

FINAL REPORT

BIOLAC: Toward Biodiversity Conservation, Sustainable Use and Benefit-Sharing in Latin America and the Caribbean

Section 1: Extended Final Publishable Summary Report

Global biodiversity loss has been identified as one of the key environmental challenges of our time. By ensuring proper functioning of ecosystems that generate a stream of goods and services that are essential to human well being, biodiversity has been identified as fundamental for the sustainability of current and future human livelihoods. Ensuring environmental sustainability is one of the 8 UN Millennium Development Goals. Halfway to 2015, there has been progress but overall success is still not guaranteed. At the UN World Summit on Sustainable Development in 2002, the articulated target was the significant reduction of biodiversity loss by 2010. The recently concluded COP10 negotiations in Nagoya attempt a stock-taking exercise in terms of progress, or lack of progress, to this target.

Most of the world's biodiversity "hotspots" are to be found in the developing world; indeed, one of the major assets of the region identified as "Latin America and the Caribbean" (LAC) is its biological wealth. By extension, the continued biodiversity loss of the LAC region is seen as one of the world's principal environmental problems, with Small Island Developing States (SIDS) in particular as one of the sites where global biodiversity is most in danger (Global Environment Outlook 2003). It is therefore essential that we 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. This was the fundamental objective of the BIOLAC project.

The specific objectives of BIOLAC were to (1) develop a protocol for assessing the contribution of biodiversity to human well-being through the provisioning of ecosystem goods and services to the LAC region (2) to assess ecosystem provisions in one selected case study (3) to derive the welfare impacts of changes in biodiversity in this case study (4) to identify the appropriate measures for the targeting and application of payments for ecosystem services for biodiversity, and (5) to develop a generic toolkit for application in other case studies in the LAC.

The paper entitled "Valuing the Environment in Developing Countries: A Pre-Testing Checklist for Empirical Studies" offers a framework for a pre-testing stage of environmental valuation in developing countries. Environmental valuation is a necessary tool in the achievement of "sustainable development", and while valuation literature yields a range of methodological techniques, the question is whether they are capable of revealing the complexities of local environmental use in developing countries where, in the absence of a localized context, such valuations run the risk of being irrelevant. 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 environmental 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. The framework presented attempts to address this question, with its application potentially determining how a resource is perceived and utilised by local communities, what can be valued, the appropriate methods to so do, and how policy recommendations should best be structured for effective environmental management within the specific developmental context. 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. The paper entitled "Biodiversity Valuation in Developing Countries: A Focus on Small Island Developing States (SIDS)" takes this argument one step further by discussing, with specific reference to Small Island Developing States (SIDS), 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.

With 2010 upon us, much attention has been focused upon the development and assessment of global indicators by which it is possible to effectively measure the progress toward the stated targets of reduction in

biodiversity loss. The ultimate winners or losers of biodiversity changes can only be judged, however, by an analysis that links such indicators of biodiversity change to the ecosystem services they support, and ultimately to the human livelihoods dependent upon these services. This firstly requires a spatial downscaling of existing, aggregate global indicator analyses to more in-depth, micro studies. The paper entitled “Biodiversity Indicators, Ecosystem Services and Local Livelihoods in Small Island Developing States (SIDS): Early Warnings of Biodiversity Change” seeks to bridge this gap with a focus on Small Island Developing States (SIDS). Biodiversity is a crucial component of local livelihoods in SIDS, with marine and coastal biomes in particular contributing significantly to food security and income via their role in the provisioning services of capture fisheries and the tourism /eco-tourism industries. This paper suggests the subset of individual and aggregate indicators of biodiversity that are particularly relevant to SIDS, discusses the existence of such data, and calculates the current trends of biodiversity at the local and regional levels of SIDS. An adapted DPSIR framework is then used to categorise these indicators, with climate change as a major global driver explicitly incorporated into the analysis. Finally, a framework for the implications for the state of benefits derived from biodiversity in SIDS, and their links to local livelihoods and human wellbeing, is discussed.

The paper entitled “Recreational, Cultural and Aesthetic Services from Estuarine and Coastal Ecosystems” discusses the role of economic analysis in guiding sustainable developing of estuarine and coastal ecosystems, by undertaking a comprehensive review of the literature on the valuation of the recreational, cultural and aesthetic services of these ecosystems, and drawing the implications of these findings for the sustainable management of Small Island Developing States (SIDS). The results of the study support the conclusion that the non-material values provided by coastal and estuarine ecosystems in terms of recreational, cultural and aesthetic services represent a substantial component of human well-being.

The proposal identified the chosen case study as “sea turtle conservation”; this theme therefore underpinned the work of the project. The Paper entitled “Marine Turtles, Ecosystem Services and Human Welfare in the Marine Ecosystems of the Caribbean Sea: A Discussion of Key Methodologies” discusses from an inter-disciplinary perspective the methodologies associated with linking marine turtles, ecosystem services and human welfare with the use of the ecosystem service categories of the Millennium Ecosystem Assessment. The marine resources of Caribbean Sea are of vital economic, ecological and social importance to the LAC region, and are under particular threat. Marine turtles play vital roles throughout the Caribbean Sea both in terms of ecological functions and human welfare. Conservation efforts in this direction can often depend 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. While the main economic benefit to be currently valued may stem from the eco-tourism potential surrounding turtle nesting sites, for a true picture of the environmental resources upon which this service depends, it is necessary to also identify the other provisioning, regulating and cultural services of the resource. In this way, human welfare impacts can be more truly judged, and effective resource management can be undertaken. Against this background,

As its case study, BIOLAC focuses on eco-tourism in the context of Trinidad, a Small Island Developing State. This is because of the significant role played by tourism and eco-tourism in the economic life of most Small Island Developing States (SIDS), and the role of biodiversity in these industries. This role is empirically investigated using panel data techniques in the paper entitled “Tourism Flows and Marine Biodiversity in Small Island Developing States (SIDS): Evidence from Panel Data”. Marine biodiversity enters into the analysis through the use of an adapted DPSIR framework. Empirical relationships are estimated that link SIDS tourism demand to the state of biodiversity, existing pressures upon these resources, and policy responses to these pressures, with climate change identified as a major pressure on existing biodiversity. Marine biodiversity indicators are constructed based on the focal areas and headline indicators of the Convention for Biological Diversity. Estimation is based on the Hausman-Taylor Estimator, which allows for the existence of time-invariant and rarely-changing environmental variables, and introduces the issue of simultaneity and feedback effects through endogenous covariates. Finally, tourism impacts of biodiversity changes are extrapolated to GDP impacts with the estimation of a second-stage panel data regression. This mechanism allows a quantification scheme for baseline values of the benefits/services of marine biodiversity to SIDS, therefore allowing an assessment of the relative magnitude that is provided by marine ecosystem services to the welfare of the local SIDS economies.

Fishery sectors also play highly significant roles in coastal livelihoods in SIDS; this sector also impacts, and is impacted upon, by losses of biodiversity. The dual role of Fisheries and Tourism is empirically investigated in the paper entitled “A Tale of Two Sectors: A Dual-Economy Framework of

Biodiversity Dependence in SIDS". An Arthur-Lewis-type dual economy framework is utilised to construct a two-sector, open-economy model of resource dependence, characterising a tourism and fisheries sector that are both directly dependent upon, and simultaneously impact, marine biological diversity. Panel VARs are estimated that link the fisheries and tourism sectors with biodiversity and economic variables. Finally, temperature is incorporated as an exogenous representation of global climate change, from which the impacts of IPCC scenarios on these economy structures via impacts on the provisioning services represented by the tourism and fisheries sectors are determined.

The BIOLAC case study was chosen as the remote village of Grande Riviere on the north-eastern coast of the island of Trinidad, the beach of which is the location of one of the major nesting sites of leatherback turtles. As a result, there has been a growing development of an eco-tourism industry surrounding this natural phenomenon. The community of Grande Riviere is a small one with low income levels, little formal education, high unemployment and a lack of formal land tenure. Within this context, the geographic area of the community is particularly rich in biodiversity and natural fauna: in particular, two very important species of Grande Riviere are the leatherback turtle and the endemic pawi or piping-guan. Both of these animals are listed as critically endangered species of animals on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species for 2009. Despite its remote location, the village is increasingly becoming a popular eco-destination despite its remote location. Ecotourism activities in Grande Riviere revolve around the pristine environment that exists in this relatively small and isolated village, including a natural environment with waterfalls, river and nature trails, and biodiversity that includes birds, trees, leatherback turtles (which has a seasonal appearance of March to August annually), and the pawi or piping-guan. It has been claimed that tourism is the most significant factor that had changed the life of villagers in this community over the period of 1870 to 2006. Bird watching in Grande Riviere is of increasing importance, with the pawi at the centre of these attractions. However, at present the ecotourism activities in the Grande Riviere community centre mainly around leatherback turtle nesting. Turtle watching is characterised by a significant seasonal inflow of both local and foreign tourists during the months of March to August annually. The Ministry of Planning and Development indicate that annual visitors to the Grande Riviere beach (based of the numbers of permits issued) average 3500. It has been estimated that in 2006, there were 10 000 overnight visitors to this small coastal village. There are 4 small eco-resorts and 10 guesthouses. The main penetration of the tourism industry from the leatherback turtle nesting industry comes through the Grande Riviere Nature Tour Guide Association, which is managed by local residents and is an existing (and potentially increasing) source of employment for the community. In addition, community initiatives to protect the nesting turtles are increasingly famous worldwide.

This coastal community faces a significant number of environmental challenges that can affect local livelihoods and community welfare, such as hillside deforestation due to unsustainable agricultural practices, reduction in fish stocks due to unmanaged fisheries, and oil spills from offshore drilling platforms. Waste disposal from the increasingly number of small beach hotels is also becoming a significant threat to the marine biodiversity of the coastal waters. The hunting of wildlife is very much a traditional activity of the community. The slaughtering of nesting leatherback turtles is also of primary concern. Finally, the over-arching issue of climate change has the potential to significantly affect this community in a number of ways. Situated in the North Eastern coastal zone of Trinidad, this village is more susceptible than other parts of the country to hurricanes and tropical storms. Furthermore, its location being adjacent to a narrow coastal zone strip, there is significant danger of sea level rise, firstly to the beach itself which, if lost, will therefore imply the loss of the leatherback turtle nesting activities and any eco-tourism surrounding that, and secondly, to the village itself which can be swamped by increasing sea level rise. Another interesting impact of climate change is its potential effect on the gender of the hatching turtles; warming temperatures can predispose hatchlings to the female gender, and this can significantly affect the gender ratio of leatherbacks and therefore their subsequent survival. Furthermore, increasing temperatures can cause the death of hatchlings altogether.

With the eco-tourism industry surrounding the leatherback turtle nesting in Grande Riviere as the chosen case study, the BIOLAC project created and administered four survey instruments during the turtle nesting season of March-August 2010. Firstly, a community survey was developed to assess the attitudes and opinions of the residents on their interactions with nature, the eco-tourism surrounding the turtle nesting, and climatic issues. This survey was developed around 5 sections consisting of (1) general (2) demographic (3) ecosystem services (4) eco-tourism and leatherback turtles and (5) climate change. Three surveys were developed to be administered to tourists. Firstly, an instrument was created to target the local tourists visiting

Grande Riviere during the turtle nesting season. At the same time, an alternative instrument was administered to the international tourists in Grande Riviere. Finally, an instrument was administered to departing tourists at the international airport of Trinidad, who may or may not have visited the village of Grande Riviere.

The objectives of the socio-economic component of this study is therefore to analyse the current community involvement in the eco-tourism activities associated with the leatherback turtle nesting, to analyse the structure and demand of the current eco-tourism activities from the perspectives of both national and international visitors, and to investigate the potential for the community-based expansion of this economic activity. Such an analysis also enabled the type and magnitude of relative (present and potential) economic costs of climate change to this community, and the proposal of mitigating strategies to ensure sustainable economic livelihoods for the community of Grande Riviere.

The methodological papers identified above spoke to the need to better understand the linkages between the environment and human-well being in developing countries, with an aim to “sustainable development”. Existing empirical studies overlook the livelihood values of natural resources in developing countries, with a focus instead on amenity values of developed countries. In response to this, there is a recent and growing literature that attempts to quantify the relationship between communities and natural resources in developing countries, pointing to the importance of natural resources in daily life. Within this context, there is also the widely held (and widely debated) view that poverty is a major cause and a major effect of environmental problems. In the paper entitled “The Importance of Nature to Rural Communities in Developing Countries: Community Perceptions of Biodiversity and Ecosystem Services in Grande Riviere, Trinidad”, these issues are empirically investigated using the primary data collected by the survey instruments above. Firstly, Factor Analysis is used to investigate and subsequently construct 3 indices for provisioning, regulating and cultural/recreational ecosystem services. Secondly, these indices are entered as dependent variables in a variable set that also includes demographic variables and variables related to the eco-tourism and leatherback turtles. General to specific modeling within the context of ordered probit models is undertaken, to determine what are the components that influence community perceptions of the use of nature in their daily lives. Some particularly interesting finds in the particular context of biodiversity and rural poverty include the fact that regulating ecosystem services, in addition to provisioning ones play a role in the value assigned to nature by the households of this community, that those with higher income levels value nature more highly, and that, despite poverty levels, significant value was placed on inter-generational equity

Community-based eco-tourism industries have been suggested as win-win scenarios in the context of the simultaneous protection of biodiversity, and the biodiversity’s potential to lift rural communities out of poverty through eco-tourism activities; this continues to be an ongoing debate. As an empirical contribution to this debate, the paper “Biodiversity as a means to Conservation: A Community-Based Development of the Leatherback Turtle Tourism Industry in Grande Riviere, Trinidad” empirically investigates (1) the community views on the existing and potentially expanding eco-tourism industry (2) community preferences for further penetration into this industry, and (3) the factors that characterize and determine these preferences. Through an analysis such as this, it is therefore possible to identify, in the specific local context, the best channels for public and private investment into this industry, and the extent to which biodiversity conservation and economic resilience can be simultaneously met in a rural context.

While the previous analysis focuses on the community-based supply side of the eco-tourism product surrounding leatherback turtle nesting in Grande Riviere, the question also arises as to what is the existing and potential levels of demand for this product. The answers to this question are investigated in the paper entitled “Biodiversity, Eco-Tourism and Sustainable Livelihoods: Empirical Linkages in Grande Riviere, Trinidad”. In this paper, analyses are conducted on both on-site and off-site tourists. On site tourists are divided into two groups, national and international visitors. Off site tourists are those surveyed at the international airport. This paper analyses (1) the eco-tourism preferences of these three groups (2) the factors influencing these preferences (3) the willingness to pay of each of these groups for this product and (4) the ways in which demand for this product can be stimulated in the future with the potential expansion of this community-based eco-tourism industry in mind.

Given existing and continued levels of biodiversity loss in the LAC region, the question arises as to the winners and losers at different levels of spatial scale. The paper entitled “Who Wins, Who Loses? An Analysis of Welfare Distributional Changes of Biodiversity Loss in Grande Riviere, Trinidad” attempts to merge both the supply and demand sides of the previous analyses by conducting a joint study targeted to

community stakeholders, national visitors, and existing and potential international tourists. The magnitudes of loss of changes in biodiversity to these different stakeholder groups are estimated, and the factors affecting these magnitudes are identified.

Rural coastal communities can be particularly susceptible to the impacts of climate change. As a coastal community, Grande Riviere faces implications from climatic changes in a number of ways; IPCC scenario simulations are used to demonstrate the dangers of sea level rise, both to the complete engulfment of the narrow beach, and to the flooding of the village itself. The immediate danger to the beach is the loss of the leatherback turtle nesting activities, and any existing and potential eco-tourism activities surrounding this. Leatherback turtles can also be affected by the potential effect of climate change on the gender composition of hatchling turtles. Much current literature focuses on adaptation and mitigation strategies of such communities to this exogenous event. However, effective adaptation and mitigation strategies can only be implemented in the context of existing community knowledge of climate change, the levels of concern in “at risk” communities and their perceptions of the risk they face. Against this background, these issues are addressed in the paper entitled “A Rural Community Perspective of Climate Change in Developing Countries: State of Knowledge, Level of Concern and Perception of Risk”, where a stock-taking exercise of attitudes of the Grande Riviere community to the issue of climate change is assessed. The paper entitled “Raising Awareness of Climate Change in Rural Communities of Developing Countries: The Role of Social Media” takes this analysis one step further by an empirical analysis of the methods of communication that currently have the most impact the Grande Riviere community in the context of climate change issues, and therefore represent the best channels of further education on climate change, with an aim to adaptation and mitigation strategies so as to minimize the exogenous impacts of climate change on this low-income, rural coastal community.

Based on the experiences of the BIOLAC project, Model Revisions are suggested with explicit reference to challenges encountered and resolved. Two main challenges encountered was (1) the timing of the data collection exercise and (2) the identification of the community liaison. Firstly, the primary data collection of an exercise such as this must be conducted within the context of the precise resource issue being investigated; in this case, timing with the turtle nesting season of March to August. Secondly, there is always the need for a resident community liaison, to both facilitate access to the local community and to provide baseline information on the local context. Four Model Revisions / Adaptations are suggested for generic application of the methodologies and analyses of the BIOLAC project. Firstly, it is necessary to adapt the survey instruments, both to other LAC contexts with respect to eco-tourism and turtle nesting, and to other coastal communities in the LAC region where other activities and contexts are relevant. In particular, as extensions of the BIOLAC project and in conjunction with the developed methodologies, community analyses will be undertaken of the urban coastal setting of Georgetown, Guyana (a South American mainland country), in Bequia, St. Vincent (a small island whose community is dependent on fisheries, tourism, and in which there is also an indigenous history of whaling), and in the communities adjacent to the Barrier Reef of Belize (a highly diverse and extensive coral reef system that supports many coastal livelihoods). In all contexts, biodiversity dependence and dependence on ecosystem services will be assessed, and climate change issues of risk, adaptation and mitigation strategies will be analysed. Furthermore, it is suggested that spatial / GIS analyses are conducted to analyse the spatial aspect of statistical differences, and further deepen the analysis.

Finally, a Toolkit is produced that outlines a roadmap for research applications to other case studies of the LAC region. The conceptual framework rests primarily in the environmental valuation checklist that should be applied to valuation studies in developing countries. In addition, to more effectively analyse the local context, background information and site descriptions are necessary factors. Furthermore, a community liaison should be incorporated into the valuation process from the beginning. Given the lack of primary data collection studies in SIDS and in the LAC region, the likelihood of the need for primary data collection is high; as such, generic versions of the survey instruments of the BIOLAC project are created. Finally, the empirical analyses of the BIOLAC project can be mirrored according to the types of surveys conducted, and potential policy recommendations surrounding welfare impacts of potential private and public investments in community-based developments of biodiversity-rich areas will result.