (see Figure 1). Valuation studies that are framed without a cognizance of these characteristics and how they affect each step of the process run the risk of being irrelevant to the sustainable development of the country within which the study is conducted. The relationship between biodiversity and human welfare in developing countries, and the extent to which particular valuation tools are able to unearth this, are therefore matters that require special attention. However, before valuation techniques can be assessed, developing countries themselves, and the characteristics of biodiversity and resources use within them, need to be better understood (Twyman 2001, Hartter and Boston 2007). It is this to which we now turn our focus.

2. "Developing Countries": A Heterogeneous Group

From a development perspective, the world has long since been divided into the dual categories of "developed economies" and "developing countries".[2] These divisions are meant to reflect basic economic status, but also now encompass other indicators that reflect social, environmental and health conditions. Many valuation studies have identified themselves with one category or the other, with some applied work conducted within, and with a focus to, "developing countries" (Georgiou et al 1997, Christie *et.al* 2006). There are indeed certain common characteristics among the countries of the developing world, such as lower standards of living than their developed world counterparts, extensive poverty, and economic vulnerabilities (UN Desa 2004 Trends and Policies in the World Economy). However, not all developing countries are created equal, and to treat them as such is to over-simplify the issue (Human Development Report 2007/2008, UNDP 2007). There exists within this group a series of sub-classifications of countries that naturally form based on a confrontation of similar developmental challenges due to common geographical, economic and environmental characteristics. "Developing Countries" as a category cannot be seen as an homogenous group. To ignore this fact is to ignore valuable information that can guide the scoping, valuation and policy prescription process.

Geographically speaking, the "Developing Countries" can be divided into Africa, Asia/Pacific (excluding Australia, Japan, New Zealand, and the member states of CIS in

[2] Historical events have also led to a third category, that of "economies in transition"

Asia), and Latin America and the Caribbean[3]. However, while it may play a role, geographical location does not imply a commonality in developmental challenges. Proximity does not imply uniformity. In recognition of this fact, the U.N. uses a series of different (and not necessarily mutually exclusive) categories for its own analytical purposes. In a 2007 Report, the U.N. Developmental Agenda identified the four overlapping categories of Africa, Least Developed Countries, Small Island Developing States, and Landlocked Developing Countries (U.N. Desa 2007), and attention continues to be paid to these categories in Development reports and statistical publications. Additional interesting categories utilised in some of the analyses of the 2008 World Economic Situation and Prospects are those of Heavily Indebted Poor Countries, Oil-Exporting Countries and Oil-Importing Countries. Each of these groups has been constructed based on particular common developmental constraints that originate in geographic, economic, sociological or environmental factors or some particular combination of these.

Comprising almost 12 % of the world population but only 0.6% of global GDP, the category of the "Least Developing Countries" (LDCs) is one of the most important distinctions of the "Developing Countries" group. Membership in, and graduation from, this deeply challenged category of countries is based on three criteria – gross national income per capita, a human assets index and an economic vulnerability index. With the establishment of the LDC category over thirty years ago, the number of countries fitting the criteria has doubled from 25 in 1971 to 49 in 2008 (UN LDC Report 2008)[4]. This group continues to become marginalised from the world economy, lacking human, financial, physical and institutional resources to lift themselves from this poverty trap (UN Desa Development for All 2007). Many of the Millennium Development Goals are targeted to improvements in this group of countries as a global priority.

"Africa" is the one analytical category that groups countries together based on geographic proximity. Disaggregated into Northern Africa (excluding Sudan) and Sub-Saharan Africa (including Sudan),[5] the urgent developmental requirements of Sub-Saharan Africa in particular dominates the global developmental agenda. Sub-Saharan Africa is the poorest and most conflict-ridden region in the world (UN Desa 2007 Development for all). It is also the region most afflicted by infectious diseases such as HIV/AIDS, with this likely to significantly constrain its future economic development. Sub-Saharan Africa dominates the LDC group, accounting for 32 out of the 49 LDC countries.

"Small Island Developing States" (SIDS) and "Landlocked Developing Countries" (LLDCs) are two subsets formed on an international recognition of geographic disadvantage (UN SIDS 2004). SIDS represent a particular case in terms of economic, environmental and developmental challenges[6]. Small populations are coupled with high population densities concentrated in coastal zone areas which comprise much of the small land areas. They exhibit a high degree of vulnerability to the world economy due to a dependence on international

[3] Appendix 1 gives the full listing of "Developing Countries" in these geographic categories based on the U.N. Desa 2008 Report "World Economic Situations and Prospects"

[4] The latest UN information as of July 2008 indicates that Botswana and Cape Verde graduated from the group, the Maldives and Samoa are expected to graduate over the next few years, and Ghana, Papua New Guinea and Zimbabwe are eligiblefor LDC status but declined to be included in the group (UN LDC Handbook 2008).

[5] See Appendix 1 for the complete country listing

[6] Note that, as recognised by the UN, there is no clear definition of this category, with suggestions ranging from population size, to land area, to national income, to share of world trade. The most commonly used criterion is a population threshold of 1.5 million (UN SIDS 2004), but this itself has no strict boundaries since the inclusion of Jamaica in this group, for example, clearly violates this criterion

trade for the absorption of exports and as a source of imports. They are highly vulnerable to the natural environment, in particular natural disasters and climate change impacts. There is a heavy reliance on natural resource exploitation, with many of the SIDS being "monocrop", tourism-oriented economies. A 2008 UN Report classified 51 states into the SIDS category (UN Desa 2007 Development for All), with 11 of these also belonging to the LDC category.

"Landlocked Developing Countries" (LLDCs) are, by definition, those countries that lack territorial access to the sea. Scattered across four continents (with half of them to be found on the African continent) , they share the common problems of geographic remoteness, and dependence on the trade and transport systems of neighbouring, coastal countries (UN LLDC Facts and Figures 2006). Given that many of these countries are characterised by transport-intensive export commodities, this is an especially constraining fact (UN Desa Development for All 2007). High transport costs render a competitive disadvantage for exports, and are disadvantageous for both investment and consumption as import costs also rise (UN Desa Development for All 2007). Many of these countries are in circumstances of poverty; of the 31 countries identified as LLDCs, 16 of them are also categorised as LDCs.

The four categories discussed above are the more utilised delineations of "Developing Countries". An additional, interesting category that points to economic vulnerability is that of the "Heavily Indebted Poor Countries" (HIPCs). 41 countries, at various stages of debt relief under the HIPC Initiative[7], belong to this category (IMF website). It is telling that 34 of these also belong to the LDC category; put another way, of the 49 countries that comprise the LDC group, approximately 69.4% of these are characterised as heavily indebted. Two further categories utilised by the U.N. are Oil Exporting Countries (with 25 countries in this group) and Oil Importing Countries (containing all the remaining developing countries). The fact that the majority of the developing world are oil importers point to their vulnerabilities to the vagaries of the international oil market and global economy. An ironic point to note of the group of oil exporters is that, of the 25 countries in this group, 8 of them are on the African continent[8], with 4 of them[9] in Sub-Saharan Africa, and Angola also belonging to the LDC category[10].

We have discussed the different categories in the context of the most recognised and utilised subset of "Developing Countries", that of the Least Developed Countries (LDCs). However, several developing countries intersect three or more of the categories outlined above. 14 countries of Africa are also Landlocked Developing Countries, with 12 of these classified as LDCs (the exceptions being Zimbabwe and Botswana). Of the 11 SIDS classified as LDCs, 5 come from the Africa group. Of the 34 countries that belong to both the HIPC and LDC group, 14 come from the Africa group. 13 countries characterised as both LDC and HIPC are also Landlocked Developing Countries. 5 of the 41 HIPC countries are also small island economies, with 4 of them also categorised as LDCs (the exception being Guyana).

12 countries remarkably (and unfortunately) intersect 4 of the groups described above[11]. All of these 12 belong to the LDC group, are to be found in Africa and are all heavily indebted.

[7] The HIPC Initiative is a programme of debt reduction for heavily indebted poor countries. To benefit from this programme, countries must undertake IMF and World Bank supported adjustment and reform programmes (IMF Website)

[8] Algeria, Angola, Cameroon, Congo, Egypt, Gabon, Libyan Arab Jamahiriya, Nigeria

[9] Angola, Cameroon, Congo, Gabon

[10] Only one of the oil-exporting countries belongs to the SIDS group – that of Trinidad and Tobago

[11] Burkina Faso, Burundi, Chad, Central African Republic, Comoros, Ethiopia, Guinea Bissau, Malawi, Mali, Niger, Rwanda and Zambia

In addition, two of them (Comoros and Guinea-Bissau) are small island developing states (belonging to the SIDS category). The remaining 10 countries are also landlocked (belonging to the LLDC category). These 12 countries therefore possess a host of characteristics that constrain them in a developmental way.

This discussion highlights some of the main desegregations of developing countries based on common developmental constraints rather than geographic proximity. Many countries categorised as "developing" in Appendix 2 do not fit into any of these groups and have not been explicitly mentioned here. However it is not the suggestion that the developmental challenges faced by such countries are not of importance or relevance or do not deserve attention. To be sure, there exist many other ways of classifying developing countries that can continue to subdivide the group along different delineations. Other groupings may also be of more relevance to other analytical situations. However, the purpose of this discussion was not to undertake exhaustive sub-classifications of developing countries along the complete lines of commonalities that may be identified. Rather, this section is an attempt to demonstrate that, while developing countries are not homogenous as a group, we can in fact homogenise subsets of them (albeit in a non-mutually-exclusive way) based on connectivities in terms of certain developmental characteristics, constraints and vulnerabilities. The question now becomes how knowledge of categories such as these can aid in the process of demystifying biodiversity perception, use, valuation and management in the countries to be found within them.

3. The Factors affecting Biodiversity Perception, Use and Valuation in "Developing Countries"

Nunes and Van den Bergh (2001) identify three factors that influence the range of estimates of biodiversity values in existing studies – the level of diversity under consideration, the biodiversity value type under assessment, and the valuation method applied. We suggest that a fourth factor, the location of the valuation study being undertaken, is also crucial to the valuation process. The development context within which a valuation process is investigated is the lens through which biodiversity resources are viewed, valued, and utilised by the local populations. In the developing world, there exists a battery of characteristics and challenges that should be understood in order to accurately construct and interpret a biodiversity valuation exercise. Furthermore, these characteristics can exist with varying levels of intensities in the sub-categories discussed above. These issues, and their intensities, determine how a resource is perceived and utilised, what can be valued, the methods that are appropriate to elicit such values, and how the policy recommendations should best be structured for effective environmental management within the particular development context. In this section we highlight some important characteristics of developing countries, how each one can in a general sense affect environmental perception and biodiversity use and how this can affect the biodiversity valuation process.

3.1. Poverty Levels

The obvious and primary demarcation between the developed and the developing world is the presence, and persistence, of levels of poverty. The Millennium Development Goals can be expressed in terms of a single overarching target – the ending of world poverty (MDG Report 2008). Similarly, all of the issues that follow can feasibly be linked back to this overarching

issue in a vicious cycle – perpetuated as a result of, and itself exacerbating, levels of poverty (albeit to different extents within the frameworks of the countries under study). Poverty is popularly expressed in terms of income inequality, with extreme poverty defined as those living under less than 1.08 USD per day[12] (MDG Report 2008). However it is widely recognised that poverty is a deep and complex issue, multi-faceted in nature, with various causes and manifestations at different levels of analysis. Furthermore, the relationship between poverty and environmental resources is a controversial one[13].

The well-known and much-tested Environmental Kuznets Curve analysis postulates an inverse relationship between income per capita and environmental degradation, though this does not empirically hold true for all environmental indicators (Dietz and Adger 2003, Casey *et.al* 2008). It is a widely held (and widely debated) view that poverty is a major cause and a major effect of environmental problems (Muphree 1993, Moseley 2001), due to a high rate of time preference and the resultant discounting of future incomes at extremely high rates (Dasgupta 1997, Heltberg 2002). The poor are often seen as compelled to exploit their surrounding environmental base for immediate and short-term survival (Sylwester 2004, Batabyal and Belabi 2006, Hartter and Boston 2007), with sometimes little choice but to exploit marginal areas or derive resources from protected areas. The poorer segments of society can themselves become unwilling agents of environmental degradation. They are also the ones that are assumed to be most vulnerable to, and affected by, natural resource degradation (Brundtland Report, WCED 1987, Casey *et.al* 2008).

Levels of poverty will affect how, and how much, biodiversity services are valued by the communities. Provisioning, regulating, supporting and cultural services will have different weights attached to them depending on the level and extent of poverty in the communities under study; this will then have implications for the techniques used to elicit such values. Traditional thinking leads to the assumption that a high dependence on surrounding resources implies a high value assigned provisioning services; in the old language it can be said that the "use-values" placed on the biodiversity resources are hypothesised to be the most important to these communities. This seems a reasonable hypothesis, and some empirical investigations of this are discussed in the following section. However, it does not immediately follow that if use-values are high, non-use values are non existent. Montgomery (2002) claims that public knowledge and preferences for biodiversity are low even in developed countries, let alone developing ones. There has in fact been little discussion on the importance of non-use values of the environment to communities in developing countries (Casey *et.al* 2008)[14]. If they exist, and their magnitudes can be estimated, this can have significant policy implications for the welfare improvements of poorer communities in developing countries.

It is essential to understand the levels of poverty in the country under study before a valuation exercise is undertaken. In the first place, poverty may have many associated characteristics (such as literacy, and other matters to be discussed here) that can have specific consequences for the actual execution of the valuation exercise under study. Secondly, in the bigger picture, if the aim of the valuation study is for recommendations of poverty alleviation through

[12] Measured in 1993 Purchasing Power Parity.

[13] We do not claim to enter or even summarise this debate here; the interested reader is instead referred to the works of Sen ( ), Dasgupta ( ).

14 In a study on oil transport on the Amazon, these authors did in fact find the presence of non-use values within rural communities. Turpie et al (2003) estimated the existence value of biodiversity in South Africa to be at high levels.

resource management policy prescriptions, then this will be a futile attempt without a more precise understanding of how poverty levels affect the resource perception and use at the site.

3.2. Rural Subsistence-Based Livelihoods, Common Property and Open Access Resources

Nearly 70% of the total population of developing countries live in subsistence-based rural communities (World Bank 2004, Hartter and Boston 2007). This leads to heavy pressures on natural resources within developing countries and a resultant resource degradation (Heltbery 2002, Sylwester 2004 Batabyal and Belabi 2006, Hartter and Boston 2007, Muhammed *et.al* 2008)[15]. There has been a great emphasis in particular on the role of agriculture as a source of rural livelihood and employment in developing countries (Batabyal and Belabi 2006, Editorial, Global Environmental Change 18 2008)[16]; in sub-Saharan Africa, for example, 58% of the total labour force is associated with agricultural activities (UN Human Development Report 07-08). Notwithstanding this, valuation studies seem to have overlooked the livelihood values[17] of natural resources in developing countries, with a focus instead on amenity values of developed countries (Deacon *et.al* 1998, Dasgupta 2001, Pattanayak and Buttry (2005).

In response to this research gap, there exists a recent and growing literature that attempts to quantify the relationship between communities and natural resources in developing countries (Hartter and Boston 2007, Narain 2008)[18]. Empirical exercises such as this not only point to the importance of natural resources in daily life, but also serve to quantify the vulnerability of communities to their loss and the importance of the proper management of such resources to the future well-being of these communities. An interesting empirical find of this literature is the unambiguous conclusion that as income rises, the share of this income due to resource dependence declines. Fisher (2004), discussing the variation in resource-income share with total household income, points to a more controversial implication – that if resource collection is viewed as a low return activity which is avoided as income increases, resource management can help to alleviate poverty but not to reduce it in cases such as these. In contrast, Narain (2008), in a household study in rural India, finds that resource collection, far from being a low return activity, is in fact a productive source of income capable of lifting incomes above subsistence levels and thus reducing rather than just alleviating poverty.

It is widely accepted that these resources upon which poor rural households from developing countries depend for their daily livelihoods are open access or common property[19] (Heltberg 2002, Quinn *et.al* 2007, Narain *et.al* 2008), with a major problem facing developing countries

15 Sylwester (2004) also points out that it is not a truism that subsistence farmers will necessarily exist within a poverty trap and cause resource degradation.

16 This emphasis can lead the analysis to a key work in the literature of Development Economics – that of the dual economy models of Arthur Lewis, where developing economies are theoretically characterised by agricultural and industrial sectors, with unlimited supplies of labour (Lewis, ref).

17 Synonymous with the "provisioning services" of the MEA methodology.

18 Narain *et. al* (2008) present a thorough discussion on the different measures available – for example, they can be income-based, time-based, or based on rate of participation by households.

19 Note the difference between the two – common property implies collective ownership while open access implies no ownership. The structure of resource ownership has direct implications for the type of management possible. Common property resources are defined based on the type of rights held by the collective owners. In contrast, open access resources can be managed by access rules that defining rules of access and regulating the sharing of output) and conservation rules that restrict total output (Heltberg 2002).

being the degradation of these "commons" (Hazari and Kumar 2003). More than this, these resources upon which heavy pressure is placed are mainly renewable in nature – such as rangelands, agriculture, fisheries and forest resources (Batabyal and Belabi 2006). Both of these facts have implications for effective resource management and sustainable development, where both a profiling of the types of resources under exploitation, and the property rights regimes under which this exploitation are undertaken, are essential.

Hazari and Kumar (2003) model the relationship between basic needs, property rights and the commons. They find that poorer households raid the commons to satisfy basic needs, while richer households do so to make profits. Therefore, reducing degradation of the commons involve a dual policy of improving poverty through the meeting of basic needs, together with the proper enforcement of property rights. Nahrain *et.al* (2008) point to the role of common property resources in acting as a buffer for poor households in response to negative income shocks. Goeschl and Igliori (2006) discuss the sustainability of different scenarios of exploitation of extractive reserves by indigenous communities in the context of property rights scenarios both within and outside the reserves. They point to the importance of research on internal property rights within the context of a bigger developmental picture, rather than a focus on the optimal management of the targeted resource.

It is inevitable that a high dependence on open access or common property resources together with a lack of (or improperly designed, or improperly enforced) property rights can lead to conflicts over resource use and ownership. In many situations there exist customary management regimes designed to deal with such conflicts, but that are seen as inferior to sweeping, statutory ones that do not properly incorporate the traditional management practices. Much research has been done on the causal factors of both the success stories, and the ones that have failed, of community management of common property resources in diverse societies around the developing world, with the aim of either replicating or avoiding similar situations (Heltberg 2002). Quinn *et.al* (2007) discuss the community management practices of common property resources in 12 villages in Tanzania. They found the management regimes to be vulnerable (in particular when confronted change) and highlight the areas in which these could be strengthened (instead of replaced) by higher institutional levels. They emphasise the importance of the particular local context as being central to further study of the management of resources such as these.

Another aspect of potential conflict over land-use and property rights comes in the form of the establishment over protected areas. Whereas such conservation efforts in developed countries generally involve in-situ and ex-situ measures that are geographically separate from local communities, in the developing world the context is that of extreme poverty and population pressures on scarce land (O'Connor 2008). Skonhoft (2007) points to rapid population growth as the major source of land-use conflict between wildlife conservation and rural development. Negative attitudes to wildlife conservation among local peoples result from measures that attempt to either displace rural communities, significantly curtail their traditionally free access to natural resources, or prevent them from eliminating "nuisance" wildlife that threaten their crops and livestock (Johannesen and Skonhoft 2005, Skonhoft 2007).

Livelihoods of rural communities, and their interactions with environmental resources that are in the main common property ones, are complex issues subject to a host of inter-connected social, economic and institutional characteristics (Hartter and Boston 2007). It is therefore essential that, firstly, valuation studies are conducted on these dependencies, and

secondly, that in such studies, these complex issues are researched and understood. Any valuation study on communities in developing countries must begin with an analysis of the resource dependence of the community, and the property management regimes in place over such resources. This can inform the weighting of services and therefore guide the techniques of valuation applied to estimate the values of such services. More than this, such a scoping study can illuminate the roadmap to the design of effective policy measures aimed at sustainable management of the resources, and the alleviation or eradication of poverty.

3.3. Energy Profiles, Food Security and Water Scarcity

A basic requirement for social and economic development is access to modern energy (Saha 2003, Dias *et.al* 2006, Kanagawa and Nakata 2007, UN Human Development Report 07-08). Approximately 25% of the world's population have no access to electricity, and approximately 39% of the world's population rely on biomass to meet their cooking and heating demands; the latter is true of a staggering 80% of the population in Sub-Saharan Africa (Kanagawa and Nakata 2007, UN Human Development Report 07-08). This has significant biodiversity implications when habitats such as woodlands and forests are relied upon to fulfill such immediate needs. Lack of energy access has significant constraining effects on the socio-economic conditions of rural people in developing countries, and significant implications for how they interact with their surrounding environment and the natural resources to which they have access. Some leading indicators of poverty, and of sustainable development, are in fact based in a framework of energy use (Kemmler and Spreng 2007).

The relationship between energy and poverty reduction is significant but complex (Kanagawa and Nakata 2007). Food security is intimately linked to energy consumption and is a major driving force in natural resource consumption (Hartter and Boston 2007). Energy improvements can have a direct bearing on health, education, income and the environment (Kanagawa and Nakata 2007). In developing countries, women are responsible for the collection of fuelwood and water; as such, improvements in energy access can also have direct linkages to gender equality and women's empowerment, articulated as the third of the Millennium Development Goals (ref). Improvements to energy access can also have significant consequences for the natural environment on multiple scales. While it can remove pressure from biomass resources, the energy development chain also has immediate and long term impacts which appear at local, regional and international levels (Saha 2003), not the least of which are climate change implications.

Taele (2007) outlines the energy profile of Lesotho as a representative of other sub-Saharan African countries. Rural populations are characterised by a lack of access to energy resources, with biomass accounting for approximately 69% of the national energy consumption. Wood is the main source, but with pressures of expanding populations, communities also rely on supplementary sources such as animal dung and agricultural residues. This has implications for deforestation, erosions of landscape and loss of soil fertility.

Water availability can also represent a significant constraint to the development of an economy (Turpie *et.al* 2008). Directly related to climate change effects as water supplies are put at risk, this is not a challenge faced by the developing world alone. However, water stress and water insecurity has particular implications for developing countries, in the context

of those dominated by rural subsistence-based communities dependent heavily on agriculture and characterised by a lack of water infrastructure. Water scarcity is estimated to increase as climate change effects are felt; it is estimated that by 2080, the number of people facing water scarcity due to climate change could increase by 1.8 billion (UN Human Development Report 07-08).

3.4. Vulnerability

The degree to which a country is considered "vulnerable" is another way of evaluating a country's developmental status. Vulnerability can be defined as the potential for loss due to a multitude of causal factors that include economic, geographic and socio-political (Turvey 2007). In terms of economic vulnerability, we refer to the susceptibility of the domestic economy to extreme events, whether exogenous economic shocks or internal fragilities; small island economies that are heavily open to the external economy can be particularly vulnerable in this respect. Geographically, countries can be vulnerable to extreme natural events. Socio-political factors refer to enforced vulnerabilities of the local populations due to internal conflicts. These different measures of vulnerability also interact together to affect the dimensions of each. Within the framework of biodiversity valuation, it is vulnerability to environmental change, whether global or local, that is of importance. Vulnerabilities of developing countries to climate change in particular is an issue that has received a lot of research attention and policy focus in recent times (Turvey 2007).

Many of the intrinsic characteristics already described play a role in, and are also affected by, the degree to which a developing country is vulnerable. As discussed above, poorer households in rural communities can use environmental resources as a buffer to negative income shocks (Narain *et.al* 2008). Countries that are largely subsistence-agriculture based are economically vulnerable to situations of water scarcity and extreme environmental conditions such as droughts or hurricanes (Editorial, Global Environmental Change 2008). If food security is directly linked to significant natural resource consumption, there exists a vulnerability to resource changes. High primary dependence on renewable resources in particular also point to economic vulnerabilities in the case of resource collapse (which in the case of open access resources are not impossible future scenarios). However it is defined, the extent to which a country is economically and environmentally vulnerable can also be affected by its level of external indebtedness which immediately restricts its financial ability to respond to sudden changes in the state of the world.

The level of economic development of a country can also affect its ability to respond to an exogenous event. Clearly, extreme environmental events such as hurricanes do not affect developing countries alone. Noy (2009) empirically finds that macro-economic consequences of hurricanes on developing economies are much greater than on their developed country counterparts. The difference is that the recovery rates from such events can differ significantly according to the development status of the country. An additional interesting debate is that the role of natural capital in the form of ecosystems can play a role in disaster reduction and mitigation (Pérez-Maqeuo *et.al* 2007) .

Biodiversity valuation studies that have as their main objective a policy prescription guidance must take into account the vulnerability framework of both the community under study and the country within which the community resides. As they are able to capture the social, economic and environmental diversities of the communities, local assessments of

vulnerability are particularly important (Editorial, Global Environmental Change 2008). The complex relationships between local communities in developing countries and the biodiversity resources upon which they rely both affect and are affected by the degree to which the community can be termed "vulnerable".

3.5. Governance and Institutional Weaknesses

Good governance is recognised as one of the key ingredients to poverty reduction and economic development (Fritz and Menocal 2007)[20]. However "good governance" as a concept, and the governance reforms that must take place in order to achieve this, can be unrealistic and unrealistically long (Grindle 2004). Hence the notion of "good enough governance", which defines minimum conditions of improved governance that are necessary for development and can enable poverty reduction measures (Grindle 2004, Fritz and Menocal 2007).

Corruption and rent-seeking behaviour is one of the explanations offered by the "resource-curse hypothesis" literature. The Natural Resource Curse postulates that countries abundant in natural resources can in fact experience slower economic growth than that of their less well-endowed counterparts. Davis and Tilton (2005) highlight the resource curse in the context of countries endowed with mineral deposits, where political control of mining rents not only increase income inequalities but can also itself lead to a decline in institutional quality[21].

Institutional settings in many developing countries are characteristically weak (Grindle 2004). This has direct implications for environmental resource use and management; for example, Quinn et al (2007) highlight the role of institutions in the management of common property resources. Institutional and government failures are one of the reasons identified for environmental destruction, through environmentally adverse policies or the inability to resolve competing objectives (Heltberg 2002). Skonhoft (2007) highlights weak institutional settings as one of the reasons for conflict over conservation and land use. Governance and institutional settings also have a direct bearing on the outcomes of international aid and donor agencies and the fulfillment of the initial objectives of the aid packages (Fritz and Menocal 2007).

More than this, weak institutional settings will directly affect the impact of a policy prescription that results from an environmental valuation exercise, as policy inaction or lack of policy implementation results (O'Connor et al 2008). Indeed, institutional settings can often determine the success or failure of a policy response (Millennium Ecosystem Assessment [5], Engel *et.al* 2008). Gatzweiler (2006) suggests the different types of governance necessary for the organisation and management of biodiversity conservation and the effective delivery of the resultant ecosystem goods and services. Many market-based incentive mechanisms for biodiversity conservation have resulted from a recognition of weak government and institutional capacity in developing countries (O'Connor et al 2008). Biodiversity valuation exercises need to be conducted with a cognizance of the local political, social, economic and institutional framework; but more than this, it then needs to be

[20] Whether or not democracy is a necessary condition for good governance is a contentious issue (Fritz and Menocal 2007).
[21] Note the case of Angola, which is an Oil-Exporting Country but also on the list of Least Developed Countries.

determined how best to embed these values into the decision-making process that exists within this framework.

3.6. Informal Economies

The notion of an "informal sector" or "informal economy" was suggested by Arthur Lewis in his seminal 1954 paper entitled "Economic Development with Unlimited Supplies of Labour" (Lewis, 1954). This dual sector, industrial/agricultural model postulated that the large subsistence sectors of developing countries were characterised by an unlimited supply of labour which would be absorbed into the industrial sector as economic growth occurred. This unlimited supply could be engaged in a range of casual or informal jobs; this would eventually disappear as the economies grew[22].

The "informal economy", as its name suggests, can be defined as the economic activities that are not, either in law or in practice, officially covered by formal arrangements[23] (Becker 2004). It can sometimes be maligned as comprising mainly criminal activities; while it can include illegal activities, the majority of informal activities comprise legal goods and services (Becker 2004). Informal economies are a strong feature of many developing countries (Lahiri-Dutt 2004) and are related to many of the other matters discussed here. Informal activities were initially seen as a means to alleviate poverty; a weak institutional setting can also facilitate its presence. Because they are by definition outside of the mainstream economic activity, informal economy activities are not covered by official economic and employment statistics; this has immediate implications for policy prescriptions and analysis based on official figures. As a result, much research has been devoted to estimating the size of informal economies in developing countries.

The presence (in varying degrees and structures) of informal economies can pose a huge challenge for biodiversity valuation and natural resource management. In a setting where a large number of economic activities are not reported, a dependence on any official economic statistics can be highly misleading; this has direct implications for valuation methods such as Revealed Preference where the reliance is placed on secondary data and reported statistics. A broader issue is that of the reliance on biodiversity of the informal sector and what types of values are important. Casey *et.al* (2008) argue that non-use values among the informal sector can be significant.

3.7. Indigenous Communities

The issue of indigenous or traditional native communities with historical customary access to resources is not one limited to developing countries alone. In many developed countries, indigenous communities represent a small percentage of the overall population Duncan (2003). Goeschl and Igliori (2006) claim that many of the world's most important biodiversity areas are successfully managed by indigenous peoples.

The protection of indigenous rights to biological diversity is an issue of the property regimes over common resources. In the context of developing countries, many of the issues discussed

[22] Informal economies in the developing world have in fact been estimated to be growing and not diminishing, with various reasons suggested for this phenomenon (Becker 2004).
[23] Numerous definitions abound; we choose the most general here.

above are also relevant as such peoples tend to exist within situations of discriminatory attitudes, poverty, under-development and lack of economic well-being (Duncan 2003)– there exist large social disparities between indigenous and non-indigenous peoples (UN Human Development Report 07-08). Much of the resource-use decisions in developing countries are based on traditional norms (Quinn *et.al* 2007). Furthermore, it is claimed that a large part of the subsistence-based population who undertake primary exploitation of biodiversity resources for economic livelihoods are indigenous peoples – O'Connor (2008) asserts this in the context of the use of forestry resources in particular. Casey (2008) highlights the importance of non-use values to indigenous peoples in Brazil. Sattout *et.al* (2007) point to the symbolic and cultural values that can be associated with biodiversity resources in developing countries; this can be particularly true for indigenous communities.

There is the need to explore the complexities of resource perception and use of indigenous communities in the developing world in particular. More than this, any valuation exercises and the policy advice that result must be conducted within a framework of the respect for the human rights of indigenous peoples.

3.8. Intellectual Property Rights and Genetic Resources

Intellectual Property Rights is a major issue of debate in the economic development literature (Trommetter 2005). The sovereignty of each State over its genetic resources, its ability to control access and its responsibility to negotiate for the fair and equitable sharing of benefits resulting from the exploitation of such resources is explicitly recognised by the Convention on Biological Diversity (Nunes *et.al* 2007, Markandya and Nunes 2008). By ruling out open access to genetic resources, the CBD has established that there exists a biodiversity value with which the owners of the resources can negotiate (Nunes *et.al* 2007).

This can have a tremendous impact on developing countries, as a considerable part of the genetic material of interest is found in the rural and indigenous communities of the developing world (Markandya and Nunes 2008). The conditions, not only of access, but of benefit sharing therefore become of paramount importance. The CBD recognises the right of indigenous communities and traditional lifestyles in the conservation and management of genetic resources. The State therefore has the responsibility to ensure the fair and equitable sharing of benefits, which some claim will also increase biodiversity conservation (Trommetter 2005, Markandya and Nunes 2008).

The issue of access to and benefit sharing from genetic resources impacts, and is impacted upon by, many of the factors discussed here. The welfare of indigenous communities in the developing world can be directly affected in a number of ways – by the role their traditional knowledge can play, by the benefits they can accrue from engagement in the sale of genetic resources, and by the disadvantages they can face if property rights are established that deny them access. The degree to which the resource use traditionally exists within the informal sector can also pose challenges for the efficient sharing of benefits. If within the context of "bad" governance and institutional weaknesses, the issue of benefit sharing becomes paramount, as the country itself may be suitably compensated in the agreement but the rents accrued to corrupt officials, denying the rights of the individual stakeholders, and in particular the rural communities within which such resources and knowledge exist, to the benefits. The needs of communities in the developing world to biodiversity resources for

immediate energy, food and water needs also become relevant if the bio prospecting arrangements and property rights establishments deny them the rights to do so.

3.9. Gender Issues

Poverty has a gender as well as a geographical aspect (Alvarez-Castillo and Feinhoz 2006). Women comprise 70% of the world's population living in absolute poverty (Deda and Rubian 2004). Where economically active, women in developing countries tend to be found more in the informal than the formal sector (USAID 2006). The third of the Millennium Development Goals is the promotion of gender equality and the empowerment of women (MDG Report 2008). The existence of a series of factors can constrain the participation of women in the productive (as opposed to the reproductive) economy.

Cultural norms can dictate their societal (household) roles, which often come with significant time burdens. The responsibility of these household duties can also fall to the female children, limiting their time access to education and so their own future participation in the productive economy. Time poverty of rural household women and children is related to energy security, food profiles and water scarcity. In developing countries, a lot of time is spent collecting potable water and fuel (USAID 2006). Studies in developing countries show that women can spend between 28 to 35 hours a week collecting water; in a study in sub-saharan Africa, it was estimated that women and girls could save hundreds of hours per year if they could source fuel and potable water within a 30 minute walk (USAID 2006).

Property and inheritance rights can lead to limited access and control of resources. Deda and Rubian (2004) note that women hold title to less than 2% of the world's private land. Notwithstanding this, the participation of women in the agricultural sector of developing countries is significant, constituting up to 80% of agricultural labour in some LDCs (USAID 2006). In social male-dominated settings where women are the relatively more significant users of the resources, there can be considerable impacts on the type, and efficacy, of the valuation method utilised. For example, in contexts such as these where panel of local experts are most likely to be men, there can be limited relevance of tools such as Delphi methods. Deda and Rubian (2004) have some interesting examples of where consultations with men, and subsequent policy interventions, came to nothing as the knowledge was not transferred to the women who were the actual users of the resource.

The issue of property rights over genetic resources is also an increasingly relevant one. In developing countries, women often rely heavily on genetic resources for crop production and food security; they are also often the holders of indigenous knowledge of biodiversity resources. As such, the patenting of resources and intellectual property rights over biodiversity in developing countries is an issue that can both benefit from the involvement of women and significantly affect their welfare; (Alvarez-Castillo and Feinhoz 2006) argue that existing social structures with respect to women can significantly affect the distribution of benefits to them from genetic research.

The Convention on Biological Diversity (CBD) explicitly recognises the vital role of women in the conservation and sustainable use of biodiversity. While the CBD affirms the need for the full participation of women at biodiversity conservation and policy making, there is little in the way of specific guidance to achieve these objectives (Deda and Rubian 2004, (Alvarez-Castillo and Feinhoz 2006). There have been recent initiatives to examine gender issues

within the context of biodiversity and analyse how women's participation can be ensured and enhanced, with the emergence of the consensus that women have a very important role to play (Alvarez-Castillo and Feinhoz 2006). Lack of female participation at the decision making levels of national and international organisations, lack of cognisance of the role of women in rural communities as it relates to environmental and biodiversity use, and the distribution of benefits of policy instruments across gender, continue to be matters that require urgent attention.

3.10. Health

Goal 6 of the MDG target health issues, with an aim to combating HIV/AIDS, Malaria, and other major diseases such as tuberculosis (Human Development Report 07 08). There is no doubt that the world's current scourge is that of HIV/AIDS; 2005 estimates point to 40 million infected people worldwide. Developing countries, in addition to other challenges, are hard hit, with sub-saharan Africa in particular in severe crisis. 17% of Zambia's population in the 15-49 age range is infected with HIV/AIDS, the world's highest infection rate.

This creates new levels of vulnerability for affected populations and significant economic and social changes. As mortality and morbidity of the workforce is increasingly affected, economic productivity inevitably declines. There are significant social effects as more and more households lose family members, with many affected households headed by children who then sacrifice their possibilities of education to look after the victims, the younger members of the household, and those orphaned by the illness. Health crises such as this impose a further level of vulnerability on already vulnerable populations, making them more susceptible to environmental changes and exogenous shocks.

In addition to pandemic crises, many developing countries face the challenges of lack of proper health care and services on a daily basis, causing morbidity, handicaps and mortality for otherwise curable ailments. Health issues related to the matter of energy use, food security and water scarcity is also a relevant point, where lack of access to potable water in particular can cause the persistence of associated ailments. Finally, the issue of reproductive health and

3.11. Literacy and Education

The notion of "development" can be seen in terms of economic growth or in terms of meeting human needs. Of course the two are not unrelated; in fact it is often argued that the former is the necessary condition for the latter. However, the perspective of "human needs" pays more attention to the way growth is achieved, how it is distributed and how livelihoods are affected in this process (Paran and Williams 2007). The question of the role of literacy in economic development generates an interesting debate.

Anderson (1966) estimated that development requires an adult literacy rate of 40% (though the necessary role of other support systems is also discussed). Azariadis and Draden (1994), examining the developmental history of 32 countries over 1940 to 1980, concluded that where literacy was not present, rapid growth was not achieved. In 1964, Unesco, the United Nations Development Programme, and the governments of 11 countries (Algeria, Ecuador, Ethiopia, Guinea, India, Iran, Madagascar, Mali, Sudan, the Syrian Arab Republic, and the United Republic of Tanzania) engineered a unique international approach to illiteracy

through the Experimental World Literacy Programme; the subsequent lack of economic development shows that literacy is not the only causal factor.

Literacy can affect the process of biodiversity valuation in developing countries in a number of ways. From a practical perspective, traditional survey instruments that assume basic literacy levels may prove irrelevant to situations where illiteracy prevails. From a methodological perspective, it is suggested (though highly debatable) that low levels of literacy can also create a barrier to the valuing of complex environmental goods (Christie *et.al* 2008). From a philosophical perspective, if literacy as a basic human right contributes in any way to the fulfillment of human needs, this can also have effects on decisions that are made towards sustainable development.

3.12. External Debt

Countries of the "Third World" face varying levels of sometimes unsustainable external debt. These debt burdens and debt servicing can appropriate much of a country's productive income in the present and future time periods. To face very real internal developmental and social challenges, therefore, some developing countries can be further limited in facing their developmental and social challenges.

3.13. Migration, Remittances, Brain/Drain

Both intra-country and inter-country migration are significant factors of social change in developing countries. Intra-country movements from rural to urban settings cause increased urban environmental pressures; this is a worldwide phenomenon not limited to developing countries. In the developing context, it is inter-country migration that is a significant characteristic (both in legal and illegal contexts) stemming from levels of poverty and a perceived lack of opportunity (Editorial, Global Environmental Change 18 2008). Against this background, the role of remittances can in certain developing countries play a huge factor in national development. In SIDS, migration and remittances are particularly important for domestic economies, accounting for significant percentages of GDP[24]. In the context of biodiversity valuation, migration and remittances within developing countries can cause shifting community socio-economic landscapes. In addition, a practical consideration is the "brain drain" phenomenon, where migration of the educated masses has implications for domestic research capacity (Christie *et.al* 2008).

3.14. Internal Conflicts and Displaced Peoples

Some developing countries are characterised by intense internal conflicts, and the inevitable consequent mass movements of migrants and refugees; sub-saharan Africa, for example, is one of the most conflict-ridden areas of the world[25]. Internal conflicts can affect the community interactions with their environmental resources in a number of ways. War-zones can lead to significant environmental destruction. In the case of lucrative mineral resources, there can be the appropriation for personal gain, leaving much of the population unable to

[24] In 2006, remittances to Jamaica were estimated to comprise approximately 16% of GDP.
[25] Many empirical studies such as Kong (2007) attempt to model democracy as an explanatory variable for economic growth. However, we do not enter into that debate here.

access these resources or benefit from them[26]. In addition, the movements of displaced peoples can impact both the country under conflict and the country of refuge, where huge influxes into areas can put significant pressure on the localised environmental resources.

3.15. Ethical issues

There are limited empirical studies on the ethics of research in developing countries (Hyder and Wali 2006). Ethical norms and requirements differ depending on the types of studies being conducted; however it is generally accepted that the underlying principles of the doctrine of "informed consent" should be applied and upheld in all research (Hyder and Wali 2006, Newton and Appiah-Poku 2007).

The issue of "informed consent" in the particular context of developing countries has generated considerable theoretical debate. Some argue the possibility of contradictions between the principles of informed consent, and the cultural norms and practices that may abound in developing countries; others question the competency of individuals to provide consent (Hyder and Wali 2006). In certain contexts, oral consent was seen to be more appropriate than written consent, in particular in situations where literacy (in particular literacy in the language of the study) was an issue[27].

Group approval and community consent is particularly important in developing country settings. Some argue that the consent of a village leader, instead of individual consent, may be more appropriate (Hyder and Wali 2006). Even if individuals are eventually approached, an understanding of the hierarchy of leadership in a community is essential to positive participation, as access to a community can be given or denied by such community leaders. There is also the view that community consent should seen as a complement to, rather than a replacement for, individual consent, with community consent sought first and individual consent sought after (Newton and Appiah-Poku 2007).

Whatever position is upheld by the researcher, it is undeniable that an understanding of particular cultural norms in primary data collection exercises within developing countries is essential. Not only is this important with a view to informed consent and ethical best-practice, but it is also important in terms of gaining access to, and successfully interacting with, the communities with whom the valuation exercises are being conducted.

3.16. Synthesis

This section discussed a series of factors that can be considered significant at different stage of the process of biodiversity valuation in "developing countries", from the relevance of the research question being framed in terms of the type of ecosystem services being valued, to

[26] Angola is an interesting example of this fitting into both the Oil Exporting category and that of Least Developed Countries, two groups that may be reasonably assumed to be mutually exclusive given the lucrative nature of oil and natural gas resources.

[27] Levels of literacy cannot be seen to be an adequate excuse for lack of informed consent in developing countries; individuals may be "illiterate" but fully capable of understanding their potential role in a research exercise once proper interpreters and effective verbal communication is utilised.

the applicability (and, where necessary, modification) of the appropriate valuation method, to the efficacy of the policy and management prescriptions that ensue.

To begin with, some of these factors can help to indicate the priorities for biodiversity research studies. Issues such as levels of poverty, food security and water scarcity, health profiles and internal conflicts in particular are crucial indicators of standards of living and human development in case study areas. Such issues can also act as critical target indicators for sustainable management. The extent to which the livelihoods of rural communities are subsistence-based impacts is also a vital component to indicate research priority areas, both in terms of the type of ecosystem service most valuable, as well as the extent of benefit-sharing that accrues to the local communities.

Many of these factors also influence the efficacy of the type of valuation method chosen. For example, a primary data collection method such as Contingent Valuation is a popular research tool due to its ability to capture a range of benefits of ecosystem goods and services beyond provisioning or use values. The CV method relies on (1) access to the communities and (2) adequate literacy levels to facilitate written responses. Therefore, both literacy and education profiles of the area of study, and gender issues in terms of societal hierarchical structures, become relevant points. Furthermore, for valuation methods that rely on marketed data (such as Market Price, Revealed Preference, and Production Function approaches), the issue of the existence and size of an informal economy, and the extent of participation of the targeted community, becomes an extremely relevant one. Where there exists "significant" informal economies, estimates from methods that rely on marketed data cannot be wholeheartedly relied upon.[28] The factors discussed can also be a determinant in the choice of method of Benefit-Transfer and Meta-Analysis, as they can serve as an indication of contextual similarity (or difference) and hence the relevance of extrapolatory methods such as this.

It is also important to note that the existence of these factors can imply by unique empirical challenges that can inhibit the valuation exercise, distort the estimation results and constrain the ensuing policy prescriptions. In particular, the issue of the time frame of the analysis is an important one. Analyses that occur over longer time periods can run the risk of invalidity due to the existence of structural breaks. While this is not an empirical issue limited to developing countries, it is possible that the risk is greater in this context; due to changing states of the world as a result of internal and external events, the assumption of parameter constancy over a longer time period may not be a valid one. This can also have implications for the methodology of Benefit-Transfer if there exists in a developing country context a significant time gap between the analysis conducted at the "study site" and the transfer of results to the "policy site".

The issues discussed in this section can also have policy and management implications, with respect to the governance and institutional framework within which recommendations and prescriptions are made. Furthermore, the issue of levels of external debt is not a small one in a developing country setting. High levels of debt servicing represent significant constraints to policy implementation and sustainable management of biodiversity resources, that will

[28] An interesting question to ponder what is the threshold (if a threshold can in fact be constructed and generalised for developing countries or their sub-categories) beyond which marketed data becomes meaningless, and what factors influence these threshold levels.

persist well beyond the specific valuation exercise. Levels of vulnerability to specific shocks can also determine the fragility of a case study site in a number of ways, and inform both the relevance of a valuation exercise within the framework of a shift in the state-of-the-world, as well as the ability of management prescriptions to adapt to such changes.

Given the discussion of this Section, the relevant question now becomes how we can assess a developing country (or category of developing country) along these lines to understand more (1) the extent to which these factors exist in the case study, and therefore (2) the extent to which these factors are affecting the relationship between biodiversity and the local communities of the case study, with a final aim to (3) the proper application of valuation techniques to the local settings. This is an empirical challenge, to which we now turn our focus within the specific context of Small Island Developing States (SIDS).

4. Biodiversity Valuation in a "Developing Country" Context: A Focus on Small Island Developing States (SIDS)

Most of the world's biodiversity "hotspots" are to be found in the developing world (Myers *et.al* 2000). Small islands in particular are seen as one of the sites were global biodiversity is most in danger (Global Environment Outlook 2003). Despite geographic location, small islands generally share a vulnerability to external economic and environmental factors that couple with a heavy reliance on natural resource exploitation. This makes the issue of sustainable resource management a particularly crucial one in SIDS.

In the development literature, 'small islands' were not firmly established as a special case and were commonly subsumed within the broader category of 'small countries' and 'microstates' (Brookfield 1990, Hess 1990). Alongside the development of 'island literature' arose an 'anti-island literature' which argued that small island issues were different in degree but not in kind from mainland areas (Bayliss-Smith et. al, 1988). However islands, and small islands in particular, have now emerged as a distinctive class in the area of environmental studies (Brookfield, 1990, Hein 1990). The category of 'small islands' now subsumes a wide array of economic, social, political, cultural, climatic and geographic conditions. The interactions between island economies and island ecologies, however, have been little explored.

Geographically, the SIDS are spread across the continents of Africa, Asia, and Latin America and the Caribbean (LAC) (see Appendix 3); there exist 5 African SIDS, with the remainder divided evenly between Asia and the LAC. A 2008 UN Report classified 51 states into the SIDS category (UN Desa 2007 Development for All). Utilising the categories defined in Section 2, we can say that 11 SIDS also belong to the LDC category (see Appendix 2). Of these 11 countries, 5 are located in the African continent – Comorros, Guinea Bissau, Uganda, United Republic of Tanzania, and the Seychelles. The 5 islands of Comoros, Guinea-Bissau, Sao Tome and Principe and Haiti are also heavily indebted. The islands of Comoros and Guinea-Bissau deserve particular mention as they both straddle 4 categories of "developing countries" as outlined in Section 2: they are both small islands (SIDS) from the African region (Africa), are considered "least developed" (LDCs) and are also heavily

indebted (HIPCs). Out of the 51 SIDS, only Trinidad and Tobago is an oil exporting nation[29].

Table 1: Some Stylized Facts in Selected SIDS[30]

Country	Population (millions)	Surface Area (sq.km. thousands)	Coastline (km)	Main Economic Sector	Imports (as % of GDP)
Comoros	0.63 (2007)	1.9	340	Vanilla, cloves, essential oils 94% of 2002 exports	39% (2007)
Grenada	0.11 (2007)	0.3	121	Nutmeg, frozen albacore, tuna, cocoa beans 52% of 2003 exports	67% (2006)
Jamaica	2.68 (2007)	11	1022	Aluminium oxide and ores 65% of 2002 exports	63% (2006)
Maldives	0.31 (2007)	0.3	644	Tourism 80% of 2002 exports	72% (2000)
Papua New Guinea	6.32 (2007)	462.8	5152	Silver, petroleum, copper and gold 71% of 2003 exports	68% (2007)
Sao Tome and Principe	0.16 (2007)	1.0	209	Cocoa 93% of 2002 exports	n.a
Solomon Islands	0.5	28.9	5 313	Wood, tuna, cocoa 77% of 2002 exports	44% (2000)
Trinidad and Tobago	1.33	5.1	362	Petroleum, natural gas and derivatives, 54% of 2000 exports	37% (2007)
Vanuatu	0.23	12.2	2528	Copra, seaweed, wood and meat 76% of 2002 exports	58% (2006)

SIDS generally share a number of economic and environmental characteristics that make them highly vulnerable to exogenous impacts (Mc Elroy *et.al*. 1990, Bass 1993, Global Environmental Outlook 2003, van Beukering *et.al* 2007). While there as yet exists no clear method of definition, the one underlying characteristic is that of small land areas coupled

[29] It is also possible to divide the 51 SIDS by their geographic location in the regions of Africa, Latin America and the Caribbean, and Asia/Pacific.

[30] Population and Coastline estimates are 2005 UN figures, obtained from http://www.un.org/esa/sustdev/sids/sidslist.htm , economic exports from http://www.unctad.org/en/docs/ldc20041_en.pdf , last three columns obtained from http://hdr.undp.org/en/countries/alphabetical2008/ and http://go.worldbank.org/ZMDGX942R0

with large coastal zones, and high population densities often concentrated in coastal zone areas. Table 1 gives selected statistics for 9 SIDS.

SIDS exhibit a high degree of vulnerability[31] to the world economy due to the existence of "monocrop"-type economies; these dominant sectors are also characterised by a heavy reliance on natural resource exploitation. Table 1 demonstrates the main economic sectors of 9 SIDS, and the percentage of total exports represented by these sectors. Though the available statistics are not recent, these figures serve to illustrate three SIDS characteristics: (1) the dependence of these economies on a small range of products (a remarkable 94% in the Comoros) (2) the high dependence of these economic sectors on primary natural resource exploitation, such as agriculture, fisheries, tourism, and mineral resources and (3) the characterisation of these economic sectors as primarily for the export market: 80% of the Maldives exports was accounted for by tourism alone, and a remarkable 94% of the export earnings of the Comoros in 2002 depended on the production of 3 products only (Table 1).

This intensive dependence on international trade includes not just the absorption of exports but also as a source of imports. Table 1 demonstrates as an example total imports as a percentage of each country's GDP. It is clear that SIDS are highly dependent on the developed world

SIDS are also known to be extremely vulnerable to environmental degradation (van Beukering *et.al* 2007). Due to the heavy reliance on natural resource exploitation for economic livelihoods at both micro- and macro-levels, environmental shifts such as ecosystem changes, natural disasters and climate change impacts can have extreme economic and welfare effects. The inevitably high ratio of coastal to total land area means that island ecosystems are frequently characterised as 'fragile', with a delicate balance existing between highly coupled terrestrial and marine ecosystems (Mc Elroy et al, 1990).

4.1. Quantitative Assessment of "Developing Country Characteristics" in the SIDS Context

Given the list of factors discussed in Section 3 above, the relevant question becomes how we can assess a developing country (or category of developing country) along these lines to understand more (1) the extent to which these factors exist in the case study, and therefore (2) the extent to which these factors are affecting the relationship between biodiversity and the local communities of the case study, with a final aim to (3) the proper application of valuation techniques to the local settings. This section aims to classify available quantitative rankings of the factors discussed in Section 3 with particular reference to SIDS[32], therefore also highlighting where there is the need for the creation or modification of relevant statistics and indices[33]. For some of these factors, there exist qualitative rankings only; in other cases, subjective judgement must be applied. However, for many of the issues discussed, it is

[31] Turvey (2007) provides an excellent empirical study on the economic and environmental vulnerability of SIDS via the development of a vulnerability assessment framework, the construction of a series of vulnerability indices, and its application to selected SIDS.

[32] Of course, all of these statistics are globally applicable to any country, developing or otherwise.

[33] The factors of Indigenous Communities, Ethical Issues and Empirical Challenges are not considered here, as they do not require (and are not suitable to) quantitative rankings; instead the discussion of these factors in Section 3 is meant to inform the valuation exercise relative to its specific case study context.

possible to obtain a range of quantitative estimates[34]. A summary of these estimates is provided in Table 2[35].

Table 2: Quantitative Assessments in SIDS

FACTOR	INDICATOR	SOURCE
Poverty Levels	• Human development index • Human poverty index • Poverty headcount ratio at the national poverty line • Income share held by the poorest quintile of the population • % of population below poverty line, rural and urban • Percentage of urban population living in slums	• UNEP • UNEP • WDI • WDI • MDG Indicators • MDG Indicators
Rural subsistence based livelihoods, common property, open access resources	• Agricultural land • Value added of the agricultural sector • Total forest acreage • Proportion of households with access to secure tenure • Total rural population (projection)	• WDI • WDI • WDI • UNEP • UNEP
Energy profiles, food security, water scarcity	• Electric power consumption (KWh per capita) • Energy use (kg of oil equivalent per capita) • Proportion of population using solid fuel • % of the population with access to improved water sources • Renewable internal freshwater resources per capita • Prevalence of malnutrition in children under 5 • Improved drinking water coverage, rural, urban and total • Internal renewable water resources per capita • % of under-nourished population	• WDI • WDI • MDG Indicators • UNEP • UNEP • UNEP • UNEP • MDG Indicators • MDG Indicators
Vulnerability	Not routinely monitored by international organisations Case-study specific estimates available in the academic literature	
Governance and institutional weaknesses	Not routinely monitored by international organisations Case-study specific estimates available in the academic literature	
Informal economies	• Female urban informal sector employment	• GenderStats
IPR and genetic resources	Not routinely monitored by international organisations Case-study specific estimates available in the academic literature	
Gender issues	• Gender-related development index • Ratio of girls to boys in primary and secondary education • Labour force participation rate by gender • Female urban informal sector employment • Gender parity index in primary, secondary and tertiary education • Female-headed households	• UNEP • WDI • GenderStats • MDG Indicators • HNPStats •

[34] These vary in relevance and suitability to the associated factor and which ones are emphasised is up to subjective judgement; however, taken together they all serve to provide a snapshot of the case study context.
[35] See the References section for database weblinks.

Table 2: Quantitative Assessments in SIDS (cont')

FACTOR	INDICATOR	SOURCE
Health	• Life expectancy	• WDI
	• Child mortality rate	• WDI
	• Incidence, prevalence and death rates of tuberculosis	• MDG Indicators
	• Incidence, prevalence and death rates of malaria	• MDG Indicators
	• % of population between 15-49 years infected with HIV	• WDI
	• HIV infections by gender	• HNPStats
	• AIDS deaths	• MDG Indicators
	• Children orphaned by HIV Aids	• HNPStats
	• % of Antiretroviral therapy coverage among people with advanced HIV infection	• HNPStats • HNPStats
	• Contraceptive prevalence in the 15-19 age group	• WDI
	• % of urban population with access to sanitation facilities	• UNEP
	• Improved sanitation coverage, rural, urban and total	• UNEP
	• Fertility rates	• WDI
	• Adolescent fertility rates	• WDI
	• Percentage of births attended by skilled health staff.	• WDI
Literacy and Education	• Adult literacy rates	• EdStats
	• Primary school completion rate	• WDI
	• Internet users per 100 people	• WDI
	• Net enrolment rates in primary and secondary education	• UNEP
	• Net enrolment in primary education by gender	• MDG Indicators
	• Internet users, personal computers per 100 population	• MDG Indicators
External debt	• Total external debt stocks	• WDI
	• Total debt service as a percentage of goods, services and income	• WDI
Migration, remittances, brain drain	• Net migration	• WDI
Internal conflicts, displaced peoples	• Refugee population by country of asylum	• UNEP
	• Refugee population by country of origin	• UNEP

The World Development Indicators (WDI) of the World Bank offers a variety of easily accessible, recent statistics on a range of topics that include Balance of Payments, Development Frameworks, Environment, Exchange Rates and Prices, External Debt, Financial Statistics, Government Finance, National Accounts, Social Indicators and Trade. Within these groups, it is possible to obtain calculations at regional as well as country levels that are relevant (or somewhat relevant) to some of the factors discussed in Section 3[36]. Many of the factors that are not highlighted (or indirectly referenced) by the WDI can be found in other, more subject-specific databases and publications of the World Bank. In particular, The EdsStats, HNPStats and GenderStats databases of the World Bank provide some additional statistics. Finally, the online data portal of the UN is particularly useful for some of the factors under-represented here. Two databases in particular were helpful: The UNEP GEO data portal, as well as the database on the Indicators of Millennium Development Goals.

[36] It would be an interesting exercise should the World Bank also offer these indicators at a "Developing Country Category" level along the lines of the discussion of Section 2.

Through these five databases, it was possible to populate most of Table 2 with relevant status indicators per factor. However, it can sometimes be the case that for many developing countries, some of the data does not exist, or exists only in dated form. Notwithstanding this, it is suggested that these indicators are a good place to start in terms of gaining a better understanding of the local conditions and context within which a valuation study should be framed.

Three of the factors are not, directly or indirectly, covered by these 5 databases: Vulnerability, Governance and Institutional Weaknesses, and IPR and Genetic Resources. Furthermore, we can also include Informal Economies in this list, since (1) the one indicator deemed relevant in Table 2 does not serve to give a complete picture of the size or status of an informal economy of a country and (2) a check of the database revealed that even this estimate was in fact unavailable for most developing countries. These four factors may be under-studied, or difficult to value at aggregate levels (in such cases, empirical indicators may exist for specific case study sites only, at the level of academic publications).

The issue of Vulnerability can be captured for selected case studies by a variety of specific indices and studies – Turvey (2007), for example, delivers an excellent and comprehensive discussion on the types of vulnerability indices relevant for SIDS. There exists a growing academic literature on empirical estimations of the size of Informal Economies in specific case studies of both developing and developed nations. Similarly, the issue of IPR and Genetic Resources in developing country settings has been the subject of recent research exercises. Finally, rankings of corruption indices by global "watchdog" organisations can go some way to capturing the factor of Governance and Institutional Weaknesses.

4.2. Biodiversity Valuation in SIDS: A Critical Survey of the Literature

From the technical perspective, the economist has access to a complete tool box set so as to measure the magnitude of biodiversity benefits. We refer to contingent valuation, attribute based methods, replacement costs, production function, travel cost, hedonic pricing in addition to the market price analysis (see Appendix 1 for more details). From the empirical perspective, the EVRI (Environmental Valuation Reference Inventory) database shows maps 30 studies that referred to environmental valuation research in any of the 51 SIDS (see Appendix 4 for more details).. Of these 30, five papers were inaccessible, yielding a dataset of 25 papers, of which only 21 were found to be directly relevant to SIDS. From these, 18 were considered relevant to biodiversity and ecosystem services valuation Table 2 summarises these contributions. In turn, 15 papers out of this group focused their research on individual SIDS, with only 3 papers focusing on more than one SIDS nation: (a) Dominica, St. Lucia, St. Vincent and the Grenadines, and Grenada, (b) Tanzania and New Caledonia and (c) Jamaica and the Netherland Antilles. Jamaica and Uganda were the most popular study sites of the group, with 3 papers respectively. Puerto Rico, Papua New Guinea, the Netherland Antilles and Tanzania had 2 papers each. The remaining papers focused on Belize, the Dominican Republic, the Maldives, Micronesia, the Seychelles and Vanuatu. This literature set therefore refers (with individual or collective papers) to biodiversity valuation in *only 17 out of the 51 nations that can be identified as Small Island Developing States*[37].

[37] While EVRI is not the only valuation database that exists, it is considered a good indication of the state of research focus in terms of locations as well as methodologies.

Table 3: Biodiversity Valuations in SIDS

	Reference	Location	Values addressed	Valuation Method	Targeted beneficiaries
1.	Allport and Epperson (2003)	Dominica St. Lucia St. Vincent and the Grenadines Grenada	WTP by eco-tourism dependent businesses for the protection of eco-tourism sites	Contingent Valuation	Domestic Businessses dependent on eco-tourism
2.	Andersson (2007)	Tanzania	Welfare loss of coral bleaching to international tourists (pre-damage estimated by revealed preference), post-damage by stated preference)	Choice Modelling Revealed Preference	International Tourists
3.	Catalino and Lizardo (2004)	Dominican Republic	Tourists' WTP for agro-tourism	Contingent Valuation	International Tourists
4.	Flatley and Bennett, (1996)	Vanuatu	Australian Tourists'WTP for the conservation of 2 rainforests	Contingent Valuation	International Tourists
5.	González-Cabán and Loomis (1997)	Puerto Rico	Households' WTP for (1) the ecological integrity of a river system and (2) the avoidance of a dam on another	Contingent Valuation	Local Households
6.	Loomis *et.al* (2007)	Puerto Rico	WTP for trips to a national forest (comparing the results of two methods)	Contingent Valuation Travel Cost	Resident visitors Distant visitors (including international tourists)
7.	Maclean *et.al (*2003)	Uganda	EGS of wetlands in Uganda (attempts at estimation of NPV)	Production Function	Local communities Global benefits
8.	Manoka (2001)	Papua New Guinea	Existence value and use value for tropical rainforests (comparing across a US and a local community)	Contingent Valuation	Local Community International Community
9.	Mathieu *et.al* (2000)	Seychelles	Tourists' WTP for visits to marine parks (use values)	Contingent Valuation	International Tourists
10.	Naidoo and Adamowicz (2005)	Uganda	Tourists' preferences for elevated biodiversity levels at forest reserves	Choice Modelling	International Tourists
11.	Naylor and Drew (1998)	Micronesia	Total Economic Value of mangroves	Choice Modelling	Coastal Communities dependent upon the resource
12.	Parsons and Thur (2007)	Netherland Antilles (Bonaire)	Economic loss of scuba divers to a decline in reef quality	Choice Modelling	International Tourists
13.	Simpson et.al (1996)	Tanzania New Caledonia	Biodiversity as a potential input into pharmaceutical products	Probabilistic economic modelling	Pharmaceutical Researchers
14.	Gustavson (2000)	Jamaica	Local use of marine biodiversity (direct and indirect use values)	Production Function	Local Communities
15.	Spash *et.al* (2000)	Jamaica Netherland Antilles (Curacao)	Marine (coral reef) biodiversity	Contingent Valuation	Local Communities International Tourists
16.	Cartier and Ruitenbeek (2000)	Jamaica	Biosprospecting and coral reef biodiversity	Economic modelling	National Community (through National Government)
17.	Eade and Moran (1996)	Belize	TEV of a tropical rainforest in Belize	Value Transfer Spatial Mapping	Local Communities
18.	Westmacott and Rijsberman (2000)	Maldives	Assessment of alternative coral reef management plans	Economic-ecological modelling scenario analysis	Local Communities

Most studies utilised one methodological approach; Contingent Valuation (CV) was the most popular (Flatley and Bennett 1996, Gonzalez-Caban and Loomis 1997, Naylor and Drew 1998, Matthieu et.al 2000, Spash et.al 2000, Manoka 2001, Allport and Epperson 2003, Catalino and Lizardo 2004, Naidoo and Adamowicz 2005, Andersson 2007, Loomis and Gonzalez-Caban 2007, Parsons and Thur 2007). In one case, more than one approach was used to facilitate comparisons across time - Andersson (2007) used a Travel Cost model to reveal past preferences for a currently damaged site, and a CV study to reveal preferences post-damage.

A major difficulty identified with the CV method by Spash et.al (2000) in the context of coral reef biodiversity is that of "lexicographic preferences" – where decision makers are not willing to accept any trade-offs for the loss of a good or service. Where these preferences are significant, it is argued that the CV is methodologically flawed (Spash *et.al* 2000). The question then becomes, to what extent such preferences are widespread in "developing countries", and how the CV method can be adapted to overcome them . None of the studies in this survey apart from Spash *et.al* (2000) tested for the existence of such preferences.

Only one study utilised the Value-Transfer method (Eade and Moran 1996) and, given that this study was done some time ago, it does not make use of the up-to-date methodologies now associated with this method. The lack of recent (or any) applications of the methods of Value-Transfer and Meta-Analysis is a surprising find. These methods that rely on completed valuation exercises have significant potential for developing countries where (1) valuation studies are sparse, (2) valuation studies may be expensive to undertake and (3) a case could be made for the applicability of Value-Transfer and Meta-Analyses laterally across the developing country categories discussed in Section 2.

Many of the studies focused on the use values of the tourism sector (Flatley and Bennett, (1996), Mathieu, et.al (2000), Allport and Epperson (2003), Catalino and Lizardo (2004), Naidoo and Adamowicz (2005), Andersson (2007), Parsons and Thur 2007). Given that SIDS have geographic advantage in marine habitat, this observation is not a surprising one, but reflects a focus on what may be one of the main productive sectors of a small island developing economy. However, given that CV is one of the few valuation methodologies that is capable of capturing both (direct and indirect) use values and non-use values (or total ecosystem services) of an environmental resource, it is surprising that most of the studies utilising this method were focused on tourism and eco-tourism, with only two studies addressing direct values in the context of bio prospecting (Simpson et.al 1996, Cartier and Ruitenbeek (2000). Only a few of the studies (Eade and Moran 1996, González-Cabán and Loomis 1997, Naylor and Drew 1998, Spash *et.al* 2000, Manoka 2001, Maclean et.al 2003) addressed any values beyond this.

A noteworthy feature of the valuation studies in the SIDS set is a relative lack of focus on local community benefits from the sectors being targeted for analysis and the biodiversity resources consequently under analysis[38]. Many of the SIDS studies focused on tourists' WTP for the use of biodiversity resources – Flatley and Bennett (1996), Mathieu et.al (2000), Allport and Epperson (2003), Catalino and Lizardo (2004), Naidoo and Adamowicz (2005), Andersson (2007). *Only 4 studies focused solely on the benefits to local communities* (Eade and Moran 1996, González-Cabán and Loomis 1997, Gustavson 2000 and Westmacott and Rijsberman 2000). In a "developing country" and more specifically a SIDS context, one

[38] To whom the survey is aimed also changes what factors need to be understood in the local context; for example, if tourists alone are being surveyed, need for community accessibility becomes less important.

important element of valuation is to see the distribution of benefits to the local population, or the benefit-sharing component of the ecosystem services provided by the biodiversity resources. The present valuation studies do not reflect this aspect.

In fact, the literature set demonstrates a significant lack of experience in valuing ecosystem goods and services from the local perspective, with the exception of Eade and Moran (1996), González-Cabán and Loomis (1997), Naylor and Drew (1998) and Gustavson (2000). While aggregate values may be small in the small populations of the SIDS, relative shares of the EGS by the local communities may be high. Addressing the question of the role of biodiversity resources into productive economic sectors cannot be overlooked; it is these provisioning services or use values that need to be addressed and valued. Market-Price approaches are straightforward choices for such valuation studies (though in the presence of significant informal economies such market data may need to be redefined to correct for this limitation). One needs to assess the magnitude that the protection of biodiversity, and the promotion of the sustainable provision of ecosystems goods and services, provides to the welfare of the local economies. This valuation exercise can be of particular importance since most of the times, the natural ecosystems under consideration are responsible for a large contribution to the income/employment of the local populations (though this is not to downplay the role of non-use values of biodiversity to developing countries, which as Carson *et.al* (2008) discuss can be significant). In other words, it is not only a question of magnitude, it is a question of the relative magnitude *vis a vis* to the income generated locally. The lack of use of these valuation methods in the SIDS context emerges directly from Table 3, which shows few studies with a valuation focus on benefits accrued local community.

The lack of use of non-monetary methods, including consultative and participatory approaches (see Appendix 1 for more details) in any of the SIDS references was a surprising find. The difficulties that can be faced by the implementation of economic-methods may lead to the use of non-economic methods as viable alternatives. However, this methodological stance is a limited one. We suggest that in a developing country setting, non-economic methods can be <u>complementary</u>, rather than alternative, to economic methods, both in terms of (1) revealing additional information in terms of the community interactions with their biodiversity resources (Christie *et.al* 2008) and (2) revealing the potential challenges to the economic techniques and so the possibility for amendments before the economic valuation exercise is undertaken. Finally, one can always rely on non-economic methods such as bio-physical dose response methods to be able to translate physical / scientific changes into economic ones and this way be able to translate, for example, land use changes in agricultural productivity losses.

4.3. Revisiting "Biodiversity Valuation: Sense or Nonsense?": Valuation Tools within the context of SIDS

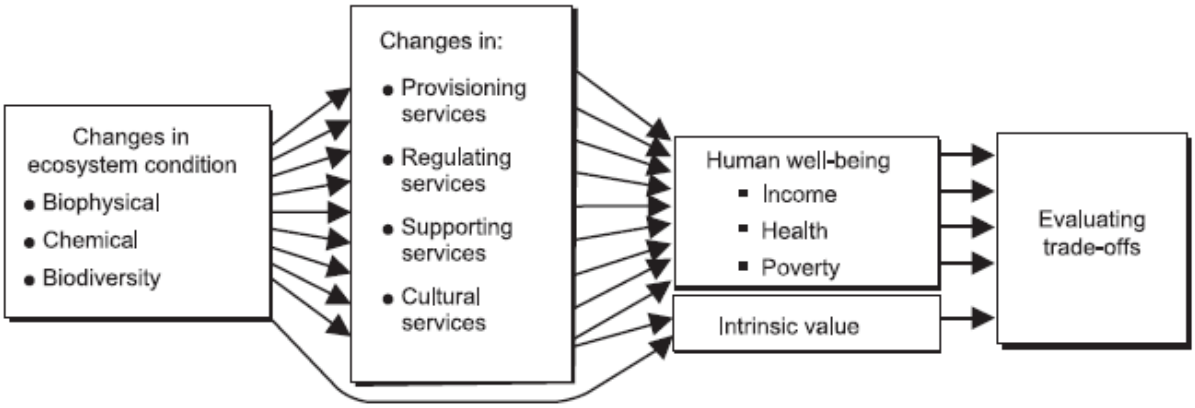
Against this background, we re-visit the Nunes and Van den Bergh (2001) tabular decomposition of the total economic value of biodiversity value categories, and the applicability of economic valuation methods to each case (see Appendix 5 for more details).

The main criticism that we present refers to the fact that this table is socio-economic/institutional context-free. As Figure 1 illustrates, it is the hypothesis of this paper that contextual characteristics, particularly in the case of "Developing Countries" and all of

the sub-groups identified in Section 2, can play a significant role in every stage of a biodiversity valuation exercise, from the prioritatisation of the ecosystem services to the valued, to the applicability of the selected tool and if necessary its modification, to the economic and policy incentives geared towards both the sustainable management of the resource and to the sharing of its economic benefits. As such, the degree applicability of methods to the valuation of certain services may change when confronted with a specific contextual application.

The second revision to the Nunes and Van den Bergh (2001) table comes with a movement away from a biodiversity perspective towards an ecosystem services based approach, building upon the Millennium Ecosystem Assessment (MA) conceptual framework. From this perspective, biodiversity is evaluated as a key element underpinning the performance of ecosystems and the respective provision of goods and services. In other words, the MA proposes an assessment of the status of ecosystems and ecosystem services ("the benefits people obtain from ecosystems) from the point of view of their contribution to human well-being. In this context, the economic valuation exercise is proposed to follow a three-step approach: (1) the determination of the role of biodiversity in creating relevant ecosystem services (2) the calculation of the reduced quantity and quality of these ecosystem services resulting in loss of human welfare under alternative scenarios and (3) the (monetary) valuation of the changes involved in the supply of provisioning, regulation, supporting and cultural services – see Figure 2.

Figure 2: The millennium ecosystem assessment approach



Source: MEA (2005) [2], adapted.

We therefore adapt the Table 2 of Nunes and van den Bergh (2001) in several significant ways, leading to the design of a matrix as shown in Tables 4.1 – 4.3 Here additional factors specific to the SIDS context are explicitly taken into consideration in the evaluation of available methods for economic valuation (and their applicability). In addition, biodiversity benefits are now translated in terms of the ecosystem provision of provisioning, regulating, and cultural services[39]. The economic value categories associated with these services are discussed in marine-ecosystem terms, given the strong significance of these within the SIDS.

[39] The category of "Supporting Services" is not explicitly covered here, as these functions are assumed to be the cornerstone of the supply of the other three categories. Not only is it difficult to separate this value set, but it can also represent a double-counting issue if considered as a separate valuation category.

Furthermore, we give focus to the degree of internalisation of the involved benefits on the behalf of SIDS as beneficiaries. In this context, we propose to rank the SIDS beneficiaries capacity to internalize the involved benefits exploring the use of a *likert* scale ranging from 'minimum', 'medium', 'strong' and 'very strong'. Naturally, the capacity of internalization depends on the economic nature of the benefits, on one hand, and also on the institutional settings, and its characteristics, where the beneficiaries are mapped. These two key elements, in turn, will shed light on the evaluation of the valuation tools. We propose to evaluate the degree of applicability of the economic valuation tolls tools via a range from '+' to '+ + + + +', with a "blank" indicating the technique under consideration is not appropriate.

Provisioning services

Provisioning services are suggested to be of particular importance to the SIDS, in particular in the context of persistent levels of poverty, a heavy reliance on rural-based subsistence livelihoods and agricultural sectors, and a high degree of vulnerability due to their institutional characteristics discussed in Section 4. In the marine-ecosystem context, these services include consumptive, direct-use values such as fishing livelihoods, as well as non-consumptive values such as the benefits of tourism and eco-tourism. In the Caribbean SIDS, for example, both fisheries and tourism play important roles in these economies. In fact, the literature reviewed in Table 3 also indicated a heavy focus on the losses/gains to the tourism sector from ecosystem changes, again underpinning the notion that provisioning services are of great importance in small island developing states.

From the theoretical (context-free) viewpoint, Table 4.1 shows that the methods of AB, RC and PF are most appropriate to provisioning services since most of these benefits are of a private good nature and therefore theoretically show a market trace. In a ranking of their appropriateness, these methods can perform equally well in the assessment of the provisioning services, as indicated by the initial mapping of '+ + + + +'. However, when assessed in the context of SIDS, a new evaluation is revealed. When applied to the SIDS, PF may reveal to be preferred to AB and AB preferred to RC, as indicated by the mapping of, AB + + + (+ +), RC + + (+ + +) and PF + + + + (+). In the new context, AB loses two stars, RC loses 3 and PF loses 1. This means that the operationalization of the RC, AB and PF is more difficult in the SIDS, respectively.

RC methods involve the use of market prices, which can be subjected to significant distortions due to factors such as the existence of informal economies. Furthermore, reparation costs by definition involve an *ex post* action, many of the times coordinated by public institutions. In the context where governance and institutional structures are weak, this can represent a challenge for the effective application of this method. Both of these factors are therefore responsible for a significant weakening of this option.

AB is also submitted to a weakening impact due to similar effects of these factors; however this impact is ranked as less strong than the impact on RP discussed above. The main reason for this is that, while a market-based approach, AB is anchored in individual rational behaviour and therefore less subject to institutional factors; as an example, fishermen can buy more technology to improve the efficiency of their boats so as to minimize some of the potential negative impacts of global change of the stocks of fish. This kind of information can be depended upon, even in the context of contextual characteristics that can lead to a loss of reliability of market-based methods.

Table 4.1: Provisioning Services and Valuation Techniques in SIDS

Ecosystem Service Category	*Economic Value Category*	*Beneficiaries in the SIDS context*	*Most suitable valuation techniques in the SIDS*
Provisioning	*Direct Use Values (Consumptive)* E.g. marine living resources with commercial value such as fish, shellfish, and mollusc. *Direct Use Values (Non-consumptive)* E.g. Tourism and eco-tourism services *Indirect Use Values (Non-consumptive)* Insurance to human health from the avoidance of algae outbreaks.	Very strong	AB + + + (+ +) RC + + (+ + +) PF + + + + (+) CV + (+) ABM + (+) HP TCM BT + + + NMT + + DR + + +

Notes: Averting behaviour (AB) or preventive expenditure, Replacement/restoration costs (RC), Production factor method (PF), Contingent valuation (CV), Conjoint choice, Choice experiment or Attribute based method (ABM), Hedonic pricing (HP), Travel cost method (TCM), Benefit transfer (BT) non-monetary techniques (NMT), dose-response (DR).

By the same token, the PF approach is suggested as the most reliable of the three market-based methods since it does NOT require the use of market prices (as an example, we can look at input productivities or total amounts of harvest fish to gauge changes in provisioning services due to ecosystem and biodiversity shifts). It is therefore the most resilient of these methods.

We can see that BT, NMT and DR do not show significant differences in their degree of suitability with a movement from a context-free perspective to a SIDS one. BT is unaffected because it relies on primary valuation studies that are carried out elsewhere and that are available to the economist. Note, however, that the transfer to the SIDS is as efficient as the degree of information available to the researcher, including a complete data set about the site and population characteristics. DR remains unaffected by the context as biophysical evaluation technique is not dependent upon the socio-economic context; thermo-dynamic laws are valid in all places on the globe. NMT are revealed as important tools since they rely on extensive qualitative surveys, which in the context of SIDS can play a significant role as supplying complementary information to the market methods.

Regulating services

The weight of regulating services to the SIDS is categorised here as "medium". This is not to say that regulating services of ecosystems are not of vital importance to human welfare in SIDS; rather, it is that the benefits of these services are globally spread and not isolated to the

SIDS case. We can illustrate with reference to carbon sequestration. Any activity that promotes the carbon sequestration in the SIDS, for example, land use management practices that promote the conservation of the tropical forests, will be associated with higher levels of carbon stock in the SIDS forests, with the benefits distributed globally. In fact, the reduction of carbon concentrations is a textbook example of a global public good. We refer here to indirect use values; in the case of marine ecosystem services these refer to values such as the value to marine ecosystem health both in the present and as insurance to the future, which therefore also play a role as an input into the present and future streams of provisioning services.

The AB, RC and PF methods are once again ranked equally (and equally high) in the context-free, theoretical application to the valuation of regulating services. Once again, the market traces of these values can be captured by these market-based methods. However, when assessed in the SIDS context, it is suggested that the applicability of these methods weaken. Why is this the case? As in the discussion of provisioning services, above, it is the presence of market distortions that can weaken both of these methods. In particular, we suggest that RC becomes less efficient when compared to AB, since, again, the individual rational behaviour that can be captured by the AB method can be relied upon even in the face of institutional characteristics that can lead to market distortions. Once again, PF is revealed as the most appropriate in the SIDS context, with the loss of only 1 star.

Table 4.2: Regulating Services and Valuation Techniques in SIDS

Ecosystem Service Category	*Economic Value Category*	*Beneficiaries in the SIDS context*	*Most suitable valuation techniques in the SIDS*	
Regulating	*Indirect Use Value (Insurance to marine ecosystem health)* E.g. balancing chemical composition of the water, balancing toxicity accumulation along the food chain, balancing soil erosion and balancing carbon sequestration	Medium	AB	+ + + (+ +)
			RC	+ + (+ + +)
			PF	+ + + + (+)
			CV	+ (+ +)
			ABM	+ + (+)
			HP	+ (+)
			TCM	
			BT	+ + +
			NMT	+
			DR	+ + +

Notes: Averting behaviour (AB) or preventive expenditure, Replacement/restoration costs (RC), Production factor method (PF), Contingent valuation (CV), Conjoint choice, Choice experiment or Attribute based method (ABM), Hedonic pricing (HP), Travel cost method (TCM), Benefit transfer (BT) non-monetary techniques (NMT), dose-response (DR).

The methods of CV, ABM and HP, while theoretically applicable to the valuation of these groups of regulating services (albeit at different levels of performance), are suggested here to be carried out with care. In the SIDS context, CV is seen to be not the most applicable method. Firstly, the weighting given to the SIDS beneficiaries as value recipients is

categorised as “medium”; within this context, it is irrational to suggest that local SIDS communities express a WTP for benefits that are globally spread. Secondly, the high ranking given to the provisioning services *vis a vis* to the regulating ones may lead to value estimates that cannot be disentangled between the two sets of services. The HP is here also less efficient than what one would expect from the theoretical view point, and for this reason we apply a loss of one star. Again we base our reasoning on the distortion of market prices. An exception, however, needs here to be signalled: we refer to the international real estate market, where the market prices full embed non-market characteristics, including the location of the property with respect to the risk of erosion or landslide.

The methods of BT, NMT and DR are seen to be equally ranked both in the theoretical and contextual applications; it is therefore suggested that the applicability of these methods lose nothing when confronted with the SIDS-specific context. NMT is here relatively less applicable due to the high complexity, and non familiarity, of the object of valuation. DR and BT perform equally well. For example, in the context of terrestrial ecosystems, DR is often associated with land management practices and one can describe one ha of forest area in terms of its annual capacity to stock carbon; therefore DR informs us that a loss of *x* ha of forest is associated with the loss of *y* tons of carbon per year.

Cultural services

The economic valuation of cultural services is only possible by the use of stated and revealed preferences. If the non-use values are at stake, then only CV and ABM are capable of valuing these. CV is less flexible than ABM and for this reason less preferred. In addition, in the context of SIDS the CV reveals a stronger vulnerability (and so a lesser degree of reliability) since this method is more susceptible to strategic answering behaviour. Institutional characteristics in particular can play a significant role here in weakening (or strengthening) the applicability of CV to a local context, in terms of the levels of trust in local institutions, the degree of tax evasions, and the overall significance of an informal economy.

TCM and HP are also important valuation tools, especially when focusing on the consumptive and non-consumptive use values. Both are anchored in the use of local prices and for this reason lose one star in their ranking. As before, an exception refers to the international real estate market, where the market prices fully embed non-market characteristics, including the location of the property with respect to the cultural amenities, such as beaches and nature sites. Furthermore, NMT continue to be an important, and appropriate, valuation tool in the SIDS context, providing significant information that can inform the valuation process and complement the remaining tools. Finally, the method of BT here plays a strong role since it allows the economist to explore the wide range of non-market valuation studies.

Table 4.3: Cultural Services and Valuation Techniques in SIDS

Ecosystem Service Category	*Economic Value Category*	*Beneficiaries in the SIDS context*	*Most suitable valuation techniques in the SIDS*
Cultural	*Direct Use Values (Consumptive and non-Consumptive)* E.g. recreational benefits derived from visits to the beach, sport fishing, swimming or sailing, landscape amenities *Non-Use Values* E.g. legacy of marine species for future generations and knowledge in guarantying that the marine ecosystems, and its species, are protected from extinction	Strong	AB RC PF CV + + (+ +) ABM + + + + (+) HP + + (+) TCM + + (+) BT + + + + NMT + + DR

Notes: Averting behaviour (AB) or preventive expenditure, Replacement/restoration costs (RC), Production factor method (PF), Contingent valuation (CV), Conjoint choice, Choice experiment or Attribute based method (ABM), Hedonic pricing (HP), Travel cost method (TCM), Benefit transfer (BT) non-monetary techniques (NMT), dose-response (DR).

4.4. Synthesis

Like all other categories of developing countries discussed in Section 2, SIDS as a developing country subset classification can be characterised by a particular range of factors that affect economic and environmental use and sustainability. These factors are expressed through different intensities of the developing country characteristics discussed in Section 3. These characteristics can be quantitatively mapped (albeit imperfectly in many cases) using a combination of available statistics from global databases as well as site-specific academic research. Table 2 gives an overview of the available indicators and their potential sources.

We reviewed the literature on biodiversity valuation in SIDS, with a general conclusion that the literature is thin. We can summarise this claim in terms of three factors: quantity, geographic location, and methodological technique. 18 papers only from the EVRI database were applicable to biodiversity valuation in SIDS. Furthermore, these 18 referred individually or collectively to only 17 out of the 51 states identified as SIDS. In addition, the main methodological technique used was Contingent Valuation, which as we discussed in Section 4.3 has limited applicability in a SIDS context. Finally, there was a remarkable lack of focus on community benefits; most of the studies targeted visitors and not communities, and there was a significant lack of focus on valuation from the local perspective.

Against this background, we revisited Nunes and Van den Bergh (2001) which presents a comprehensive tabular description of the economic values of biodiversity and the relative applicability of economic valuation techniques to each. However, this is done from the context-free viewpoint. We therefore updated this table by correcting for the applicability of the methods in the SIDS-specific context, within an MEA framework of provisioning, regulating and cultural services and in light of the relative benefit-sharing to SIDS communities. We can see that, in many cases, the application of the location constraint of the SIDS both in terms of characteristics and beneficiaries can re-classify the applicability of many of the economic valuation techniques. With respect to the monetary techniques, PF and ABM are revealed as important tools that are available to the economist; however more care is needed in the design and execution of the valuation exercises in the SIDS context.

Finally, it is interesting to note that, while Tables 4.1-4.3 separate the valuation techniques into mutually exclusive sets, sometimes a combination of methods can yield a synergy of reliability; while applied on their own, some techniques have limited validity, but when combined, the joint information set can yield robust estimates. In particular, we refer to the use of Non Monetary Techniques (NMT) which, in a developing country and SIDS context in particular. While these methods do not yield monetary indicators as do the economic techniques outlined above, they can provide useful insights into how biodiversity is perceived and utilised, and can serve to complement the economic methods which can then, with these added insights, yield more accurate, rigorous and robust monetary estimates.

5. Conclusions: A Contextual Template for Biodiversity Valuation Studies in "Developing Countries"

The ultimate goal of any biodiversity valuation exercise must be a movement towards the sustainable management of the resource as a result of the estimated monetisation of its services. Nowhere is this more important than in rural communities of "Developing Countries" who depend most on the ecosystem goods and services and who as a result may suffer most from its continued degradation. There exists a range of methodological tools for both economic and non-economic valuation, but in the absence of a localised context such valuations run the risk of being irrelevant.

The usual practice is a separation of countries into "Developed" and "Developing". However, it is suggested here that to categorise countries this way is to apply a generalisation that causes a loss of valuable information that can guide the valuation process. Standard global organisations separate "Developing Countries" into a variety of (inevitably overlapping) sub-groups according to certain economic, geographic, social and environmental characteristics. To identify beforehand the membership of the targeted study site in one or more of these groups is to predispose the researcher to a greater understanding of the context within which the valuation exercise is to be undertaken.

It is argued that there are a series of characteristics that are particular to "Developing Countries" and represent immediate challenges to their livelihoods. The social, cultural, economic and political characteristics of a country is the context within which local communities interact with their environment and so can to some extent pre-determine how biodiversity is perceived, utilised and protected. Within the heterogeneous set of "Developing Countries" these factors can exist with different intensities; membership in any (or a

multitude) of the Developing Country categories defined therefore predisposes a study site to certain characteristics and vulnerabilities.

It is possible to undertake a quantitative assessment in the potential case study area of many of these characteristics, using routinely available global statistics, a quantitative (albeit imperfect) assessment of many of these characteristics, and site-specific or qualitative assessments of others. In this way it is possible to assess, before a valuation exercise is undertaken, the context within which a study is to be done. Valuation exercises need to be cognizant of these facts in the pre-valuation stage in order to (1) appropriately identify the relevant services of the environmental asset upon which the community depends and (2) to effectively apply the methodological valuation tools within the localised contexts. The types of policy recommendations to flow out of valuation studies with an aim to sustainable management must also be framed within these characteristics, if they are to be both applicable and effective.

As an illustration, this paper focused on a discussion of the "developing country" sub-category of Small Island Developing States (SIDS). We undertook a critical assessment of the literature on biodiversity valuations and found the literature to be thin in terms of quantity, location, valuation technique and a lack of focus to local community beneficiaries. We revisited the Nunes and Van den Bergh (2001) paper to update the applicability of the valuation methods to the MEA categories of ecosystem goods and services in the context of the SIDS. This evaluation is discussed in terms of the applicability of the valuation methods of Appendix 1 to each of these services according to the SIDS, developing country context, bearing in mind the different factors as discussed in Section 3. In particular, we evaluated the techniques in the light of the characteristics of the beneficiaries, including the SIDS and their communities. Finally, it is suggested that similar exercises can be done for any other sub-category.

While the valuation of biodiversity goods and services is an intricate affair, in the developing world it is also a necessary one. The localised context within which such valuation exercises are to be undertaken can potentially affect every stage of the process, from the prioritisation of the biodiversity service to be valued in the context of local beneficiaries, to the applicability of the methodological tool, to the validity of the incentives and policy prescriptions to result from the exercise with an aim to the more sustainable use and greater benefit sharing of the ecosystem goods and services. It is therefore essential that we obtain a greater understanding of the localised contexts within which such valuation exercises are to be undertaken, and a mapping of how these localised factors can affect the process. This paper has suggested a structure for doing so. With valuation exercises conducted within a framework such as this, it is suggested that the seemingly complex "Ménage-à-Trois" of biodiversity, human welfare and developing countries may become a less complicated, more revealing and more understandable relationship.

Appendix 1: Methodological Tools for the Economic Valuation of Biodiversity

Valuation aims to confer accurate economic values on non-market goods and services, but in order to place an economic value on a non-marketable, say an environmental good or service, the various components that make up its total economic value (TEV) need to be identified. The TEV of environmental goods consists of use value and non-use value. The use value (UV) is a value related to the present or future use of a particular habitat by individuals. It can be subdivided into direct use values and indirect use values. Direct use values are derived from the actual use of a resource either in a consumptive way or a non-consumptive way (e.g. timber in forests, recreation, fishing); indirect use values refer to the benefits derived from ecosystem functions (e.g. watershed protection or carbon sequestration by forests);

The non-use values (NUV) are associated with the benefits derived simply from the knowledge that a natural resource - such as a species or habitat - is maintained. By definition, such a value is not associated with the use of the resource or the tangible benefits deriving from its use. It can be subdivided into two parts that overlap according to its definition. First, there are existence values, which are not connected to the real or potential use of the good, but reflect a value that is inherent in the fact that it will continue to exist independently from any possible present or future use of individuals. Secondly, bequest values are associated with the benefits of the individuals derived from the awareness that future generations may benefit from the use of the resource. These can be altruistic values, when the resource in question should in principle be available to other individuals in the current generation.

A separate category is made up by option values, which are values attributed by individuals given the knowledge that a resource will be available for future use. Thus it can be considered like an assurance that a resource will be able to supply benefits in the future. The quasi-option value, which is sometimes classified as a non-use value, represents the value derived from the preservation of the future potential use of the resource, given some expectation of an increase in knowledge. The quasi-option value is important when the decisions on consumption are characterized by a high reversibility. Other values worthy of mention, but not discussed further in this study include: functional, biocentric, assigned and held values (Lockwood, 1998) and psychological (Nunes 2002, Nunes and Schokkert 2003).

An example of TEV can be exemplified by considering a coastal which is part of an ecosystem. A UV might be a planned recreational visit to the coast, the beach or the coral either now or later. The NUV may consist of unplanned or non-usable sources of welfare related to the marine and coastal habitat, where one is willingness to pay (WTP) for the existence of this ecosystems or to leave it for other generations. On one hand, an individual might feel empowered to protect this coastal area (stewardship) and on the other, may have the urge to let the marine system be available to the present generation (altruism) and/or allow it to be available for future generations (bequest). The use of valuation methods varies according to the different forms of value, that is, whether UV or NUV is estimated. Taking the forest example of the costal and marine ecosystem, *Figure 1* illustrates the classification of economic values derived from the conservation of this ecosystem and the various market and non-market approaches used to capture the magnitude of the respective benefits.

Types of Market Valuation Methods

The market-based methods attract little attention from environmental economists, perhaps because they are considered straightforward and do not pose interesting methodological

challenges. They are, however, of considerable importance and a good part of the value of ecosystems is in fact represented by commercial and financial gains and losses. Some of the market valuation approaches include: averting behaviour, replacement/restoration, production factor method and dose-response.

Averting behaviour (AB) or preventive expenditure

The preventative expenditure technique measures the expenditure incurred in order to avert damage to the natural environment, human infrastructure or to human health. The technique can be used to measure the impacts of biodiversity loss on both marketed and non-marketed goods and services, with the exception of non-use values. In terms of costing biodiversity loss impacts, preventative expenditure should be seen as a minimum estimate of impact costs since it does not measure the consumer surplus (i.e. the additional amount above actual expenditure that consumers would be willing to pay in order to protect a particular good or service from the impacts of biodiversity loss). In the context of climate change, preventative expenditure, if undertaken, would in reality be an adaptation cost, since it is an expenditure aimed at reducing the impacts of climate change (which may also include the loss of biodiversity). As such, great care needs to be taken if using the technique in the context of a cost-benefit analysis of adaptation options.

Replacement/restoration costs (RC)

The replacement/restoration cost technique can be used to measure the costs incurred in restoring or replacing productive assets or restoring the natural environment or human health as a result of the impacts of environmental degradation. As with preventative expenditure, restoration costs is a relatively simple technique to use and has the added advantage over preventative expenditure of being an objective valuation of an impact – i.e. the impact has occurred, or at least is known. Use of the replacement costs method relies on replacement or restoration measures being available and the costs of those measures being known. As such, the method is unlikely to be appropriate for costing the impacts on irreplaceable assets such as biodiversity loss. Another shortcoming with the technique is that actual replacement or restoration costs do not necessarily bear any relationship to willingness of individuals' to pay to replace or restore something. For example, in the context of climate change, the potential health impacts of an increase in the air temperature, and the associated additional health service costs incurred to restore the health of someone made ill by a tropical disease, may be less than that person's WTP to avoid getting the disease in the first place.

Production factor method (PF)

This estimates the economic value of an environmental commodity through an 'impact-pathway' approach, in which a change in the environmental attribute is linked to impacts on 'endpoints' that are relevant for human wellbeing. For example the benefits of tree planting via reduced erosion are measured first by the link between soil cover and erosion rates and then by the link between erosion rates and agricultural productivity. Such methods can be very useful to value many services provided by ecosystems, including forestry (timber and non-timber), agriculture (value of diversity in crops and use of genetic material) and marine systems (losses from overfishing, species invasion).

Types of Nonmarket Valuation Methods

Market prices and costs can provide estimates of the increase in the value of commercial activities, such as timber extraction, fishing etc., the value of revenues from tourism activities related to visits to natural areas and the value of contracts signed by firms and governmental agencies, also known as bioprospecting contracts. However, some environmental goods and

services do not affect markets and market data are not available to value them. In such cases methods have been developed to derive consumers' preferences namely: revealed and stated preference valuation methods.

A number of studies have used stated preference methods when market information has been unavailable, in converse situations, where such data exists, revealed preference methods are applied. Moreover, the stated preference methods are frequently used to elicit the NUV, as these values do not have recorded behaviour, unlike the UV that can be better measured by revealed preference methods. *Table 1* confronts the characteristics of both approaches.

The stated preference methods include:

Contingent valuation (CV)

CV is currently the most used technique for the valuation of environmental goods where individuals state their WTP/WTA for a good or service. One important reason for this is because only SP methods like CV can elicit the monetary valuation of the non-use values, which typically leave no 'behavioural market trace'. Furthermore CV allows environmental changes to be valued even if they have not yet occurred (i.e., *ex ante* valuation). It allows the specification of hypothetical policy scenarios or states of nature that lie outside the current or past institutional arrangements or levels of provision. Finally CV allows one to enrich the information base by submitting the process of value formation to public discussion. Against this is the criticism that the values are hypothetical (payments are not actually made or cash paid out) and that the method is subject to many biases.

Table 1: Differences between revealed preferences (RP) and stated preference (SP)

Revealed preference (RP)	Stated preference (SP)
1) Portrays the world as it is i.e. the current market equilibrium	1) Describe hypothetical or virtual decisions context (flexibility)
2) Consist of inherent relationship between attributes (technological constraints are fixed)	2) Control relationships between attributes (permits utility functions with technologies)
3) Only existing alternatives as observables	3) Include existing, and/or proposed and/or generic choice alternatives
4) Represent market & personal limitations on decision maker	4) Does not represent changes in market and personal limitations effectively
5) High reliability & face validity	5) Appears reliable when respondents understand, commit-to and respond to tasks
6) Yield one observation per respondent	6) Yield multiple observations per respondent

Source: adapted from Louviere *et al*. (2000)

Conjoint choice, Choice experiment or Attribute based method (ABM)

Conjoint choice is also a common used SP method, and the relative merits of this against CV are much discussed in the literature. This method elicits information on values by asking individuals to choose between alternatives; conjoint ranking, where individuals rank alternatives in order of preference and conjoint rating, which indicates their strength of preference on a cardinal scale.

According to Bateman *et al.* (2002), choosing which of the two stated preference approaches to use depends on: the kind of value needed (i.e. total or relative), information availability (CV has greater literature), welfare and/or welfare-consistent estimates, cognitive processing and sampling means (number of responses per individual). Freeman (2003) was 'cautiously optimistic' about the SP method and reported that others are attracted to stated preference methods because of the 'relatively easy and inexpensive way to get usable values for environmental resources'. In a similar vein, Whittington (2002) concluded that SP is vital to a developing country's policy application, but it is far from being a high quality option at a low cost.

The revealed preference methods include:

Hedonic pricing (HP)
This estimates the economic value of an environmental commodity, say, clean air or an attractive view, by studying the relation between such attributes and house prices (Palmquist, 1991). Hedonic price estimation has been applied to elicit environmental/ecosystem values associated with recreation, landscape values and genetic and species diversity. Hedonic techniques are particularly employed in valuing visual amenity, quality of soil assets and exposure to air pollution.

Travel cost method (TCM)
This estimates the economic value of recreational sites by looking at the generalized travel costs of visiting these sites (Bockstael *et al*., 1991). The valuation is then based on deriving a demand curve for the site in question, through the use of various economic and statistical models. Where the individual makes a choice involving more than one site, the discrete choice models have used the random utility theory framework to value not only visits to different sites but also the attributes of sites, such as water quality. The travel cost technique has been widely applied, especially in North America, where Parsons[40] has assembled a list of over 120 such studies. There are three dimensions in TCM: the quality of the good to be valued, the number of visits and duration and the substitutes to other sites (Kolstad, 2000).

Benefit transfer (BT)
This method consists of exporting previous benefit estimates (either from SP or RP) from one site to another, at one point in time, with regards to the researcher's area of interest. In BT estimates there are three possible forms of transfers: transfer of an average of WTP estimates from one primary study, transfer of the WTP function, and transfer of WTP estimates by aggregating other WTP estimates employing meta-analyses (Bateman *et al*., 2002). According to Rosenberger and Loomis (2001), BT involves the use of economic values from one specific area, with a known resource and policy conditions, to another site in similar circumstances. Generally, the first site is known as the 'study site' and the second as the 'policy site'. Sites differ in characteristics and one has to be cautious when applying these from one site to another. On the one hand, this method reduces the cost of starting a completely new valuation study, whereas on the other hand, the compilation of a comprehensive database often proves costly.

In addition, there also exists a host of non-monetary techniques (NMT) that have attempted to assess the importance of biodiversity; a comprehensive discussion of these is provided by

Christie *et.al* (2008). Such methods include consultative and participatory approaches such as focus groups, citizens' juries, health-based approaches, Q-methodologies and Delphi-surveys. While these methods do not yield monetary indicators as do the economic techniques outlined above, they can provide useful insights into how biodiversity is perceived and utilised. The possibility also exists that these non-economic methods can serve to complement the economic methods which can then, with these added insights, yield more accurate, rigorous and robust monetary estimates.

Finally, we refer to non-economic techniques, including dose-response (DR). This technique involves a change in environmental quality affecting the output of goods (or services). The cause is the source (dose) impacting on the environment (the response). For instance, significant amounts of sulphur dioxide (dose) in the air leads to acid rain, which pours into streams and rivers (the response) causing acidification. However, it is difficult to distinguish the various causes that affect the receptors, hence there needs to be a strong association between the dose and its impact. The dose response function can be used to estimate use values either directly or in association with stated preference and revealed preference approaches.

Appendix 2: The Sub-Groups of "Developing Countries"
Source: World Economic Situation and Prospects 2008 (UN Desa 2008)

LDCs	Africa	LLDCs	SIDS	HIPCs	
(least developed countries)	**(countries of Africa)**	**(landlocked developing countries)**	**(small island developing states)**	**(heavily indebted poor countries)**	
afghanistan	algeria	afghanistan	American Samoa	Afghanistan	
angola	angola	armenia	Anguilla		
bangladesh	benin	azerbaijan	Antigua and Barbuda	Benin	
benin	botswana	bhutan	Aruba	Bolivia	
bhutan	burkina faso	bolivia	Bahamas	Burkina Faso	
burkina faso	burundi	botswana	Barbados	Burundi	
burundi	cameroon	burkina faso	Belize	Cameroon	
cambodia	cape verde	burundi	British Virgin Islands		
central african republic	central african republic	central african republic	Cape Verde	Chad	
chad	chad	chad	Commonwealth of Northern Marianas		
comoros	comoros	ethiopia	Comoros	Central African Republic	
democratic republic of the congo	congo	kazakhstan	Cook Islands		
djibouti	cote d'ivoire	kyrgyzstan	Cuba	Comoros	
equatorial guinea	democratic republic of the congo	lao people's democratic republic	Dominica		
eritrea	djibouti	lesotho	Dominican Republic	Cote d'Ivoire	
ethiopia	egypt	malawi	Fiji		
gambia	equatorial guinea	mali	French Polynesia	Congo	
guinea	eritrea	moldova	Grenada	Democratic Republic of the Congo	
guinea bissau	ethiopia	mongolia	Guam	Eritrea	
haiti	gabon	nepal	Guinea Bissau		
kiribati	gambia	niger		Ethiopia	
lao people's democratic republic	ghana	paraguay	Haiti		
lesotho	guinea	rwanda	Jamaica	Gambia	
liberia	guinea bissau	swaziland	Kiribati	Ghana	Ver
madagascar	kenya	tajikistan	Maldives	Guinea	
malawi	lesotho	Marshall Islands	Uganda		

LDCs	Africa	LLDCs	SIDS	HIPCs	
(least developed countries)	**(countries of Africa)**	**(landlocked developing countries)**	**(small island developing states)**	**(heavily indebted poor countries)**	
maldives	liberia	Mauritius	United Republic of Tanzania	Guinea-Bissau	
mali	libyan arab jamahiriya	uganda	Micronesia (Federated States of)		
mauritania	madagascar	uzbekistan	Montserrat	Guyana	
mozambique	malawi	zambia	Nauru		
myanmar	mali	zimbabwe	Netherlands Antilles	Haiti	
nepal	mauritania		New Caledonia		
niger	mauritius		Niue	Honduras	
rwanda	morocco		Palau	Kyrgyzstan	
samoa	mozambique		Papua New Guinea		
sao tome and principe	namibia		Puerto Rico	Liberia	
senegal	niger		Samoa	Madagascar	
sierra leone	nigeria		Sao Tome and Principe		
solomon islands	rwanda		Seychelles	Malawi	
somalia	senegal		Singapore	Mali	
sudan	seychelles		Solomon Islands		
timor-leste	sierra leone		St. Kitts and Nevis	Mauritania	
togo	somalia		St. Lucia	Mozambique	
tuvalu	south africa		St. Vincent and the Grenadines		
uganda	sudan		Suriname	Nepal	
tanzania	swaziland		Timor-Leste	Nicaragua	
vanuatu	togo		Tonga	Niger	
yemen	tunisia		Trinidad and Tobago		
zambia	uganda		Tuvalu	Rwanda	

Appendix 3: The geographical categories of "developing countries"
based on UN Desa (2007), United Nations Developmental Agenda: Development for All

AFRICA

North Africa:
Algeria, Egypt, Libyan Arab Jamahiriya, Morocco, Tunisia

Sub Saharan Africa, excluding Nigeria and South Africa:
all other African countries except Nigeria and South Africa

ASIA/PACIFIC (excluding Australia, Japan, New Zealand and the member states of CIS in Asia)

Western Asia:
Bahrain, Iraq, Israel, Jordan, Kuwait, Lebanon, Occupied Palestinian Territory, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Turkey, United Arab Emirates, Yemen

South Asia:
Bangladesh, Bhutan, India, Iran (Islamic Republic of), Maldives, Nepal, Pakistan, Sri Lanka

East Asia:
All other developing economies in Asia and the Pacific

LATIN AMERICA AND THE CARIBBEAN

South America:
Argentina, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela

Mexico/Central America:
Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Mexico

Caribbean:
Barbados, Cuba, Dominican Republic, Guyana, Haiti, Jamaica, Trinidad and Tobago

Appendix 4: EVRI References for Biodiversity Valuation Studies in SIDS

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Appendix 5: From Nunes and van den Bergh (2001)

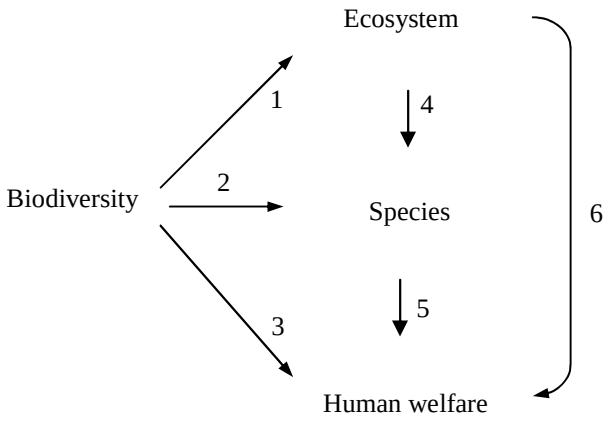

Figure 1: Economic values of biodiversity

Table 1: Total economic value of biodiversity

Biodiversity value category (see Figure 1)	Economic value interpretation	Biodiversity benefits	Methods for economic valuation (and their applicability)
2→5	Genetic and species diversity	Inputs to production processes (e.g. pharmaceutical and agriculture industries)	CV: + TC: - HP: + AB: + PF: + Contracts: +
1→4→5	Natural areas and landscape diversity	Provision of natural habitat (e.g. protection of wilderness areas and recreational areas)	CV: + TC: + HP: - AB: - PF: + Tourism revenues: +
1→6	Ecosystem functions and ecological services flows	Ecological values (e.g. flood control, nutrient removal, toxic retention and biodiversity maintenance)	CV: - TC: - HP: + AB: + PF: +
3	Nonuse of biodiversity	Existence or moral value (e.g. guarantee that a particular species is kept free from extinction)	CV: + TC: - HP: - AB: - PF: -

Nota: the sign + (-) means that the method is more (less) appropriated to be selected for the design of the valuation context of the biodiversity value category under consideration.

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(UNEP) UNEP GEO Data Portal: http://geodata.grid.unep.ch/

(MDG Indicators) UN Millennium Development Goal Indicators:
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