Biodiversity, Nature-Based Tourism, and Jobs
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Washington, D.C. 20433
Telephone: 202-473-1000
Internet: www.worldbank.org

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Contents

Section 1 — Introduction 1

Section 2 — Conceptual Framework 3

Section 3 — Economic Impact of Nature-Based Tourism 5
  Magnitude 5
  Distribution 5
  Alternative Sources of Benefit Sharing 7
  Costs 8
  Local Perception 8

Section 4 — Determinants of Economic Benefits 9
  Local Economy — Tourism Linkages 9
  Tourism Site Characteristics 10

Section 5 — Implications for Conservation 11
  Economic Impact vs. Conservation 11
  Local Economic Benefits and Conservation 11
  Governance 11

Section 6 — GEF Projects and Economic Benefits of Nature-Based Tourism 13
  The Greater Addo Elephant National Park Project, South Africa 13
  Dana Nature Reserve and Wild Jordan 15

Section 7 — Discussion and Conclusion 17

References 19
Annex A — Economic Impacts of Recent Nature-Based Tourism Projects 23

Annex B — Conceptual Framework 25

Notes 27

Box
1 Estimates of National Economic Impacts 7

Table
1 Types of Benefit Sharing for Local Communities 4
Introduction

Biodiversity, the variability among living organisms and ecosystems, has been argued to have great value for humanity. In addition to the intrinsic value of biodiversity, sources of value include the use value and existence value of individual species; biological prospecting for useful compounds and genetic material, particularly for pharmaceutical and agricultural innovation; and the role of biodiversity in the provision of ecosystem services (Polasky et al. 2005). It is well understood that human beings depend on ecosystems to provide valuable goods and services such as food and water, the regulation of climate and disease, the support of the nutrient cycle and crop pollination, along with cultural and recreational benefits often enjoyed via tourism (Daily 1997, MEA 2005). It is argued these ecosystem services are more resilient with greater biodiversity, though the relationship is as yet not well understood (Walker et al. 1999, Hooper et al. 2012).

Habitat loss due to population pressure and the expansion of economic activity is regarded as the leading cause of biodiversity loss (Primack, 2000). Habitats are cleared for agriculture, manufacturing, resource extraction such as mining and logging, and urban settlements. As a result, the designation of protected areas to conserve natural habitats has come to be seen as the principal means of protecting biodiversity (Joppa et al. 2008).

A fundamental challenge of biodiversity conservation, however, is to achieve conservation in the context of pressing development priorities and limited funding made available by national governments for protected area management (WCMC 1992, Simpson 2004). Many of the world’s most biodiversity rich areas are in developing countries which often lack the capacity to enforce protected area designations (Brandon 1998). Local populations near protected areas, often in poorer rural areas, bear a large share of the costs of protected area designations in the form of restricted access to land and natural resources (Ghimire 1994), crop damage due to raiding wildlife (Studsrod and Wegge 1995), or inadequate compensation for resettlement. In the context of low capacity to maintain protected areas, conservation projects that do not address the needs of local communities are argued to be less likely to succeed in protecting biodiversity (Adams et al. 2003, Honey 1999, Sekhar 2003, Walpole and Goodwin 2001, Weladji et al. 2003). As a result, policymakers have turned to integrated conservation and development programs (ICDPs) as a means of achieving both conservation and sustainable development for local communities (Brandon and Wells 1992).

Nature-based tourism has been argued to be a means of achieving both conservation and sustainable development (UNWTO 2007). Nature-based tourism refers to tourism whose main purpose is the viewing or enjoyment of the natural environment, which include hiking, birdwatching, or safaris (Eagles 2001, Naidoo and Adamowicz 2005). Proponents of this approach argue that local communities receiving economic benefits from nature-based tourism will have an incentive to discontinue consumptive land uses, such as habitat
conversion, since the success of tourism will depend on the conservation of natural habitats (Sekercioglu 2002, Goodwin 1996). At the same time, the development needs of the local community can be served by the income generated from tourism. Moreover, it is argued that local communities are the best positioned to resist environmental threats posed by external loggers and miners, since their livelihoods through nature-based tourism would be adversely affected (Wunder 2000).

This paper draws from the literature centered on case studies of nature-based tourism projects in developing countries to evaluate the empirical support for key premises for nature-based tourism being a viable conservation and development strategy. In doing so it also assesses the extent to which nature-based tourism generates jobs for local communities.

Our review of the literature indicates that nature-based tourism can achieve conservation and generate meaningful economic benefits for local communities under certain conditions. First, local communities must receive direct economic benefits from nature-based tourism. As these projects typically take place in poorer rural areas, tourism products that require a significant amount of unskilled labor can yield large local benefits. In general, however, tourism is a capital intensive enterprise which skews benefits toward wealthier, better capitalized locals and nonlocals who are able to build tourist accommodations and offer transportation services. In these instances, projects must turn to alternative benefit-sharing schemes such as revenue sharing or targeted public goods provision in order to transfer benefits to local communities.

While benefit-sharing is critical, the project design must also consider how to generate the greatest economic benefit from the protected area while maintaining its ecological quality. When too little revenue was generated, local communities were found to continue consumptive land uses.

Finally, the implications for achieving conservation in addition to these economic benefits point to the importance of balancing the need to generate sufficient economic benefits for local communities in order to create incentives to cease consumptive uses, while also preventing the tourism venture from exceeding the carrying capacity of the site and harming conservation. The economic benefits must also be closely linked to conservation actions in order to produce adequate incentives. In meeting these challenges, the case studies highlighted the importance of the capacity of protected area management institutions to both develop the tourism product, through complementary investments, involve local stakeholders, and also to effectively monitor the ecological effects of tourism.

The rest of the paper is organized as follows. Section 2 presents a simple conceptual framework to highlight, on the one hand, the need for benefit-sharing mechanisms to achieve conservation goals, and on the other, the need for designing mechanisms that also maximize economic benefits without compromising the conservation goals. Section 3 presents results from the literature review on whether nature-based tourism has successfully generated economic benefits for local communities, Section 4 identifies which factors have led to the successful generation of economic benefits through nature-based tourism and Section 5 discusses the implication of economic benefits for conservation. Section 6 looks at a couple of World Bank GEF project in light of the findings in the literature. The paper concludes with an assessment of the extent to which nature-based tourism can serve as a strategy to achieve the twin goals of conservation and sustainable development and what this implies for World Bank projects.
The mechanisms driving the success or failure of nature-based tourism as a conservation and development strategy can be illustrated via a simple model. Consider a community that depends on a forest area for its livelihood. This community may extract forest products or it may cultivate some of the area for agriculture, both consumptive uses. Say its use of the forest area is leading to forest degradation.

Say the national government decides to conserve this forest area for its biodiversity wealth and declares the land to be a protected area. The question is what mechanisms are needed to achieve this conservation goal? With perfect, costless enforcement, the government would be able to restrict access to the area through, for example, “fences and fines” to preserve the forest and its biodiversity. Under this scenario, conservation could be achieved, however, at the expense of making the community worse off.

Under the more realistic case where perfect enforcement is not feasible due to either its high cost or the difficulty in monitoring resource extraction, the conservation goal can only be achieved if the community continues to derive some benefit from the forest area, but now no longer through consumptive use. Say, for example, that the forest area supports nature-based tourism such that economic benefits derived from the forest area depend on the abundance of the natural resource in question (e.g., the number of wildlife or the amount of unspoiled nature). Then the community will have an incentive to cease its consumptive use practices if part of the tourism revenue is then shared with the community. Benefit sharing can take place through revenue-sharing arrangements or through employment in tourism-related activities, or other arrangements (see Table 1). Under this scenario conservation would only be achieved if the community is made no worse-off.

As shown in the analytical model (see Annex), and as expected, the community’s incentive to cease consumptive use practices is greater the greater its share of the total revenues from the nature-based tourism activities. However, all else equal, its incentive also increases in the total revenues generated by the tourism venture. What this implies is that it is important not only to split the pie but also to ensure that the pie is as large as possible while maintaining the ecological quality of the protected area. This, in turn, has implications for the benefit-sharing mechanism that is used to share the pie. Say, the economic revenues from the forest area can be maximized through high-end tourism that requires high skills and large capital investments. If the benefit sharing mechanism however limits the tourism operators to be locals or to hire locals, then the revenue generated may be limited and not provide sufficient incentive to the community to limit its practices. A tax on the tourism industry that is used to support development activities in the local community may be a more efficient way to achieve conservation and development goals. It is important, however, that economic benefits are maximized while ensuring that the economic activity does not lead to resource degradation.
In this simple framework, it is apparent that the ability of nature-based tourism to achieve conservation and development will depend on specific conditions. First, if the tourism venture is not productive, particularly relative to the benefits of resource extraction, the community will have little incentive to cease extraction. Secondly, the tourism venture may yield large revenues, but the community’s incentive to protect the resource may be weakened by limited revenue sharing. Thirdly, tourism visitation and economic activity may surpass the carrying capacity of the natural area resulting in resource degradation, and defeating the conservation objective. It should be noted that the tradeoff between economic gain from tourism and conservation is less acute in the long-run as the long-run viability of nature-based tourism and the condition of the natural area are closely related. Policies which allow for long term planning such as security of contract and property rights will incent actors to take a longer view. Overall, these scenarios illustrate that the ability of nature-based tourism to generate economic benefits and conservation will depend on particular conditions and it is ultimately an empirical question how readily those conditions occur in practice.

<table>
<thead>
<tr>
<th>Benefit Sharing Scheme</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct and indirect employment</td>
<td>Direct: restaurant employees, wait staff, gardeners, taxi/boat drivers, park guides, and handicraft work.</td>
</tr>
<tr>
<td></td>
<td>Indirect: Construction, food/goods for restaurants etc.</td>
</tr>
<tr>
<td>Revenue sharing schemes</td>
<td>Purchase of goods and contracting services locally (Wells, 1997). Several nature-based tourism sites adopt policies for hiring which favor locals (e.g. Jordan (Johnson, 2007); AENP (World Bank, 2004)).</td>
</tr>
<tr>
<td>Conservation concessions</td>
<td>Government or private tourism operator may pay local communities to cease land conversion and decrease hunting in exchange for payment. Kirkby et al. (2011) discuss cash and in-kind payments made to local communities in Peruvian rainforest in exchange for alterations in their hunting and forest clearing practices.</td>
</tr>
<tr>
<td>Limited harvesting of plant and animal species</td>
<td>Locals may be allowed limited hunting, livestock grazing, and collection of natural products such as fuelwood. Karanth and Nepal (2011) discuss restricted access to natural resources in protected areas in India and Nepal.</td>
</tr>
<tr>
<td>Shared decision-making authority</td>
<td>Local consultation on decisions regarding tourism development and rules governing protected area access. Monteverde Cloud Forest Biological Reserve in Costa Rica employed participatory approach (Aylward et al., 1996)</td>
</tr>
<tr>
<td>Tourism development and promotion</td>
<td>Local communities and entrepreneurs may benefit from tourist visitation generated from the effective marketing and promotion of tourism. Royal Society for the Conservation of Nature (RSCN) in Jordan established a commercial arm, Wild Jordan, to market and promote nature-based tourism in Jordan (Johnson, 2007)</td>
</tr>
<tr>
<td>Local public goods</td>
<td>Tourism revenues in Annapurna Conservation Area reinvested in community development projects such as health clinics, water and sanitation infrastructure (Matthews, 2003).</td>
</tr>
<tr>
<td>Capacity building</td>
<td>Training individuals in order to take advantage of employment in nature-based tourism and starting small businesses (e.g. AENP South Africa)</td>
</tr>
</tbody>
</table>
The case study literature on nature-based tourism indicates that economic benefits due to nature-based tourism can be significant sources of income for local communities (Almeyda et al. 2010, Lepper and Schroenn 2010, Lindberg et al. 1996, Sandbrook 2010, Sheppard et al. 2010), even when relatively small in magnitude. Nature-based tourism projects are often located in poor rural areas where even marginal gains can be significant relative to a paucity of other available opportunities to earn income (Lepper and Schroenn 2010, Mbaiwa and Stronza 2010). For instance, wages in a tourism project in Ngamiland, Botswana for locals employed in positions such as wait staff, cooks, and drivers, were found to be more than twice the average rural wage of $60 per month.

A direct means of receiving benefits from nature-based tourism is through the employment of a household member in the tourism sector. Annex Table 1 discusses economic impacts of nature-based tourism drawn from a set of recent case studies. Employment is typically in tourism-related activities such as offering accommodation, restaurants, transportation, handicraft sales, and park services. Employment opportunities for local communities tend to be in lower-skilled and lower paid positions such as park guides, domestics, cooks, and service staff. Nevertheless, wages for those able to obtain positions in tourism can be substantially higher than opportunities outside of tourism, which are often in agricultural positions in areas near protected areas (Bookbinder et al. 1998, Mbaiwa 2005). Working on Mount Kilimanjaro guides earned $1,830 annually on average, porters $842, and cooks $771 in the context of a rural agricultural wage of $2 per day (Spenceley 2010). Furthermore, as these figures indicate, among jobs within tourism, positions that leverage specialized skills or local knowledge such as guides, interpreters, or rangers can be higher paid jobs accessible to locals.

While employment benefits can be significant, surveys indicate the proportion of the local working-age population employed in nature-based tourism near protected areas is often marginal. Proportions of working age adults employed in nature-based tourism can be less than 6 percent of the total working age population (Saayman et al. 2009, Bookbinder et al. 1998, Karanth and DeFries 2010). Successful island tourism cases such as Taquile Island in Peru are exceptions in which the vast majority of the population is employed in tourism (Mitchell and Reid 2001). It should be noted that any assessment of the employment generated due to a nature-based tourism venture should take into account the stage of the tourism product life-cycle. Jobs are more likely to grow over the course of the life-cycle. There are however only a limited number of studies that track the employment benefits and among them very few that take account of the stage of the tourism venture.

A consistent theme in the literature is the unequal distribution of economic benefits both within
and between villages and cities. Between villages, case studies in the literature consistently draw attention to the significant “revenue leakage” from the local economy to nearby urban centers which often serve as the origin of package tourism of the nature destination or supply inputs to villages near the tourist destination (Lacher and Nepal 2010, Campbell 1999). Evidence of leakage is also reflected in the recent case studies discussed in Table 2. In a case study of Taquile Island, Mitchell and Reid (2001) estimate 91 percent leakage of tourism revenue. In general, higher skilled positions tend to be staffed by outsiders, and accommodation and transportation services often owned by non-locals. The disproportionate benefit received by non-locals has led authors to conclude that nature-based tourism is not a successful strategy for rural development (Mowforth and Munt 2003). Yet, other authors caution against the conclusion noting that even despite high leakage the tourist revenue can be among the largest source of income in the local community. Sandbrook (2010) finds that in Bwindi Impenetrable National Park in Uganda tourism remained the largest source of income despite revenue leakage of 76 percent from the local economy.

A similar pattern governing the distribution of resources between villages is reflected within villages in which wealthier or higher skilled locals are more likely to receive benefits from tourism (Xu et al. 2009, Zapata et al. 2011). Wealthier and skilled locals possess the capital and know-how to start restaurants, offer transportation services via boat or taxi, or convert part of their home to offer accommodations to tourists. On Taquile Island, boat and restaurant owners received 74 percent of local tourism income (Mitchell and Reid 2001). Walpole and Goodwin (2000) in a case study for Indonesia, and Karanth and DeFries (2010) for one in India found similar results. Even among owners, the benefits are often concentrated among a relatively small number of operators. Particularly relevant for conservation outcomes, poorer households, most dependent on the natural resource base, are often unable to obtain economic benefits for reasons which include their lack of skills and capital or their distance from the main tourism activities (Xu et al. 2006, Lacher and Nepal 2010).

Estimates of the economic impact of nature-based tourism have largely focused on estimating local economic impacts due to an interest in rural development and the premise that generating local benefits will provide incentives for conservation. Yet, as evidenced by the high rates of revenue leakage from the local economy, other stakeholders in the country stand to benefit from nature-based tourism as well. Moreover, benefits accruing to non-local but national stakeholders may be important to policymakers in deciding on conservation versus alternative land uses. Box 1 provides estimates of the share of total employment in Brazil and Namibia due to nature-based tourism. Estimates are obtained by scaling estimates of employment due to tourism in general by the proportion of visitation believed to be due to nature-based tourism. The estimates suggest that approximately 2.1 percent of total employment in Brazil can be attributed to nature-based tourism, and this number increases to 19 percent in the case of Namibia. Relatedly, the employment impact of tourism provides a useful upper-bound on the impact of nature-based tourism. World Travel and Tourism Council (WTTC) statistics indicate that the proportion of total employment directly attributable to tourism ranges by region from 2.4 percent in Sub-Saharan Africa to 5.6 percent in North Africa, with a global average of 3.3 percent. Considering both direct and indirect effects on total employment due to tourism yields a range of 5.8 percent in Sub-Saharan Africa to 14 percent in Oceania, and a global average of 8.6 percent. These estimates are very rough and should be interpreted and used with caution.
Alternative Sources of Benefit Sharing

While employment benefits have been most common, local communities have also received benefits from nature-based tourism in the form of profit sharing and compensation agreements, as well as public investment in infrastructure, training, and social services. For instance, Kirkby and others (2011) document compensation agreements forged between tourism operators and local communities in the Peruvian rainforest in which cash and in-kind payments were made to local communities in exchange for alterations in their hunting and forest clearing practices. Private wildlife tourism operators in Ngamiland, Botswana have entered joint partnerships with local communities in which the private operators pay a local community-based organization a lease fee in exchange for use of the land (Lepper and Schroenn 2010). Such benefit sharing through community organizations, however, can also result in unequal distribution of benefits due to elite capture. Simasiku et al. (2008) document how tourism revenues transferred to several Community Resource Boards in Zambia were spent on travel allowances, meetings, and accommodations rather than community development.

Local communities also benefit indirectly from public infrastructure investment designed to facilitate tourism. Expenditures on rural roads to support tourism in the Okavango Delta, Botswana were significant in garnering local approval for tourism (Mbaiwa and Stronza 2011). Galapagos National Park in Ecuador is perhaps the most notable example of local benefit sharing through large infrastructure investments in the forms of airports, water and sanitation services, and other infrastructure (Proano and Epler 2006).

Local communities may also benefit directly through the investment of tourism revenues in local public goods such as schools and health clinics. Archabald and Naughton-Treves (2001) study three protected areas in Uganda and document that the Uganda

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**BOX 1  ESTIMATES OF NATIONAL ECONOMIC IMPACTS**

In order to produce a rough estimate of the contribution of nature-based tourism to total employment, we use the World Travel and Tourism Council (WTTC) country tourism statistics multiplied by estimates of the proportion of tourist arrivals or expenditure estimated to pertain to nature-based tourism where these are available. This method assumes the share of employment due to nature-based tourism is equal to its share of tourism arrivals or expenditures. The relationship between these quantities may vary across countries and tourism sites and so estimates should be interpreted with caution.

We focus on the cases of Brazil and Namibia for which estimates were available of the share of tourist arrivals and spending due to nature-based tourism. In 2011, the Brazilian Ministry of Tourism released a survey of international tourists travelling to Brazil in which 27 percent of respondents reported that nature, ecotourism, and adventure were the main reasons for travel (Embratur 2011). The WTTC reports that in 2011 tourism in general contributed 2.7 percent directly to employment and 7.8 percent in total (directly and indirectly). As a first approximation, assuming that 27 percent of this employment was due to nature-based tourism yields estimates of 0.7 percent due to direct employment and 2.1 percent of employment due to direct and indirect jobs in nature-based tourism.

A much larger share of tourism in Namibia is due to nature-based tourism. Janis (2011) reports that 70 percent of total tourism expenditure is due to nature-based tourism. WTTC estimates of tourism contribution to employment in Namibia in 2011 were 6.8 percent of a direct contribution and a total contribution of 27 percent. Again, assuming 70 percent of tourism jobs were due to nature-based tourism yields a contribution of 4.8 directly and 19 percent in total.
Wildlife Authority administered tourism ventures and then redistributed revenues to individual parishes (i.e. group of villages) to be spent on school construction. Surveys of local residents near the Ugandan sites found that tourism revenue sharing in this manner was the most important reported advantage to living near a protected area (Archabald and Naughton-Treves, 2001). Likewise, Annapurna Conservation Area Project in Nepal has reinvested all park revenue generated from visitor fees in the construction of community development projects such as agriculture extension, women’s programs, health clinics, and water and sanitation infrastructure (Brandon 1996).

Costs

Local communities also incur costs associated with protected areas and nature-based tourism. Surveys of local communities find that the perceived costs of protected areas pertain to restricted access to resources, park management conflicts, crop damage and threats to safety due to raiding wildlife, as well as price increases of local goods and services (Karanth and Nepal 2011, Lapeyre 2010, Weladji and Tchamba 2003). Indian protected areas studied by Karanth and Nepal (2011) indicate that crop damage due to wildlife can be a particularly prevalent cost of living near protected areas. The authors report that over 75 percent of survey respondents in the Indian protected areas studied report damage caused by wild animals. Yet, overall Karanth and Nepal (2011) conclude based on survey responses that households value the existence of the protected areas despite incurring crop damage. More troublesome for households appear to be conflicts with park staff over restricted access, resulting in park staff often perceived negatively. Researchers have also documented increases in the prices of land, labor, and food related to nature-based tourism (Lindberg and Enriquez 1994, Walpole and Goodwin 2001).

Local Perception

Despite these costs, surveys of local communities near nature-based tourism sites find that overall large majorities of respondents indicate their support for tourism and perceive net economic benefits from tourism (Matthews 2003, Karanth and Nepal 2010, Stone and Wall 2004, Alexander 2000, Mitchell and Reid 2001, Lacher and Nepal 2010). For instance, 93 percent of respondents near Komodo National Park reported that they would like to see increased visitation, and 89 percent reported that would like their children to work in tourism (Walpole and Goodwin 2001). Mbaiwa and Stronza (2011) note that local support for tourism and the conservation in the Okavango Delta in Botswana appreciably improved once local communities began to perceive economic benefits from the project. Such benefits pertained to the construction of roads, employment, and opportunities to sell small handicrafts. These perceptions indicate that the economic benefits local communities receive, whether through employment or public goods, are welcome additions to their livelihood strategies.
Local Economy — Tourism Linkages

A recurrent theme among case studies was that a chief limitation in generating local economic benefits were poor linkages between the skills and resources of the local community and the needs of the tourism product (Kiss 2004, Zapata et al. 2011, Simpson and Wall 1999). Nature-based tourism projects occur in areas engaged in primary production but are meant to cater to tourists in the tourism sector, which is regarded as a tertiary sector of the economy (Walpole and Goodwin 2001). The tourism product generally requires secondary sector manufactured goods which must be supplied by outsiders.

This relatively capital intensive characteristic of the nature-based tourism sector confers advantages on those with the capital and skills to manage tourism operations (Loon and Polakow 2001, Salafsky et al. 2001). Local residents generally do not possess the capital or skills required to open and manage such establishments. As a result, a large proportion of benefits are captured by wealthier and higher skilled individuals. Unskilled locals can benefit in circumstances in which demand for unskilled labor is high such as with guided hiking tours of Mount Kilimanjaro which require a sizeable labor force (Spenceley 2010). At the same time, Wunder (2000) argues that the skill and resource barrier to achieving greater benefit sharing cannot simply be overcome by excluding outsiders in favor of autonomous locally operated tourism ventures. Using case studies from five Ecuadoran nature-based tourism sites, Wunder (2000) found that autonomously operated venture did not achieve greater benefits for locals relative to a salary-based tourism model.

Furthermore, though high-value, low-volume tourism may result in higher revenue leakages, it is likely to be a response to the threat to sustainability which large tourism volumes pose. Due to the relatively low value-added of local skills and resources, backpacker-type tourist experiences have tended to generate greater economic benefits for locals, through, for example, the sale of a greater number of handicrafts (Scheyvens 2002). High-value tourism may involve luxury transport via helicopter or stays in more up-scale accommodations – services best provided by greater capitalized and skilled non-locals (Lepper and Schroenn 2010).

To a limited extent, local communities may be able to increase their economics benefits by organizing to create barriers to entry from outsiders to maintain local wages. Guided hiking tours on Mount Kilimanjaro, for example, forbid the use of non-registered guides (Spenceley 2010). Lacher and Nepal (2010) document villagers forming a cooperative to set prices for guiding services, and the Annapurna Conservation Area Project in Nepal requires that a percentage of the guides used in the protected area be local rather than from Kathmandu (Spiteri and Nepal 2008).

The upshot of these findings is that projects that promote nature-based tourism need to pay attention to the design of benefit-sharing mechanisms both so
that local communities can benefit but also so that economic benefits that are generated are maximized.

**Tourism Site Characteristics**
Another consistent theme in the case study literature has been that the economic benefits generated and the likelihood of conservation depend importantly on the characteristics of the tourism site. In Krüger’s (2005) meta-analysis, the presence of a flagship species such as charismatic birds or mammals was a robust predictor of a sustainable tourism project. Species which are attractive to tourists are necessary to attract a sufficient number of visitors to engage locals economically and redistribute resources away from consumptive land uses. The importance of having particular charismatic species, while important for tourists and less so for biodiversity, have led Krüger (2005) and Wells (1993) to conclude that nature-based tourism is appropriate as a biodiversity conservation and development strategy under a relatively narrow set of circumstances.
Economic Impact vs. Conservation

A limitation to the generation of ecologically sustainable economic benefits to local communities is the tension inherent between economic activity and conservation. That is, all else equal, economic benefits increase with greater tourist visits which may threaten the conservation of protected areas. A successful nature-based tourism venture may draw greater and greater interest leading to environmental degradation (Jacobson and Robles, 1992). For instance, the significant growth in tourism in the Galapagos islands is a frequently cited example in which the tourism sector has been argued to have surpassed the carrying capacity of the islands through greater visitation and an influx of people seeking employment (Nolan and Nolan, 1998; Taylor et al., 2002). This tension is a general phenomenon as evidenced by a Krüger (2005) review of 188 ecotourism studies which found that a failure to manage tourism volumes was a principle reason for a project being deemed to have been ecologically unsustainable. As a result, Krüger concludes that nature-based tourism projects can achieve sustainability only under careful management.

Local Economic Benefits and Conservation

Conservation also depends on the successful generation of sustainable local economic benefits whether through employment, revenue sharing, or local public goods. Krüger (2005) finds that in nearly 40 percent of all case studies, the main factor determining sustainability was the involvement of the local community in the tourism project and the generation of local economic benefits. When too little revenue was generated, local communities were found to continue consumptive land uses. Local economic benefits, however, are not sufficient conditions to achieve conservation. Apart from the risks of excessive tourist volume, local benefits may be used by locals to complement rather than substitute away from consumptive land uses. Yang et al. (2009) document that local residents in the Liming Valley in China practiced more intensive agricultural practices as a result of the increased income from tourism. Likewise, Ferraro and Kramer (1997) report that poachers who were employed in a protected area of Madagascar used their money to hire more poachers. These examples illustrate that local economic benefits need to be substantial or otherwise may not redirect local communities from consumptive land uses.

Governance

The need for careful management of nature-based tourism projects points to a deeper determinant of the creation of sustainable economic benefits, namely the capacity of a country’s protected area management institution. Protected area management institutions must be able to monitor visitor numbers to ensure that the carrying capacity of the site is not exceeded. The GEF project in AENP discussed below illustrates the importance of South African National Parks in monitoring the ecological effects of tourism among other functions. This may be difficult as elites
interested in relaxing ecological standards in order to capitalize on short term profits can exert pressure (Coria and Calfucura 2012). These criticisms complicate the notion of nature-based tourism as a solution in a context with low institutional capacity.
This section examines the economic benefits generated in a couple of World Bank GEF-funded projects which have promoted nature-based tourism as part of an integrated conservation and development program. Of the small sample of projects considered that promoted nature-based tourism, only these two projects highlighted and quantified benefits from nature-based tourism. These projects also allow one to understand how two key determinants of successful nature-based tourism projects which emerged from the case study review, namely the importance of the suitability of the tourism site to attract visitors (e.g. presence of flagship species) and the institutional capacity of the protected area management agency to control visitation and develop the tourism product, interact. That is, can careful planning and management overcome the absence of charismatic fauna? And how critical is institutional capacity at favorable tourism sites. The Greater Addo Elephant National Park project in South Africa speaks to the importance of strong capacity on the part of the implementing agency in managing the tourism product even in the context of a favorable nature-based tourism site. The Dana Nature Reserve project in Jordan demonstrates that innovative planning and management can foster successful nature-based tourism even in the absence of flagship species and location in a politically volatile region.

**The Greater Addo Elephant National Park Project, South Africa**

Addo Elephant National Park (AENP), located in the Eastern Cape Province of South Africa, is a protected area containing a significant array of biodiversity—representing five of South Africa’s nine terrestrial biomes. The Eastern Cape Province is also one of South Africa’s least developed provinces with GDP per capita half of the national average, 51 percent of households living in poverty, and unemployment rates above 25 percent. By 2004, livelihood strategies of local communities, heavily based on pastoralism, had begun to pose a threat to the region’s biodiversity through advanced desertification. At the same time, AENP was in need of expansion in order to accommodate a growing elephant population in the protected area.

In response to these circumstances, the Government of South Africa in 2004, along with financial support from GEF and French GEF, initiated an integrated conservation and development project which sought to expand the boundaries of AENP, and also contribute to sustainable development by stimulating direct employment in nature conservation and nature-based tourism for local communities. The strategies the project adopted to foster employment centered around offering local communities training in order to take advantage of tourism opportunities;
granting contracts and concession to small, medium, and micro-enterprises (SMMEs) to supply necessary infrastructure for the park’s expansion; conduct analyses to identify promising SMME’s and incubate them; develop a communications strategy and marketing materials to promote the park and tourism; and implement a concessions process to attract private investors to the park to initiate nature-based tourism ventures (World Bank 2004).

Training occurred in the areas of basic environmental and cultural management, natural resource use enterprises (arts and crafts), alien vegetation removal, basic business and financial management, basic adult education, and HIV/AIDS awareness. The project recorded a total 514 training days per year and 32 internships were delivered in the areas of tourism guidance, conservation guardianship, and hospitality reception. Overall, the project sought to ensure a more equitable distribution of benefits by targeting employment, SMME development, and training toward local communities. Displaced persons in particular were given priority in matching with employment opportunities.

The project largely achieved its objective of expanding AENP, reaching 83 percent of the targeted expansion of the park. Regarding generating local employment benefits, at the end of the project 540 additional people were employed inside AENP and employment outside the park reached 1,842 people. This level of employment was estimated to support an estimated 1,400 households with 5,600 people total. Locals were employed in a variety of activities relating to infrastructure improvement such as road-building and fence line maintenance, conservation activities such as removal of alien vegetation, and tourist services such as support for accommodations. Additionally, a total of 11 SMME of more than 3 permanent employees and two years of existence were created as a result of the project. The ICR, however, did not specify what proportion of the working age population surrounding the park was employed due to the project. In terms of financial sustainability, AENP is one of the few parks in South Africa to turn a profit indicating the sustainability beyond the initial project stimulus.

The success of AENP project in achieving financial sustainability and generating some local economic benefits reflects several of the determinants which emerged in the review of the case study literature. First, the characteristics of AENP suggested it was well suited to nature-based tourism ventures. Prior to the initiation of the project in 2004, AENP attracted nearly 95,000 tourists with a visitation rate that had been increasing at 8 percent per year since 1991 (World Bank 2004). Tourists have been attracted to AENP for the opportunity to view elephants and other flagship species, the presence of which has been a necessary condition for a nature-based tourism project to achieve success (Krüger 2005). Moreover, 50 percent of the tourists have been foreign tourists, mostly from Germany, Holland, and the UK, which contributed to a greater likelihood of tourism earnings and job creation (World Bank 2011). Secondly, nature-based tourism was able to substitute land and labor away from consumptive land uses in the Province in part due to the low returns in agricultural activities due to poor soil conditions and water availability (World Bank 2011). The case study literature also reflects the reality that nature-based tourism can more readily draw resources away from unsustainable uses if the relative returns to the tourism activity are higher.

Finally, the implementing agency, South African National Parks, played a critical role in attracting private investment via concessions, monitoring the ecological impact of tourist numbers on the park, over-seeing infrastructure investments, and building consensus among stakeholders (World Bank 2011). This role reflects the importance of institutional capacity seen in other case studies in effectively planning and managing an ICDP in order to achieve both conservation and development results.
Dana Nature Reserve and Wild Jordan

Founded in 1989, the Dana Nature Reserve is the largest protected area in Jordan and home to diverse plant, bird, and mammal species in the Jordan Rift Valley. In 1994, Jordan received a GEF grant to develop an integrated conservation and development program. The Royal Society for the Conservation of Nature (RSCN), the NGO tasked with managing Jordan’s protected areas, chose the Dana Nature Reserve as the focus of the conservation and development project. Serious ecological problems had begun to develop in the reserve from excessive livestock grazing, hunting, and fuel wood collection from the several thousand people living in and around the reserve. In the decades prior to the GEF grant, the RSCN had managed protected areas as sanctuaries with little consultation of local communities. The RSCN altered this approach with the GEF grant and sought to foster more sustainable income sources among local communities in order to improve conservation and as compensation for restricted access (Johnson 2007).

The ICDP implemented by RSCN was focused on tourism of the protected area in order to generate funds for the protection of the reserve and also foster sustainable employment for local communities. The project included several components. First, RSCN conducted an assessment to identify the areas of the reserve most appropriate for tourism based on environmental conditions and use-patterns of local communities. Secondly, the RSCN utilized donor funds to construct infrastructure in the reserve such as visitor accommodations, hiking trails, a visitor center, and transportation services. Third, Johnson (2007) emphasizes the importance of the effective marketing campaign undertaken by RSCN and later its commercial arm, Wild Jordan, in marketing the nature-based tourism experience both within Jordan and abroad. Fourth, the socioeconomic aspects of the project centered on training programs designed to assist local communities in taking advantage of tourism opportunities. Training and business development involved the production of souvenirs and local products. An emphasis was placed on attempting to target those communities considered the most intense users of the natural resources of the reserve. Employment opportunities were restricted to local residents.

Nature-based tourism of the Dana Nature Reserve has been successful in maintaining ecological sustainability, garnering the support of local communities, and generating a self-sufficient source of funds for protected area management. Evidence of sustainability is given by indicators such as increasing populations of endangered species despite dramatic increase in visitation to the park from 100 visitors in 1994 to 20,000 in 2000. Moreover, the number of full-time employed persons reached only 55, though significantly 800 individuals are reported to be supported directly or indirectly by tourism. The revenues generated from visitor accommodations, activities, and entrance fees covered the operating costs of the reserve by 1998.

The success of the Dana Reserve in achieving self-financing protected area management along with the support of local communities echoes lessons from the case study literature and suggests insights of its own. At first glance, several features of Dana Nature Reserve would suggest that the establishment of a successful, sustainable nature-based tourism operation was not assured. The absence of a charismatic flagship species and Jordan’s location in a politically volatile region with potentially variable foreign tourist visitations would have suggested based on the experiences of other cases that generating sufficient tourist visitations to supplant local community consumptive land uses would have been infeasible. Furthermore, having generated tourist visitations, the dramatic increase in visitations in a short span of time could have led to threats to sustainability. The ability of RSCN to overcome these limitations through careful planning,
management of tourism volume, and creative marketing underscores the key role that institutional capacity plays in generating an economically successful, and also sustainable ICDP. The lesson may be that the institutional requirements of nature-based tourism as an instrument for conservation can be high absent ideal conditions for tourism.
Discussion and Conclusion

In sum, the case study evidence indicates that the economic benefits from nature-based tourism can be significant even when small. Several authors have emphasized that local communities capture only a small fraction of total tourist spending due to significant revenue leakages (Xu et al. 2009, Lepper and Schroenn 2010, Lacher and Nepal, 2010). These leakages are the result of poor linkages between the local economy and the tourism product, requiring the hiring of more skilled outside staff (Xu et al. 2009, Mbaïwa 2005), the investment of outside capital for accommodations and transportation (Walpole and Goodwin 2001), and the importation of food and supplies. Nevertheless, case studies indicate that economic benefits can be often economically significant to local communities despite high leakages (Sandbrook 2010, Mbaïwa and Stronza 2011, Spenceley 2010, Mitchell and Reid 2001). The location of nature-based tourism projects in poorer, rural areas with limited alternative income generating opportunities renders even small benefits significant.

Complementarity between human or physical capital ownership and tourism benefits which causes revenue leakage also leads to unequally distributed revenues within local communities. Wealthier locals are better positioned to use their skills and capital to offer tourist services such as transportation, restaurants, and accommodations. Surveys generally indicate that the benefits the average local resident receives are nevertheless significant to them—whether they be through employment, local infrastructure or social development spending. Cases have noted, however, that local residents most dependent on natural resources are often the least endowed with skills and resources, have limited market access being often located away from tourist gateways, and therefore least likely to benefit from nature-based tourism.

Revenue leakage and inequitable distribution of benefits within communities, however, points to the importance of the design of the benefit-sharing mechanisms to overcome the lack of skills or capital and still yield substantial benefits for local communities and for the majority of households within these communities. The choice of benefit sharing scheme should be sensitive to a tradeoff between equity and the financial success of the tourism venture. That is, project design should pay attention to both increasing the share of the pie and splitting the pie to provide local communities the incentive to limit consumptive use practices.

Nature-based tourism projects appear able to achieve conservation and sustainable development under certain conditions. First, local communities must benefit from the tourism activity to have an incentive to cease their consumptive practices. Secondly, the tourism destination must be sufficiently attractive to tourists to be able to generate sufficient alternative sources of income and benefits for local communities to draw resources away from consumptive uses, and fund and build support for conservation. This can be achieved through the presence of charismatic fauna or a well-designed tourism concept as in the case of the Dana Reserve. Finally, due to the tension between tourist traffic and sustainability, the protected areas agency must have the ability to resist
commercial pressure and the capacity to monitor tourist volumes and habitat impacts.

Overall, these conclusions indicate that future World Bank operations considering nature-based tourism as an integrated conservation and development strategy should carefully assess whether the characteristics of the candidate tourism site can generate sufficient local benefits to incentivize local communities to reduce consumptive activities. Training and infrastructure investments may be necessary to facilitate direct local involvement and to make the tourism venture viable. To the extent that locals cannot be directly involved via employment, the project should assess whether benefits via alternative benefit sharing schemes such as targeted local public goods or revenue sharing can instead be achieved. At the same time though the project design should also consider how to generate the greatest economic benefit from the protected area while maintaining its ecological quality.

More generally, this framework could form the basis of a review of the effectiveness of the application nature-based tourism to biodiversity conservation in the wider GEF portfolio. Such a review may be constrained by the fact that few projects currently explicitly monitored for employment generation, although most included project components to target employment. Moving forward more projects should integrate impact evaluation tools to better plan for and measure these benefits.
References


Biodiversity, Nature-Based Tourism, and Jobs


References


Annex A — Economic Impacts of Recent Nature-Based Tourism Projects

<table>
<thead>
<tr>
<th>Nature-based tourism project</th>
<th>Economic impact</th>
<th>Type of tourism employment</th>
<th>Local distribution</th>
<th>Non-tourism income</th>
<th>Leakage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bwindi Impenetrable National Park, Uganda (Sandbrook 2010)</td>
<td>Tourism income largest source of income</td>
<td>Staff in tour camps, craft shops, restaurants, bird-watching guide</td>
<td>Benefits concentrated in villages nearest park entrance</td>
<td>Dominant livelihood activity is subsistence farming, and limited cash crops such as tea and coffee</td>
<td>Despite 76 percent leakage of revenue from local area, retained income locally significant</td>
</tr>
<tr>
<td>Wolong Nature Reserve, China (He et al. 2008)</td>
<td>Number of temporary and permanent jobs equaling 15 percent of rural labor force employed in tourism</td>
<td>Low-skilled employment in construction (temporary), accommodations, restaurants, and souvenir shops</td>
<td>Households benefiting from nature-based tourism were significantly closer to the main road</td>
<td>Mostly farmers, logging for fuelwood, agriculture, ranching, collection of medicinal plants</td>
<td>Majority of jobs, investment, and revenue went to non-locals. High-skilled positions filled by non-locals</td>
</tr>
<tr>
<td>Ten selected protected areas, India (Karanth and DeFries 2010, Karanth and Nepal 2011)</td>
<td>Direct income benefits to less than 0.001 percent of working age population in 10 km radius around parks</td>
<td>Authors studied employment in tourism accommodations</td>
<td>Locals employed as gardeners and housekeepers</td>
<td>Agriculture was the primary source of income for households</td>
<td>Higher-skilled and higher-paid positions filled by non-locals</td>
</tr>
<tr>
<td></td>
<td>Locals work typically in lower paid and seasonal positions</td>
<td>Many jobs were seasonal</td>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Jianfengling and Diaoluoshan National Forest Parks, Hainan China (Stone and Wall 2004)</td>
<td>Very limited employment opportunities, though tourism project in early stages</td>
<td>Limited employment in park hotels, park travel companies, guides, small convenience stores</td>
<td>Limited benefits at this stage of tourism project</td>
<td>Parks located near traditionally natural-resource dependent communities</td>
<td>Few opportunities for tourists to spend money in villages near park. Authors note high potential for leakage</td>
</tr>
<tr>
<td>Ngamiland, Botswana (Lepper and Schroen 2010, Mbaiva, 2005)</td>
<td>5 percent of all households benefiting directly from employment in tourism joint venture</td>
<td>Local staff work in lower-paid jobs as camp hands, wait staff, laundry staff, housekeepers, cooks, and drivers</td>
<td>All households engage in subsistence agriculture; 50 percent of households earn income in retail, teaching, government</td>
<td>High leakage due to substantial in part due to high-cost/low-volume tourism model</td>
<td>Expatriate workers fill vast majority of higher paid positions</td>
</tr>
<tr>
<td>Taquile Island, Peru (Mitchell and Reid 2001)</td>
<td>98 percent of surveyed adults employed in tourism; 87 perceive direct economic benefits from tourism</td>
<td>Direct tourism jobs as guides, handicraft sales, boat staff, taxi</td>
<td>Inequality Local boat owners and restaurant owners earn 75 percent of revenue 10 percent of restaurant and boat owners earn over $1,000 annually (rel. to median of $187)</td>
<td>Agriculture, fishing, weaving</td>
<td>Estimated 91 percent leakage of tourism revenue</td>
</tr>
<tr>
<td>Mount Kilimanjaro, Tanzania (Spenceley 2010)</td>
<td>Significant income gains over average farm wage</td>
<td>Guides earn annually $1,830, porters $842, and cooks $771, (avg farm wage $2 per day)</td>
<td>10,000 porters, 400 guides, and 500 cooks</td>
<td>Agriculture</td>
<td></td>
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</table>
1. Model

Consider a community that generates consumption by collecting a portion of a resource stock, $R$ (normalized to 1) from the commons according to the following production function which is strictly increasing and concave in the amount of labor allocated to collection $l$ (net of leisure). The parameter $\alpha_1$ captures the productivity of resource collection:

$$Q(l) = \alpha_1 f(l), \quad \alpha_1 > 0, f_l > 0, f_{ll} < 0$$

The community also produces goods for consumption according to the following production function by using the remaining labor time $1 - l$ as follows:

$$H(l) = \alpha_2 g(1 - l), \quad \alpha_2 > 0, g_l > 0, g_{ll} < 0$$

The amount of the resource remaining after the community’s labor allocation decision is given by

$$R = 1 - Q(l)$$

The community maximizes consumption by selecting time allocation across production and resource collection activities as follows:

$$\max_l C = Q(l) + H(l)$$

The community’s maximization problem yields the optimal time spent in production and collecting resources from the commons given implicitly by

$$\frac{dC}{dl} = \alpha_1 f_l(l^*) - \alpha_2 g_l(1 - l^*) = 0$$

The remaining stock of the resource after the community’s decision is given by $R^* = 1 - Q(l^*)$. Unsurprisingly, the community’s optimal allocation of labor to resource collection is (weakly) increasing in the productivity of resource collection relative to production, $\frac{a_1}{a_2}$.

2. Community Behavior and Conservation Outcomes

2.1 Perfect Enforcement

Suppose the government would like to preserve the resource $R$ such that the socially efficient value of the resource is $\bar{R} = 1$ (i.e., no resource collection). Under a perfect enforcement regime, a government would be able to restrict access to the resource through, for example, “fences and fines” so that $\bar{R} = 1$ and the optimal community labor allocation is $l^* = 0$. It is clear under this scenario, the community is (weakly) worse-off as their feasible set of consumption choices has decreased.

2.2 Imperfect Enforcement

In most contexts, however, perfect enforcement is not feasible because either it is prohibitively costly or the behavior of the community is not observable. In this scenario, suppose the government promotes a nature-based tourism venture in order to provide an incentive to the community to limit resource collection. Suppose the nature-based tourism venture generates revenue based on the abundance of the resource remaining, $\bar{R}$, after the community has made labor allocation decisions:
2.2.1 Benefit Sharing

Tourism Revenue Sharing
If the fraction $\tau$ of tourism revenues is shared with the community, the community faces the following maximization problem:

$$\max_l C = Q(l) + H(l) + \tau E(R) = Q(l) + H(l) + \tau \alpha_3 (1 - Q(l))$$

Community maximization yields an implicit labor choice for the community $l^{**}$:

$$\frac{dC}{dl} = \alpha_3 f(l^{**})(1 - \alpha_3 \tau) - \alpha_2 g_l(1 - l^{**}) = 0$$

No Revenue Sharing
Note that if the community does not share in the tourism revenues ($\tau = 0$), then the community's labor allocation decision is unchanged by the tourism venture and $l^* = l^{**}$. In an imperfect enforcement regime, some amount of revenue sharing is required to deter consumptive use.

Partial Revenue Sharing
For revenue sharing values $\tau \in (0,1]$, the community decreases time spent collecting as $l^{**} < l^*$ and resource conservation moves closer to social efficiency. Note that the community's labor spent in resource extraction is decreasing in the productivity of the tourism venture, $\alpha_3$. Reductions in resource extraction, therefore, depend in part on factors that increase the productivity of the tourism venture, such as the attractiveness of the tourism site (e.g., due to charismatic fauna) or complementary inputs such as roads constructed by the government, or private investment in accommodations and other tourist offerings.

Resource extraction is also decreasing in the amount of revenue sharing, $\tau$. However large the revenues from tourism, the smaller the share received by the community, the less incentive to shift labor away from resource extraction. In a more realistic setting in which multiple communities depend on the resource $R$, efforts by the government to equally distribute tourism revenues without regard for a communities effect on tourism vis-a-vis resource extraction will come at the expense of conservation goals as incentives to reduce resource extraction will be dampened. Likewise, equity and conservation objectives may be at odds to the extent that favorable revenue sharing terms must be reached with the private sector in order to encourage investment. Lastly, as in the Winkler (2010) model, a setting with multiple communities induce incentives for “free-riding” off the conservation actions of others, further dampening conservation incentives.

Employment in Tourism
To consider another means the community may benefit from tourism, suppose the community does not receive a share of the tourism revenue, but rather is employed in the tourism venture at a wage $w$. The community now chooses to allocate labor to resource extraction ($l_1$), employment in nature-based tourism ($l_2$), and production of other goods $(1 - l_1 - l_2)$. The community’s maximization problem is now

$$\max_{l_1, l_2} C = Q(l_1) + H(1 - l_1 - l_2) + wl_2$$

First order conditions yield:

$$\frac{dC}{dl_1} = \alpha_1 f_{l_1}(l^{**}_1) - \alpha_2 g_{l_1}(1 - l^{**}_1 - l^{**}_2) = 0$$

$$\frac{dC}{dl_2} = -\alpha_2 g_{l_2}(1 - l^{**}_1 - l^{**}_2) + w = 0$$

Combining these conditions yield the condition that $f_{l_1} = \frac{w}{\alpha_1}$. It follows from the strict concavity of $f$ that the community's allocation of labor to resource extraction is decreasing in the wage available in nature-based tourism, $w$. This scenario illustrates that apart from revenue sharing, a sufficiently high wage
in nature-based tourism (to avoid a corner solution in which all labor is allocated to resource extraction) can substitute labor away from resource extraction and lead to greater resource conservation.

### 2.2.2 Consumptive Tourism

Finally, in the exposition above it was implicitly assumed that the nature-based tourism was non-consumptive. In practice, however, the degree of visitation and economic activity at the site can degrade the natural resource. Enriching the model in this manner serves to limit the feasibility of nature-based tourism as an ICDP in that incentives for conservation operating via tourism revenues are dampened.

**Notes**

1. Following Naidoo and Adamowicz (2005), the broader term nature-based tourism is used over the related term ecotourism as the latter often presupposes that the tourism activity is sustainable which may not be the case.

2. While this review focuses on the developing country contexts, a large literature exists on nature-based tourism as development tool in developed countries (see e.g., Eagles et al. 2002).

3. A broader discussion of the merits of government support for nature-based tourism would consider the relative merits of other methods of achieving conservation and development, and the relative importance of each priority. The discussion in this paper starts from the premise that a government has made a decision to pursue conservation and evaluates the effectiveness of nature-based tourism in achieving conservation and economic benefits.

4. see the Annex for the corresponding an analytical model.

5. Leakage typically includes the importation of materials, capital goods, consumables, the employment of non-locals, and profits retained by non-locals (Wells 1997).

6. A Markandya et al. (2003) study found that 40 of 135 World Bank-GEF projects in the area of Biodiversity highlighted tourism. However, of these only 8 quantified benefits that can be derived from tourism.

7. These GEF projects were selected by applying the criteria that (1) the project was closed, (2) nature-based tourism was adopted as a significant component in the project appraisal document of an integrated conservation and development project, (3) preference was given to projects which adopted outcome indicators related to economic benefits generated due to nature-based tourism, specifically employment, and attempted to quantify the extent to which this indicators had been met by the project. Consistent with Markandya et al. (2003), a relatively small percentage of GEF projects highlighted and quantified benefits from nature-based tourism. Other projects considered but not discussed due to inadequate information were the Panama San Lorenzo Effective Protection with Community Participation, Indonesia Coral Reef Rehabilitation and Management Project, and the Croatia Karst Ecosystem Conservation Project.

8. Evaluating the first order of $l^*$ and noting that by assumption $0 < a_3 \tau < 1$, it follows that $f(l^*)(1 - a_3 \tau) - a_3 \tau g(l^*) < 0$. The first order condition is therefore satisfied by a $l^* < l^*$ by the strict concavity of $f(\cdot)$ and $g(\cdot)$. Allowing for corner solutions, $l^* \leq l^*$.

9. By Cramer’s Rule, $\frac{\partial l^*}{\partial a_3} = \frac{a_1 f(l^*)}{a_1 f(l^*) a_2 g(l^*)} < 0$.

and $\frac{\partial l^*}{\partial \tau} = \frac{a_1 a_3 f(l^*)}{a_1 f(l^*) (1 - a_3 \tau) a_2 g(l^*)} < 0$. 

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**Annex**