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WILDLIFE CONSERVATION SOCIETY

PROTECTED AREAS AND HUMAN LIVELIHOODS

Edited by Kent H. Redford and Eva Fearn

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Cover photographs: © Kent H. Redford/WCS. Front cover: Fisherman in Antongil Bay, adjacent to Masoala National Park, Madagascar. Back cover: In the Luangwa Valley, Zambia, WCS promotes wildlife conservation through agricultural extension and marketing in the COMACO (Community Markets for Conservation).

The Wildlife Conservation Society saves wildlife and wild places worldwide. We do so through science, global conservation, education and the management of the world's largest system of urban wildlife parks, led by the flagship Bronx Zoo. Together these activities change attitudes towards nature and help people imagine wildlife and humans living in harmony. WCS is committed to this mission because it is essential to the integrity of life on Earth.

Over the past century, WCS has grown and diversified to include four zoos, an aquarium, over 100 field conservation projects, local and international education programs, and a wildlife health program. To amplify this dispersed conservation knowledge, the WCS Institute was established as an internal "think tank" to coordinate WCS expertise for specific conservation opportunities and to analyze conservation and academic trends that provide opportunities to further conservation effectiveness. The Institute disseminates WCS' conservation work via papers and workshops, adding value to WCS' discoveries and experience by sharing them with partner organizations, policy-makers, and the public. Each year, the Institute identifies a set of emerging issues that potentially challenge WCS' mission and holds both internal and external meetings on the subjects to produce reports and guidelines for the institution.

The WCS Working Paper Series, produced through the WCS Institute, is designed to share with the conservation and development communities in a timely fashion information from the various settings where WCS works. These Papers address issues that are of immediate importance to helping conserve wildlife and wildlands either through offering new data or analyses relevant to specific conservation settings, or through offering new methods, approaches, or perspectives on rapidly evolving conservation issues. The findings, interpretations, and conclusions expressed in the Papers are those of the author(s) and do not necessarily reflect the views of the Wildlife Conservation Society. For a complete list of WCS Working Papers, please see the end of this publication.

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INTRODUCTION

Protected Areas and Human Livelihoods: Experiences from the Wildlife Conservation Society

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The creation of the global protected area estate is a contested process. It has been called both the greatest biodiversity conservation planning exercise and the largest illegitimate taking of private property and resources in the history of the world. The global protected area network now exceeds 100,000 sites and covers 12% of the world's land surface. These sites range from fully protected national parks and wilderness areas (IUCN I and II), to multi-use reserves (IUCN IV-VI) designated primarily to protect the resource rights of local people. Though wholly protected parks were historically predominant, today, multi-use reserves are expanding fastest and now represent about 90% of all terrestrial protected areas (Naughton-Treves et al. 2005). Yet despite, or perhaps because of, the apparent success of creating parks and reserves to protect biodiversity, their future is not assured. Myriad problems militate against the successful protection of biodiversity in protected areas. These include inadequate gazetting, ineffective management, rising expectations, and, most importantly, lack of public support at all levels.

One of the most vexing problems facing protected areas is their expanding remit. Originally established with the relatively limited scope of providing a place for recreation and to protect some component of nature, the protected area estate today is also expected to provide an increasing range of benefits to an increasing range of people. Parks are no longer allowed to simply "protect" but are charged with providing ecosystem services and facilitating poverty reduction via local development, ecotourism, and sustainable resource use. And, though often established for the benefit of people living at a distance from the area (regional, national, or international), they are now expected to provide increased direct benefits to people living in and adjacent to the protected areas themselves.

Tension over historical injustices of establishment of protected areas, the costs of enforcing their management regulations, and rising expectations for economic benefit provision have combined to slacken broad scale support for protected areas. This has been compounded by much recent rhetorical discussion in the social science literature about protected areas and the purported return to an emphasis on strict protection. These claims ignore the overwhelming push on protected areas in the other direction—towards much greater integration with the human communities in and adjacent to them—and further diminish support for protected areas as an essential tool for conservation of biodiversity.

These complicated currents confront many of the Wildlife Conservation Society's (WCS) field programs at sites where we work and in national and international discussions about the role and effectiveness of protected areas. As part of our on-going commitment to conserving wild places, WCS, in col-

laboration with the White Oak Conservation Center, is conducting a set of three workshops to address the constraining broader support for protected areas. The overall theme for the meetings is "The future of protected areas in changing social contexts." The first meeting, held in 2006, was on "Protected areas and human displacement" (Redford and Fearn 2007). The second meeting, on which this WCS Working Paper reports, was on "Protected areas and human livelihoods," and examined the ways, positive and negative, that protected areas influence the human communities that once relied or still rely on natural resources within protected areas. The final meeting will be on the topic of "Protected areas, ecological scale and governance."

To bolster support for biodiversity conservation it is vital to produce a more nuanced approach to the interaction between protected areas and local people. It is clear that in some cases protected areas have been responsible for diminishing the livelihood prospects of people living in and near them. Left largely unexamined, however, are the benefits that protected areas may provide for these same people. Sprinkled throughout the literature are references to protected areas and the organizations that work to sustain them being sources of support for local development, democratization, land titling and sustainable resource planning. There are additional examples where protected areas were created with the significant purpose being support for local empowerment (e.g., Redford and Painter 2006; Alcorn et al. 2006) and even cultural protection and the protection of the rights of people as of yet uncontacted (e.g., Tagaeri and Taromenane in the Yasuni Intangible Zone of Ecuador; and the Ayorea in Kaa Iya National Park, Bolivia).

To address the complexity of conservation implementation in the context of protected areas and livelihoods, with the specific aim of examining both costs and benefits of creating and managing parks and reserves, we present case studies from WCS field conservationists working at 12 sites on four continents. These are complemented with six contributions from experts outside WCS that explore such diverse dimensions of the livelihood-protected area debate as the roles of agricultural development, economic policy, and wildlife (zoonotic) disease. All were selected to explore two primary questions: 1) When and how are local livelihoods influenced by the ecological parameters of a protected area? and 2) When and how can markets be used to achieve sustainable livelihoods and conservation? Together these varied case studies demonstrate the fallacy of facile generalizations too commonly found in the current literature. Instead they document the richness and complexity found in the real world and the importance of considering a diversity of individual cases, the nuances and experience that informs effective conservation and poverty alleviation, when drawing conclusions about the costs and benefits of protected areas.

Grouped regionally, these cases provide some commonality when considering the relationship between protected areas and human livelihoods. For WCS work in Asia, the way in which conservation detracts from livelihood potential is similar across the case studies from Indonesia, Malaysia, and Afghanistan. Livelihoods of local people are constrained by management activities designed to protect target species, such as patrols and limits on grazing and resource harvesting. At the same time, livelihoods, or the foundations for better livelihoods, are supported by conservation projects by institution-building, training, and improvement of representation. At all three sites, conservation organizations provide support for agricultural improvement. In areas where there is nascent eco-tourism, local people benefit via job creation or direct revenue. Additional livelihood-enhancing projects include formal education for indigenous people

living within a national park in Sarawak, Malaysia, and a proposed microfinance program for poor farmers on the fringes of a national park in Sumatra, Indonesia.

In the Latin American cases, Mamiraua (Brazil), Kaa-Iya (Peru), and Madidi-Tacana (Bolivia) were all created, in part, to protect indigenous peoples' rights from being usurped by outsiders—in these cases, commercial fishers, farmers and colonizers, and a natural gas company. In Mamiraua, by securing fishing rights solely for local people, valuable but over-exploited fish stocks were able to recover and today provide significantly improved incomes for resident fishers. Though the protected areas have helped local people to avoid a taking of their present nature resource access and use rights, they come at the cost of accepting some resource use proscriptions (e.g., not hunting endangered species) and foregoing some future rights (e.g., setting aside in perpetuity some of their land for conservation). To offset these costs, conservation work focuses on strengthening the capacity of local institutions to enforce their rights, and helping to establish profitable and wildlife-friendly enterprises.

In the African cases, much like elsewhere, conservation activities both impinge on and support local livelihoods. In Madagascar, conservation restricts expansion of rice cultivation and other market crops, but compensates for these loses through payments for forest protection financed through a voluntary carbon-offset market. In Tanzania, conservation work has helped secure land claims of local people, an important first step in their generating income from wildlife tourism and trophy hunting. Simultaneously, conservation work has resulted in the ousting of non-resident pastoralists from a wetland grazing area, which has helped increase river flows to the benefit of all users of the great Ruaha river. In Kenya, Marine Protected Areas exclude fishers from parts of the reef, but recovery of fish stocks increase catch outside the MPAs and generate tourism revenues.

In the North American example of the Adirondack Park, conservation regulations limit timber, mining, and development, even on private property. However, New York state compensates residents for land development restrictions and municipalities for lost property taxes by subsidizing schools and other social services. In addition, investment in the park created many government and tourism jobs.

Conservation activity is associated, in all cases, with both benefits and costs to local people. The mix of these two depends on many factors, including the social, ecological, and conservation circumstances of each area and what sorts of other organizations (local, national, international) are working with WCS to provide benefits to local peoples. In most circumstances, in most places, there are trade-offs between conservation and local livelihoods but across a broad range of currencies and over differing time frames. No simple calculations can be made about winners and losers.

Discussion across case studies, and from broader experience, reached two overall conclusions: First, in all of the systems examined, there were ecological limits to achieving sustainable livelihoods from natural systems. Too often, unfettered access to natural systems is assumed to be able to ensure improvements in local livelihoods, and denial of such access is viewed as responsible for local suffering. Natural systems can improve livelihoods in some cases but not in all, and the returns may be short-lived if the systems are used non-sustainably. Second markets were not a panacea for achieving twin goals of sustainable livelihoods and conservation of protected areas. Unfettered access to markets is also often thought to be the solution to local deprivation. Although sometimes

the source of durable solutions, market access is likewise only a partial solution that works in some cases and not others. These two conclusions are important when assessing under what conditions the livelihoods of local peoples suffer or benefit from the establishment of protected areas.

Conclusion

The last centuries have seen massive changes in human population in terms of demography and distribution. Human population has increased many-fold, people are living longer, and for the first time in the history of the planet are predominantly urban. Population growth, combined with strife, natural disasters, land-use changes, and political change, have altered and realtered where people live. In the countryside, not only have many people left, but massive land-use changes have forever altered the landscape, now composed of industrial forestry, agriculture at large scales on almost all suitable land, logging in most forests, diversion or damming of many rivers, grazing across vast swaths of grassland, disease increasing in some areas and decreasing in others with concomitant land-use changes, and greatly increased settlement along coasts. It is against these massive changes in land use and human population movements that the impact on local peoples of protected area establishment must be judged. This makes it extremely difficult to assign responsibility for changes in human livelihoods to single factors.

Taken collectively, the contributions in this volume reject the essentialist arguments that prevail in the policy literature: Protected areas are not necessarily bound in any predetermined relationship to poverty or to wealth. Conservation is not necessarily good for local people, nor is it necessarily bad (Fisher 2006). The particularities of place—ecology, biology, productivity, social history, governance structures, protected area management, and other factors—are powerful determinants of the interaction between protected areas and livelihoods. But we are not yet at a point to be able to build predictive models.

There is a broadly developing understanding that protected areas must be integrated into the surrounding land and with the neighboring human populations. The recent rise in appreciation for the value of ecosystem services and the fragility of the ecosystems that provide them has highlighted the interactions between protected and non-protected parts of the landscape. This joins an earlier understanding that parks cannot survive as islands, but rely on flows with non-protected parts of the landscape. It comes as no surprise then that protected areas, because they are protected and therefore subject to a different set of pressures than surrounding land uses, provide both benefits and costs to neighboring peoples. In fact the World Commission of Protected Areas established a task force on protected areas, equity, and livelihoods that is in the process of completing a three-continent set of meetings. This working paper offers to this broader discussion the experiences of the Wildlife Conservation Society—including the Tranlinks project dedicated to the question of conservation and livelihoods—that emphasize the importance of a balanced approach to the question, one not based on the soaring rhetoric so dominant today, but rooted in decades of implementation and local experience.

PART 1
WCS CASE STUDIES – AFRICA

1.1 Linking Livelihoods, Land Stewardship, and Resource Conservation in the Antongil Bay Landscape, Madagascar

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Madagascar is a remarkable biodiversity trust, containing a wealth of unique flora and fauna. It is also an island of remarkable poverty and environmental destruction with a largely rural population that is denuding the island at an unsustainable rate. Finding the balance between biodiversity conservation, sustainable resource use, and economic development has long been a priority for Madagascar: As early as the 19th century, there was legislation banning deforestation for agriculture. At the end of the 20th century, the government enacted the National Environmental Action Policy (NEAP), which included the development of the country's national park authority, ANGAP. Today, Madagascar finds itself at a turning point: President Marc Ravalomanana's pledge at the 2003 World Parks Congress was that Madagascar will triple the surface area under IUCN recognized protection, largely through integrative, community-based conservation initiatives.

The fate of biological diversity is dependent not only on the resilience of the biological system, but equally on the resource management system. This is nowhere more apparent than in Madagascar. Madagascar has an annual population growth rate of almost 3%; 87% of the population depend on a rural subsistence livelihood; and more than half of the population is 16 years or younger, meaning the island's natural resources and unique biodiversity are under ever-increasing pressure. In this setting, the Wildlife Conservation Society, in collaboration with the Ministry of Environment, Water and Forest (MinEnvEF) and ANGAP, strives to develop the Antongil Bay landscape as a model for resource conservation and biodiversity protection through better land stewardship linked to improved livelihoods.

The Biological Landscape: A Hotspot within a Hotspot

The Antongil Bay landscape in northeastern Madagascar is the epicenter of the island's biodiversity. The landscape encompasses marine, coastal, and forest habitats, and includes Madagascar's largest protected areas, Masoala National Park and the Makira Protected Area. Together Masoala, Makira, and their buffer zones represent over 900,000 ha and over 10% of the remaining forests of Madagascar, including half of the island's critically endangered coastal forest and 25% of the remaining critically threatened lowland forest. Masoala's marine parks, some of the first in Madagascar, protect coral reefs, sea grass beds, and mangroves around the Masoala peninsula. Antongil Bay itself is the largest sheltered bay in Madagascar, and the most significant breeding, calving, and nursing grounds for humpback whales in the East Indian Ocean.

Surface Area

At just over 240,000 ha, Masoala National Park is a complex of protected areas including three marine parks totalling 10,000 ha, three detached parks totalling 2,980 ha of coastal forests, and the principal protected area at just under 230,000 ha. Also included in the management of Masoala is the island of Nosy Mangabe, a 520 ha special reserve in Antongil Bay. Physically connected to Masoala via a corridor of mid-altitude forest is the Makira Protected Area, 371,000 ha of mostly pristine mid- and high-altitude forest—Madagascar's largest protected area. Together these two parks protect over 50% of Madagascar's species-level diversity. The high degree of biological diversity and endemicity is a result of the landscape's various geological formations, bioclimatic zones, and rugged terrain that has sheltered the biologically rich low- and mid-altitude forests.

Fauna and Flora

Counted among its biological riches, the Antongil Bay landscape is home to the only populations of the critically endangered red ruffed lemur (*Varecia variegata rubra*), tomato frog (*Dyscophus antongilii*), Masoala pitcher plant (*Nepenthes masoalensis*), and red owl (*Tyto soumagnei*). Fifty of the island's 112 palm species are found here, as are 19 of 22 raptor species and over 100 of the 203 resident bird species. The diversity of reptiles, amphibians, and freshwater fish is similarly high. Recent primate censuses in Makira have confirmed the presence of 22 of Madagascar's 71 currently identified lemur species and subspecies (GERP 2006), more than any other single protected area. Included among these is the silky sifaka (*Propithecus candidus candidus*), one of the world's most endangered primates. The Masoala and Makira protected areas also represent the only intact landscape large enough to support viable populations of Madagascar's critically endangered, area-demanding serpent eagle (*Eutriorchis astur*) and fosa (*Cryptoprocta ferox*), the island's principle predator (Hawkins and Racey 2005). This landscape also ensures connectivity to the network of protected areas in the north, allowing a continued flow of genetic material through Madagascar's northeastern forests.

Threats to the Landscape

The main threats facing the Antongil Bay landscape are swidden agriculture, bush meat hunting, collection/exploitation of timber and non timber forest products (NTFP), burning forest for cattle grazing, illicit commercial exploitation of the forests' hardwood species, and illicit commercial mining of quartz and precious stones. These threats are driven by both subsistence and larger economic pressures. Of these threats, the most ubiquitous and destructive to the forests is swidden agriculture, or "tavy," which takes the form of rain-fed hillside rice. Tavy requires clearing and burning of forest habitat. While it can be a sustainable form of agriculture in tropical forests, its sustainability is contingent on long fallows and low density. In Madagascar, fallow periods should be up to 15 years (Ferraro 1994). However, limited land availability and increasing population pressure have resulted in decreasing fallow periods, and, in the Antongil Bay landscape, an estimated 1,500 ha of primary forest are threatened by deforestation annually (Meyers 2001).

Bush meat hunting is also a significant threat. Opportunistic as well as targeted, hunting is driven by both subsistence and market influences. Ongoing research has found that 21 forest mammal species—including four carnivore, three bat, and 11 lemur species—are common targets and hunting for them is

largely unsustainable (**Table 1**) (Golden 2005). Hunting can include damage to forest structure; traditional trapping techniques for lemurs require clearing forest areas of up to 10 x 200 m for a single snare (GERP 2006).

Additional ongoing threats are the well-organized illicit commercial harvesting of hard woods and extraction of quartz and precious stones. Centered largely along the northeast coast of the Masoala peninsula, illicit extraction of hard woods—mostly ebony (*Diospyros* sp.) and rose wood (*Dalbergia* sp.)—from the protected forests of Masoala remains a major challenge for park management. In 2000 an estimated 40,000 tons of rose wood with a value of $2,000 per ton were extracted from the peninsula. In 2006 all extraction permits were frozen in an attempt to gain control of the situation. Less evident, but no less damaging, is the extraction of quartz from the southern forests of the Makira Protected Area. Organized by wealthy buyers paying an average of $2 per kg, locally hired laborers extract quartz in a process that uproots trees, fragmenting the forest. Extraction typically occurs in remote pristine forest and the mobility of the operation makes it difficult to monitor (Dokolahy 2004).

The Human Landscape: Factors Influencing Resource and Land Use Decisions

The Antongil Bay landscape has always been important for the regional economy: historically with commercial logging, but also for its coastal fisheries, as well as for the production and export of several cash crops, including vanilla (first introduced in the 1900s) and cloves. The forests' ecosystem services protect watersheds for the regions whose economies are driven by agriculture: In 2003, 95% of the revenue generated in the landscape came from agriculture, including 41% from rice and 27% from cash crops (Monographie de la region de Toamasina 2003). The forests also regulate water levels in the plains, preventing erosion and reducing sedimentation into Antongil Bay, an area that supports small scale fisheries, artisanal shark fisheries, and industrial shrimp trawling.

The forests also serve as the principle resource base for a largely rural population of 230,000 people. The inhabitants are the coastal agrarian Betsimisaraka, although the high western plateau of Makira is largely populated by semi-pastoralist Tsimihety. Surrounding the Makira Protected Area is a population of greater than 150,000 people in a network of over 120 villages situated in a 280,000 ha belt of mixed forest and agricultural lands. The population surrounding Masoala National Park exceeds 85,000 individuals in over 250 permanent villages. Human settlements start along the coast and in the plains, progressing upstream along the valleys.

Household Economy

Individual households center on subsistence cultivation of irrigated paddy rice and rain-fed hillside tavy rice with varying investment in cash cropping of vanilla, clove, and coffee. The communities on the eastern coast of Masoala also invest in artisanal fisheries, while the Tsimihety of western Makira herd cattle.[1]

Table 1: Species commonly hunted in the Antongil Bay landscape, and their conservation status

Species Name	Common Name	Conservation Status
Lemurs		
Indri indri	Indri	endemic, endangered
Varecia variegata variegata	Black and White Ruffed Lemur	endemic, critically endangered
Varecia variegata rubra	Red Ruffed Lemur	endemic, critically endangered
Eulemur fulvus albifrons	White-Fronted Brown Lemur	endemic, low risk
Eulemur rubriventer	Red-Bellied Lemur	endemic, threatened
Hapalemur griseus griseus	Eastern Grey Bamboo Lemur	endemic, low risk
Lepilemur mustelinus	Sportive Lemur	endemic, low risk
Avahi laniger laniger	Eastern Avahi	endemic, low risk
Microcebus rufus	Mouse Lemur	endemic, low risk
Cheirogaleus major	Fat-Tailed Dwarf Lemur	endemic, low risk
Daubentonia madagascariensis	Aye-aye	endemic, endangered
Carnivores		
Galidia elegans	Ring-tailed Mongoose	endemic, low risk
Cryptoprocta ferox	Fosa	endemic, endangered
Fossa fossana	Fanaloka	endemic, vulnerable
Viverricula indica	Lesser Indian Civet	introduced, low risk
Bats		
Pteropus rufus	Madagascar Flying Fox	endemic, low risk
Rousettus madagascariensis	Madagascar Roussette	endemic, low risk
Miniopterus manavi	Long-Fingered Manavy Bat	endemic, low risk
Other		
Subfamily Tenrecinae	Spiny and Hedgehog Tenrecs	endemic, low risk
Potamochoerus larvatus	Bush Pig	introduced
Nesomys rufus	Forest Rat	introduced

Households reported average annual cultivation of 0.80 ha of tavy rice and 0.72 ha of irrigated rice, with yields of 319 kg and 561 kg respectively (**Table 2**). With average household sizes of 6.4 individuals, and an average annual consumption of 120 kg of rice per person, a household would have to produce at least 768 kg of rice annually for household consumption. Based on a 2005 survey, neither tavy rice nor irrigated rice was sufficient to sustain households. However, a mixed cultivation was sufficient, with a reported average surplus of 112 kg.[2] This added value of tavy rice production to a household's food stores is important to consider when introducing alternative economic and agricultural activities to these communities.

Table 2: Relative investment by crop across surveyed households in the Antongil Bay Landscape

Land Use	Number of Households	% of Households	Total Area (ha)	% Total Area	Average Area by Household	Total Production (kg)
Subsistence						
Tavy rice	606	56.37	483.08	19.44	0.80	319,628
Irrigated rice	829	77.12	597.00	24.02	0.72	561,337
Cassava	845	78.60	212.20	8.54	0.25	276,655
Potato	745	69.30	169.43	6.82	0.23	170,335
Beans	96	8.93	29.71	1.20	0.31	16,810
Cash						
Vanilla	694	64.56	203.45	8.19	0.29	34,325
Clove	309	28.74	141.24	5.68	0.46	29,021
Coffee	390	36.28	267.09	10.75	0.68	27,755
Other						
Banana	729	67.81	381.90	15.37	0.52	227,500

Subsistence and Cash Crops

For the rural population, the relationship between subsistence and market economies is influential as they assess their annual investment in various agricultural activities. Potential revenue from cash crop sales of vanilla, clove, and coffee in 2005 was approximately $250 per household; the reported average annual expenditure on basic household necessities, health, and clothing for these households was just over $150. Therefore, variation in cash crop prices can have a clear and immediate impact on land use decisions. During the height of the 2000-2001 vanilla market, for example, when vanilla sold for up to $120 per kg, the Masoala National Park managers found a considerable drop in tavy activity—measured in observations of smoke from tavy fires and evidence of new clearings. In 2004 and 2005, however, the vanilla prices bottomed out at roughly $5 per kg, and park authorities recorded increased tavy activity. The year 2006 found tavy activity reduced around Masoala as a result of a productive clove season coupled with high market prices.

Cultural Significance

Strong spiritual ties to the forest, as well as local institutions concerning land tenure, also influence land use decisions. The importance of respecting ancestors plays prominently in Malagasy culture, and ancestral spirits are believed to reside in the land. For the Betsimisaraka, this translates into a belief that clearing forest for agriculture is a way to pay respects to the ancestors. The Betsimisaraka also consider the forests as common property, with private ownership recognized only after an individual has cleared the land and made it productive. These cultural norms, juxtaposed against the fragility of the biological landscape and placed in the context of an expanding subsistence agrarian society, produce a potential "perfect storm" for environmental degradation. Cultural etiquette favors clearing forest, growing populations demand more land to be cultivated, and the local economy encourages revenues to be reinvested in agriculture. The projected result, in the absence of resource protection, is deforestation by the end of this century (Meyers 2001).

Climatic Significance

It is worth considering the role that coastal climate plays in land use decisions in the Antongil Bay landscape. It is likely that the northeast coast of Madagascar will be hit by a cyclone on average every 25 years. The occurrence has drastically increased in recent times with cyclones driving through the landscape in 2000, 2002, 2004, and twice in 2007. The effects of cyclones on the human and ecological systems are enormous: Strong winds blow over all but the largest trees, snap the trunks of clove trees, and destroy vanilla plantings. Torrential rains swell rivers and wash out downstream irrigated rice, thereby destroying food stores. In the context of increasingly common and destructive climatic events, an investment in mixed rice cultivation between irrigated drainages and cleared forest seems like a good practice as it provides a degree of food security.

Non-timber Forest Products

The population uses timber and non-timber forest products in almost every aspect of their lives. With the exception of purchased goods (e.g., flashlights, cook pots) and consumables (e.g., sugar, kerosene, cooking oil), virtually every item in a rural household—including the house itself—is a refined timber or non-timber forest product. Products include building materials and boats, woven products, gathered foodstuffs, and medicinal plants. In addition to providing the raw materials for household needs, refined timber and non-timber forest products also provide some income through their sale in local markets, although transportation costs from the villages to market centers are such that sales are usually opportunistic and combined with the more profitable sale of crops.

The forests of Masoala and Makira contain over 180 locally named species of hardwood, palm, vine, and reed that are commonly used by households to produce everything from mats and baskets to fish traps, tables and chairs, floors, walls, roofs, and canoes. Given the absence of electricity in even the largest of rural villages, fuel wood and/or charcoal is the sole source of energy. A 2004 survey of non-timber forest product use in selected villages bordering the Makira Protected Area produced a list of over 40 locally named species of tuber, fruit, and palm that are commonly collected in the forest as supplements to a household's diet, largely during the lean periods between rice harvests (Wilson 2005). In some villages the wild tuber "ovy ala" (*Dioscorea* sp.) is reported to make up 38-45% of the household diet during the off-season (Ramanandriana 2006). Also commonly collected is the bark of the "bilahy" tree (*Melicope* sp.), the key ingredient in the locally produced beer-equivalent "betsa betsa." The popularity of betsa betsa has increased the rarity of the tree in the forests, with collectors reportedly searching for two to three days to find the tree.

While some cultural beliefs, such as sacred forests and hunting taboos, and strong markets for cash crops can favor forest resource conservation, other culturally and economically influenced activities, such as tavy, present serious challenges. Understanding the extent of cultural, demographic, and economic factors on land- and resource-use decisions is therefore fundamental to appropriate integration of communities into conservation planning and resource use management.

The Civic Landscape: Administrative Boundaries and Public Services

The civic landscape of the Masoala and Makira protected areas introduces another layer of complexity to land and resource use management. Masoala National Park is located in two administrative regions and partially overlaps with nine communes (townships). Within these communes are over 50 fokontany—a grouping of several villages with a common government administrator—that partially border the protected area. The situation is slightly more complicated for the larger Makira Protected Area, which is located in three regions. The protected area sits in five districts, partially overlaps with 25 communes, and is bordered by over 104 fokontany.

At each level of this administrative hierarchy sits an elected government official with whom the management staffs of the Masoala and Makira protected areas maintain communications and consult regarding protected area activities. Employees of the Department of Water and Forest (Eaux et Forêts), under the direction of the MinEnvEF, assist the ANGAP and WCS protected area managers in these communications and consultations. There is an Eaux et Forêts officer positioned at the provincial, regional, and district levels. In Makira, Eau et Forêt officers are involved in all aspects of management and monitoring. In Masoala, Eau et Forêt officers are not engaged in day-to-day management but are the key component to law enforcement; ANGAP has the authority to manage Masoala National Park, but only Eaux et Forêts has authority to issue citations and arrest transgressors.

Health and Education

Each commune has a government-established health clinic and school. Given the isolation of many of the fokontany, particularly those that share limits with the protected areas, access to these services is limited. Among school-aged children and adults surveyed in 24 villages around Masoala and Makira in 2005 (n=4,746), an average of 63% reported no formal education; this average ranged from 91% in the most isolated fokontany of western Makira to just over 46% in the fokontany of eastern Makira and western Masoala. During a 2006 health survey of 892 households in 21 villages around Makira, 70% of households reported to have been in moderate to poor health during the past 30 days, with 79% of respondents reporting poor health as having a moderate to severe impact on their work productivity. Of these, only 29% sought treatment from a health clinic. Improving access to healthcare and education are two necessary elements for improving livelihoods. The manner in which protected area managers in the Antongil Bay landscape should work toward improving community access to these services, either directly or indirectly, is a question of their relatedness to conservation priorities and the availability of funds.

The Managed Landscape: Conservation Activities, Land Use Planning, and Governance

In the management structures of Masoala and Makira, there is interest in community integration into conservation planning and resource use management. With a period of 10 years separating the establishment of these two protected areas (1997 and 2007 respectively), one can see an evolution in approach to community integration: The current management structure of Masoala National Park was adopted from an Integrated Conservation and Development Project (ICDP) approach, while the management structure being developed for the Makira Protected Area is the result of lessons learned from the ICDP approach, as well as changes in national legislation regarding resource use management.

Protected Area Establishment

Masoala began in 1993 as an ICDP partnership between CARE International, WCS, ANGAP, and MinEnvEF. The ICDP period ended in 1997 when the park was officially gazetted as an IUCN Category II protected area. In 2000 ANGAP and WCS took over co-management of Masoala National Park—management authority rests with ANGAP, and WCS provides technical and financial support. The boundaries of Masoala National Park were based on sound biological and socioeconomic understanding of the system. Limits were identified with local community participation and based on the existence of human settlements and their subsistence resource needs, resulting in over 71,000 ha of forest being left outside the park boundary (Kremen et al. 1999).

The establishment of the Makira Protected Area has benefited from the hard work and lessons learned while establishing Masoala. Like Masoala, the limits of the Makira Protected Area are based on extensive biological and socioeconomic inventories and surveys. Boundaries were identified based on legitimacy and legality of activities in traditional village territories, and the final physical delimitation—an activity still ongoing—involves the participation of local commune and fokontany authorities. Makira is scheduled to receive IUCN Category II status in December 2007.

For both protected areas, baseline biological and socioeconomic work also informed internal zoning, allowing subsistence resource use by villages adjoining the protected areas under controlled circumstances. While no new settlements are allowed in either protected area, the permanent residences inside the park date back to pre-establishment, and their continued presence is justified based on this history, as well as the type and extent of subsistence agriculture practiced. The internal zoning is as follows:

- Strict protection no-take zones (noyau dur) account for 90% of Masoala and 93% of Makira.
- Limited-take zones, called Zones of Controlled Use (ZUC), permit local use of certain resources by the adjacent villages. The allowed users are registered and the limited uses are defined in a by-law adopted in a participatory manner.
- Enclaves, called Zones of Controlled Settlement/Occupation (ZOC), do not allow immigration; the inhabitants are registered, and activities destructive to the environment are forbidden.

In addition to this internal zonation there is an external Zone of Protection that extends 2.5 km outside the boundary and serves as a buffer to the protected area. Controlled selective extraction is allowed in this buffer zone.

Direct Management and Co-Management

The principal difference between Masoala and Makira is in the protected areas' management structures. The management structure for Masoala is one of direct management by ANGAP with local community involvement limited to a level of consultation concerning park affairs. This consultation occurs through the *comité d'orientation et de soutien a l'aire protegee* (COSAP). While the COSAP does not provide local communities with a deciding voice in management decisions, it does provide an effective forum in which park management and local community authorities can discuss management issues, thus allowing for more informed decision-making. In addition to the COSAP, there is a *comité du survallience* (COS) for each of the three Masoala marine parks. These 15 member committees are composed of local community members from the local fishing associations. The COS collaborates with park management in monitor-

ing activities in the marine parks, which are 90% "controlled take" and 10% "no take."

Unlike Masoala, Makira's management structure is proposed to be one of collaborative co-management between WCS and local community associations —WCS acts on behalf of MinEnvEF as protected area manager. Formal integration of the local communities will come via the inclusion of community resource management association (COBA) representatives on the *comité d'orientation et de suivi* (COS), which validates all Makira work plans. The COBAs will also be engaged to work with WCS and Eaux et Forêts as part of the *comité de gestion* (COGE) responsible for carrying out validated management activities.

Community Resource Management around the Protected Areas

This difference in management structures is largely the result of changes in national legislation concerning resource use management; in 2001 the government formalized the devolution of resource management authority to local community associations through forest management contracts, *gestion contractualisé des forêts* (GCF). To better insure the lasting protection of habitats within the Makira Protected Area, MinEnvEF and WCS placed great emphasis on the conservation and sustainable use of the bordering mixed forest and agricultural land—a "green belt" equaling 280,000 ha. Conservation and sustainable use within this "green belt" will be achieved through a program to establish forest management contracts (GCFs) with the surrounding communities.

These contracts have to be requested by the local communities. The community rights and resource use claims for the land under question are then negotiated and the community managed land is delineated—in the case of Makira, this negotiation and delineation coincides with the delimitation of the protected area boundaries. The zonation within the GCFs includes zones for agriculture, subsistence resource extraction, services such as ecotourism, as well as a no take zone; the no take zones are up against the shared boundary with the protected area. The GCF process is finalized through the creation of a COBA and the validation of the management contract, which specifies resource use rules and indicates the rights and duties of the different partners (COBA, MinEnvEF, and WCS). Since 2004, there have been 16 GCF contracts formalized in the mixed forest and agricultural "green belt" surrounding the Makira Protected Area, involving 30 villages and over 13,000 inhabitants in the sustainable management of over 40,000 ha of forest. The expansion of GCF sites will continue through 2010 and total roughly 28 sites.

Community Development Activities

The legal framework to devolve resource management authority to local communities did not exist when Masoala National Park was established in 1997. However, the importance of addressing local community resource needs was still very much a part of developing that park. During the ICDP period, while WCS worked with ANGAP and MinEnvEF to create the park, CARE addressed the development needs of the people living on the peninsula. Working directly with regional authorities, improved subsistence agriculture and sustainable forestry were advanced in the 71,000 ha of forest land outside the park. After the disengagement of CARE, these activities were taken over by ANGAP and WCS outreach officers. Only since 2004 has management authority of these forest lands begun to devolve to the local communities. Since then, Masoala park authorities have established five GCF sites involving 10 communities and encompassing 20,700 ha of forest.

In addition to development activities, the local communities bordering Masoala National Park also receive tourist revenue: In keeping with ANGAP's national policy, half of all tourist fees are redistributed to local communities to be invested in infrastructure improvement as the community sees fit. While this revenue sharing program is meant to demonstrate the direct benefit local communities receive from the protection of natural resources, in fact it has often resulted in community conflict brought on by unachievable expectations. In 2005-2006, $7,300 of tourist revenue was to be redistributed to the inhabitants living around Masoala National Park. The insufficiency of these funds to address community needs was coupled with a perceived unfairness on how the funds were distributed. Since 2004, ANGAP has been working to decentralize the process of deciding how tourist funds should be distributed to local communities by establishing committees with community representation.

The Future of the Landscape: Next Steps in the Antongil Bay

The rural population of the Antongil Bay landscape depends on the resources of these forests for their livelihoods, but this should not be considered solely in terms of mounting threat. It should also be considered that they have a collective interest in protecting the forests and conserving resources through sustainable use. For this to occur several issues have to be addressed, including: 1) reducing human population pressure in order to meet food security and subsistence resource needs, 2) developing, monitoring, and maintaining community capacity to be good land stewards, and, 3) securing clear benefits to the communities from their sustainable management of the forest. WCS, in collaboration with ANGAP and MinEnvEF, will continue to address these issues in the following ways.

Food Security, Subsistence Resource Needs, and Human Welfare

Expanding rural populations can increase resource use pressure and overwhelm outreach efforts to introduce sustainable resource use alternatives. Coupling sustainable resource use alternatives outreach with human welfare outreach will help to mitigate this pressure. Efforts to improve the rural agricultural infrastructure in the landscape, and thus improve productivity, will continue. Activities include further development of the rural irrigation systems, as well as expansion of improved agricultural/permaculture micro-projects, including intensified rice production, permanent gardens, tree nurseries, watershed management, technical training, and applied research/trials of new techniques. In complement, human welfare activities will expand: In collaboration with CARE and Population Services International, a baseline of community awareness of—and need for—health and family planning information is being established, and health and family planning education is being coupled with improved access to those services.

Community Land Stewardship

In the context of mounting pressure on forest resources, "community-based forest management transfers" represent an opportunity for formal integration of local communities into management efforts, as well as long-term conservation of a buffer of productive forest around the protected areas. Efforts will continue to expand the network of community forest management (GCF) sites bordering Masoala and Makira, while at the same time focusing on building the capacity of these local communities to be good land stewards. Devolution of resource management will allow benefits (as well as costs) of sustainable management to

be internatilized, and improved governance will allow transparency of management and promote greater cooperation between and within communities.

Economic Alternatives and Revenue Generation

Until local communities realize a larger and lasting benefit from conserving forest resources, illicit and unsustainable activities will continue. To this end, activities that provide dependable alternative revenue to these communities will continue to be developed, including advancing community-based ecotourism and identifying and establishing markets for sustainably produced products such as bio-vanilla, bio-clove, and eco-silk. Together with these direct revenue-generating activities, WCS will collaborate with development partners and regional banking institutions to establish a system to make low interest loan guarantees available for ecologically sustainable investments. Finally, WCS, in collaboration with MinEnvEF, is developing sustainable financing mechanisms with direct benefit to local communities through the sale of carbon emission credits based on avoided deforestation. Calculated on a per hectare basis, benefits to the communities from the sale of carbon credits are tied directly to their successful stewardship of the forest. The security of these benefits, coupled with ongoing governance, targeted development, education, and welfare outreach efforts, can provide an appropriate framework to advance integrative resource management that protects both biodiversity and human welfare.

[1] 2005 socioeconomic survey of 1,075 households in 24 villages surrounding the Masoala and Makira protected areas found 56% of households (n=606) owned active tavy plots, and 77% (n=829) owned irrigated rice fields. Vanilla was an important cash crop with 65% (n=694) of households reporting cultivation.

[2] 2003 survey of households around Makira found that only 31% cultivated both tavy and irrigated rice, and that surplus stocks of rice were often used for gifting or reserved for ceremonial activities.

1.2 Livelihoods and Protected Areas in the Ruaha Landscape: A Preliminary Review

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Ecological Setting

The Ruaha Landscape covers an area of approximately 50,000 km^2 in central Tanzania. The landscape is a mosaic of habitat types straddling the southern limit of the Sudano-sahelian "*Acacia*-thorn savannas" and the northern end of the *miombo* woodlands. The landscape changes along edaphic, elevational, and rainfall gradients, with the drier (<200 mm rainfall) lower-elevation (~700 m) and richer soils in the Rift Valley giving way to wetter (up to 1,500 mm rainfall), higher elevation *miombo* woodland and *Drypetes* forest. The landscape's physiognomic diversity is reflected in Ruaha National Park's diverse bird community—529 species recorded—and the large mammal community, which includes the southernmost population of Grants gazelle and lesser kudu, and roan, sable and greater kudu.

Cultural Setting

The Ruaha Landscape's location in the Great Rift Valley suggests that some human settlement has been present for as long as anatomically-modern humans have existed. Rock art can be found at Kondoa, just east of the Ruaha Landscape, and there are colonial accounts of rock art present in Ruaha National Park and Rungwa Game Reserve. More recent cultural history reveals a diverse ethnographic landscape. Bantu horticultural groups inhabit wetter areas and places where traditional irrigation is possible, and Nilotic pastoralists from Barabaig and Maasai ethnic groups have moved into the area in the last 50-70 years.

Also significant is Tanzania's history of *Ujamaa* or "villagization," where, in the mid-1970s, scattered settlements were relocated into nucleated villages and communal and managed village farms were established. This phenomenon had lasting effects on Tanzanian society, but two are particularly significant for conservation. First, nucleating villages created a pattern of human development that concentrated human impacts in villages and left large unsettled tracts for wildlife. Second, the process validated the idea of government-sponsored resettlement in the minds of many Tanzanians.

History of Protected Areas Establishment

Colonial Period: Saba Reserve

The earliest conservation efforts in the area were consistent with the general history of conservation in Tanzania: dry season aggregations were protected as colonial hunting reserves. The Saba Reserve was established by the German colonial government and covered most of what is today recognized as the Ruaha Landscape. During this period, there was relatively little permanent settlement in the landscape, but over 40 named places are still recognized in the protected portions of the landscape, suggesting that the area was used seasonally and was relatively well-known.

Post-Colonial: Rungwa-Ruaha

Just after independence (and with support from the New York Zoological Society) Ruaha National Park was established to cover 10,800 km^2 between the Great Ruaha and Mzombe Rivers. From the beginning, no consumptive use was allowed in Tanzanian national parks, which represented a step back from the consumptive use allowed in the Saba Reserve. The areas in present-day Rungwa, Kizigo, and Muhezi Game Reserves receiving game reserve status between 1974 and 1984 and continued to be hunted. Usangu Game Reserve was established in 1996 by upgrading the Utengule Swamp hunting block in response to an influx of Sukuma and Maasai pastoralists, many of whom had left northern Tanzania in search of better grazing lands. Those already settled in Usangu were compensated and left, but unfortunately there was little enforcement of the new regulations, and many returned almost immediately.

The final protected area in the Ruaha Landscape is Pawaga-Idodi Wildlife Management Area (PI-WMA), which was officially designated in March 2007. This 750 km^2 strip south of Ruaha National Park is village land. In 1995, a UK Department for International Development (DFID)-Funded program began buffer-zone management activities in this area. This process coincided with Tanzania's establishment of "Wildlife Management Areas" legislation, which (for the first time) allows local people to manage wildlife on their village land. With the exception of management staff and tour operators, none of these protected areas has human settlement within its boundaries. For PI-WMA, a consortium of 21 villages is about to receive User Rights to manage the area.

Current Situation

During the 2006 dry season the drying of the Great Ruaha River forced the Mtera Hydroelectric plant to close and reduced the Kidatu Hydroelectric Plant's production by 50%. A major driver of the river-drying was degradation of the Ihefu Swamp in Usangu Game Reserve, where around 170,000 livestock were grazing. In response to the power crisis, the Government of Tanzania expanded Usangu Game Reserve's boundaries and upgraded it to national park status. Grazing in the game reserve was already illegal, but numbers of livestock had increased steadily since the initial evictions, so Usangu was placed under the Tanzania National Parks Authority (TANAPA), which is relatively better funded and in general is more effective at enforcement. At present the area is slated to be annexed to Ruaha National Park, making it the largest Park in Africa, at just over 20,000 km^2. The boundaries of the expanded area are not yet final.

In keeping with its policy of no settlement in protected areas, at least three villages will be resettled as part of this process. At this stage (actual movement has not started), most of the affected people are cooperative, which may reflect Tanzania's recent history of resettlement. Present conflicts surrounding the resettlement process focus on compensation amounts and who is eligible, rather than whether or not resettlement should occur.

Resource Use and Governance

National parks allow no consumptive use, while game reserves allow low-volume trophy hunting by (mostly expatriate) tourist hunters. Pawaga-Idodi WMA will be managed with both photographic (non-consumptive) and hunting zones (81% and 19% of the area respectively).

One exception to these rules is Muhezi Game Reserve, which, in an effort to demonstrate "tangible benefits" to adjacent communities, was designated a "multiple use" game reserve in 1995. The result is that two extractive uses—

beekeeping and artisanal gold mining—are allowed. Beyond honey, gold mining, and trophy hunting, there are no consumptive uses in the protected portion of the landscape. Neither honey nor gold from the protected area have a special market associated with them.

The "tangible benefits" of honey production and artisanal mining may be more appropriately labeled "visible benefits." The Rungwa-Kizigo-Muhezi complex of reserves (the only management unit for which revenue data are available) generates over $850,000 per year. These revenues go into Tanzania's central treasury, so they do in fact produce tangible monetary benefits, but only as part of the national budget. This revenue is effectively invisible in the local context, so the need for *visible* benefits contributed to the decision to allow honey and gold mining in the Muhezi Game Reserve. It is not clear whether this was perceived or presented as livelihood improvement or mitigation of lost access.

Resource use outside protected areas is managed by village and district government. As part of the Village Land Act, villages must establish land use plans which are enforced through village by-laws. In general, village by-laws only apply to land uses like cultivation, grazing, or settlement. Permits for wood cutting and hunting are issued by forestry and wildlife officers, who are part of district councils but administratively are part of the Ministry of Natural Resources and Tourism.

Resource Use and Conservation Targets

It is generally accepted that in Tanzanian savannas, sanctioned use of natural resources have far less impact than illegal uses. For example, assessments of tourist hunting quotas show that with the exception of big cats, quotas tend to be low (<2%) and are not generally considered to be a threat to wildlife populations. But illegal hunting outside reserves and in boundary areas is known to have significant effects, even leading to local extinctions. For this reason, most research and monitoring in the Ruaha Landscape has focused on illegal uses and not systematically assessing the direct effects of legal consumptive uses. Nevertheless, it is possible to paint a preliminary picture of the effects of mining and beekeeping.

Honey is collected from wild baobab trees or from artisanal hives made from hollowed logs. The direct effects of honey collecting are minimal, but the indirect effects—fire and associated hunting—can be significant. Illegal hunting associated with honey gathering is difficult to assess quantitatively for a number of reasons. First, it is likely that a significant proportion—if not most—hunting associated with honey gathering goes unnoticed because detection rates are low, particularly in the dense *miombo* woodlands and *Itigi* Thicket of Muhezi Game Reserve. Second, only arrests are recorded, so there is no mechanism to capture encounters that do not lead to an arrest. Furthermore, no centralized record remains after arrests are moved (administratively) to the legal realm, so retrospective analyses are impossible. Management and enforcement personnel point out that honey collecting provides an excuse for people to enter the reserve, so an individual's presence in the reserve may not necessarily be illegal, even if his intentions are to hunt illegally. This "cover" for illegal hunters who have no intention to collect honey is the primary concern voiced by management personnel. Despite—or possibly because of—these difficulties in measuring honey-related hunting, managers and rangers complain that the proportion of genuine honey gatherers to disingenuous ones attempting to gain access is quite low.

Fires, the second effect associated with honey gathering, are more easily measured. Fires are common throughout the dry season, from the time grasslands dry in May until the rains begin, usually in November. Because "dry lightning" is not common in the Ruaha Landscape, virtually all fires can be attributed to people. As a honey hunter opens a hive, the smoldering stick used to subdue the bees is cast aside, often starting a fire. Fires are also intentionally set to facilitate safer travel through the bush (to make snakes and large mammals more visible), or to divert enforcement personnel because they are also responsible for extinguishing fires.

The effects of artisanal mining are not dissimilar to those of honey hunting: The direct disturbance from digging is minimal, but the human presence in the reserve is much more significant. Again, by providing a legitimate excuse to enter the reserve, mining creates an opportunity for illicit resource users to enter under the guise of sanctioned use. Poor regulation of permits also means that while only 12 initial miners were authorized to remain in the reserve, literally hundreds of individuals claim access as one of the original 12. Miners—unlike honey hunters who enter the reserve, collect honey, and leave—are inclined to stay for long periods. This increases the probability that they themselves will hunt for the pot while in the reserve.

The "effects" of honey hunting and mining described above are focused primarily on illegal hunting and fires as potential threats to wildlife. But what effects are visible through ecological outcomes like the decline of a species? To address this question, we examined the available data on buffalo, as they are a useful lens because they are affected by both threats and because they are economically valuable. Their abundance relative to the other highly-prized trophy species (like lion and leopard) and the cost of a buffalo hunt ($27,000 for a one-week hunt) make buffalo the cornerstone of the tourist hunting industry.

Using buffalo as an indicator of overall ecosystem health, it is clear that the decision to incorporate extractive use has affected Muhezi Game Reserve. Ecosystem-wide, numbers of buffalo appear stable, but a closer look at the subunits of the landscape reveals a different story. Parts of the Ruaha Landscape have seen a marked decline in buffalo (up to 70%). Poor nutrition may be driving or at least exacerbating this trend. Muhezi Game Reserve has the lowest density of buffalo when compared to the adjacent reserves and Ruaha National Park. While it would be inaccurate to attribute the decline of buffalo simply to fires from honey collecting, the fires are an important contributing factor. Fires affect all grazing species.

As far as hunting is concerned, other species may be facing more significant threats than buffalo because buffalo are large and dangerous, and are avoided by many subsistence hunters. Furthermore, buffalo use open habitats and are in large herds, making them more difficult to hunt at close range, which is a necessity when using homemade muzzle-loaders (the most common method of illegal hunting).

In summary, very little consumptive use is allowed within the protected areas of the Ruaha Landscape: Honey hunting and artisanal mining are the only uses allowed, and these are practiced in Muhezi Game Reserve, which covers just over 9% of the landscape. The direct effects of these sanctioned uses are relatively small when compared to those of their indirect effects, hunting and fire. While high quality data are not available, a preliminary assessment of the effects of fire on buffalo suggests that it has significant local effects.

Displacement of Use

Excluding tourist lodges, reserve management, and hunting camps, there are no human settlements in these protected areas. Therefore, the effects of protection on local use, or "displacement," are only visible in adjacent areas.

As mentioned above, the human population adjacent to protected areas is split between horticulturalists and pastoralists. Because pastoralism is spatially extensive, and because pastoralists are politically marginalized, they are the most likely sub-population to suffer the effects of "economic displacement." Because pastoralists live closest to the protected areas of the Ruaha Landscape and because their livestock share many resources with wildlife, their interactions with the protected areas are stronger than those of horticulturalists. For this reason, and because more data are available for pastoralists, we limit our analysis of displacement to pastoral households.

To examine whether pastoralists are experiencing economic displacement, we examined whether their access to grazing land was affected by the presence of protected areas. To do so, we tracked 35 groups of cattle as they were herded from their households, and analyzed whether living closer to protected areas affected the distance that herds needed to travel—the "herding radius." Economic displacement could increase the herding radius—by forcing herds to travel farther to find other grazing areas to substitute for protected rangelands —or decrease the herding radius—if the spatial constraint imposed by protection made it impossible to travel farther.

We found no evidence for either type of displacement. Distance from protected area boundary was not correlated with herding radius, and households living between village centers and the protected area traveled no further than households that lived on the opposite side of the village from the protected area.

It is possible that displacement may be uniformly affecting all households within the area. In that case, variation would only be apparent at larger spatial scales. However, this seems unlikely in light of the following observations: First, herding radii are short, relative to the overall size of villages. Because households are only using small areas, there is local variation in the density of livestock and in grazing pressure; in other words, entire villages are not experiencing a uniform shadow of displacement. Furthermore, large, unsettled and more lightly-grazed areas exist between villages, suggesting that grazing resources are not uniformly exhausted. Given the long time since park establishment, one would expect that if displacement were significant, resource use would shift and these areas would be more uniformly exploited. Finally, in the villages examined, resettlements occurred during the colonial period, at protected area establishment, during villagization, and nearby villages were resettled after establishment of a dam for hydroelectric power. That resettlement affects land use is undeniable, but the protected areas would be unclear. This preliminary analysis suggests that livestock herding is not spatially constrained by protected areas. But the spatial aspect of herding is only one component of pastoral livelihoods.

Conservation and Livelihoods in Ruaha

Livelihoods may still be significantly affected by protected areas. The costs of living near a protected area include livestock depredation by carnivores, crop raiding by elephant and hippo, and the potential for disease transmission between wildlife/livestock/human interfaces. Benefits may include employment (by protected area authorities, tour operators, and lodges or by conservation

organizations), growth in reserve-adjacent village economies, or through services like veterinary extension benefit sharing programs or land/resource-use planning undertaken as part of reserve establishment or management.

Costs of Living with Wildlife in Ruaha

The costs of living with wildlife for pastoralists in the Ruaha Landscape are that most pastoral households reported losses to carnivores. Reports varied from 0 to 12 cattle, but households averaged 0.34 animals lost during the year preceding the study. (Animals stolen or dying from disease and starvation were also recorded.) **Table 1** shows the numbers of animals reported lost to these factors, and their ratios. The economic cost of human-carnivore conflict (HCC) can be calculated using animals' market price, but since only a small percentage of animals are sold, the more common losses are in terms of household productivity. No human deaths have been attributed to carnivores over the last four years, but one herder was injured by a leopard while defending livestock. Whether this should be "counted" as a cost is unclear because the livestock were being herded illegally within a protected area.

Table 1: Average livestock losses per household

	Mean # of each class of livestock killed by predators	Mean # stolen	Ratio of stolen: predated	Mean # dying from disease and Starvation	Ratio of diseased or starved: predated upon	Ratio of non-carnivore deaths to carnivore predation
Cattle	0.34	1.27	3.75	1.93	5.70	9.45
Small stock	0.93	1.54	1.66	2.96	3.20	4.86

Quantifying the costs of disease is more difficult. Disease and starvation often go together, and many herd owners were reluctant to attribute deaths to one or the other, so these two categories were aggregated. Reported losses to disease and starvation are much greater than the losses to carnivores: 3 to 1 for small stock and 5 to 1 for cattle. But the proportion of these losses to attribute to wildlife is unclear. We examined households' reported losses to disease in relation to their distance to the protected area boundary and the densities of other households and livestock. Reported losses to disease were most strongly correlated to cattle density. Distance to the nearest protected area boundary was not correlated to disease losses. Taken together, these results suggest that livestock are a more significant reservoir for their own diseases than are wildlife. Because disease and starvation were lumped, it is difficult to say which process drives this result more strongly, but direct sampling of zoonotic diseases in livestock is underway.

Benefits of Living with Wildlife in Ruaha[1]

Pastoral communities have also benefited from living near protected areas. During the last five years, five tourist lodges have opened in the area, and three more are under construction. In addition to the lodges, many of the families of Ruaha National Park (RUNAPA) staff choose to live outside the park, where goods and services are more available, cultivation is possible, and regular transportation to Iringa (the district center) is available. While the RUNAPA families outside the park are uncounted, the economic effects of their salaries are apparent in Tungamalenga, the closest village to the park entrance. In addition

to growing rapidly, having more stores and a wider selection of goods for sale, Tungamalenga is also the only one of the nine villages in Idodi Division that has guest houses (in addition to the eight wildlife-tourism camps).[2]

Another benefit of living next to a protected area comes in the form of HCC mitigation. There has been research to understand and outreach to reduce livestock depredation, primarily in an effort to protect Ruaha's intact carnivore guild (it harbors the third largest population of wild dogs in Africa). One could argue that without the protected area there would be no carnivores and no conflict, but this would be an overstatement, as hyenas often persist in human-dominated landscapes. Rural areas without protected areas may still have carnivore depredation without the benefit of mitigation efforts.

Pastoralists and tour operators also joined forces last year when an increase in snaring killed two giraffe and a handful of pastoralists' cattle. The Pastoral Association raised the issue and pointed out that snaring was affecting livestock in addition to wildlife. As the pastoralists began collecting snares in the bush, the tour operators, with greater political standing and access to village government, demanded an investigation and an increase in enforcement (two suspects were arrested and remain in custody).

Tourism development may not benefit pastoralists forever. It is conceivable that tourism could expand to fill all the available wildlife-only area, and tour operators could push for more area to be designated as wildlife only. However, this seems unlikely since only about 5% of Ruaha National Park is developed for tourism. Furthermore, traditional pastoralism is well integrated with wildlife conservation in northern Tanzania, where wildlife and cultural tourism go hand in hand. Many pastoral groups have developed lucrative "cultural bomas" to capture a share of tourist revenues. Therefore, it seems unlikely that Ruaha's tourism and pastoralism will come into conflict in the near future.

Other activities to protect wildlife also indirectly benefit local people. For example, during heavy El Niño rains in early 2007, small stock began dying in great numbers. Initially, authorities speculated contagious caprine pleuropneumonia (CCPP). A Sokoine University veterinarian working on wildlife-livestock disease interactions noticed cattle abortions and sheep deaths, signs of Rift Valley Fever rather than CCPP. Early detection and action may have been significant in helping Iringa District limit human cases of Rift Valley Fever to four, while the adjacent regions of Morogoro and Dodoma endured 50 and 156 cases respectively. WCS and the Danish International Development Agency (DANIDA) District Agricultural Development Support (DADS) Program have worked together on water development in places where water shortages force pastoral livestock into contact with wildlife at shared water sources. This may help mitigate elephant conflicts, because elephants invade irrigated fields as a water source, and trample crops.

Another—perhaps the most significant—benefit for pastoralists provided by protected areas is land-use planning. Tanzania's Wildlife Management Areas legislation requires that every village seeking authority to manage wildlife on its land must complete a land use plan. During the establishment of Pawaga-Idodi Wildlife Management Area, WCS, WWF, and RUNAPA all contributed to the land-use planning process. This support sped up the process and significantly expanded the number of stakeholders that were able to participate, which both improved the plans'content and increased buy-in from those involved. Land-use planning is particularly significant for pastoralists because their movements and absence from some grazing areas during the year makes some non-pastoral people think that grazing areas are unused or unwanted. By establishing

unequivocal zonation, the land-use planning process has strengthened pastoral land tenure. Now every village recognizes and designates grazing zones within its boundaries.

These benefits are not evenly distributed throughout the landscape. Tungamalenga is the nearest village to Ruaha's only entry point. By virtue of its location, it enjoys the lion's share of tourism benefits and the economic activity from RUNAPA's employees. Other villages sit directly on the boundary of Ruaha, where they endure crop raiding and livestock depredation, but because there is no entry gate nearby, they capture few of the benefits to offset these costs. **Table 2** summarizes some of the livelihood-related costs and benefits for pastoral people living in the Ruaha Landscape.

Table 2: Summary of protected areas effects on pastoral livelihoods

Effect	Positive	Negative
Carnivore Depredation	• Assistance in decreasing livestock depredation	• Losses to carnivores
Disease	• Additional livestock extension available through wildlife conservation efforts • Water development to increase productivity and decrease wildlife-livestock interactions	• Some diseases may be present or more prevalent as a result of wildlife (but overall data suggest livestock as the primary reservoir)
Tourism development	• Opportunities for employment (8 lodges) • Opportunities for cultural tourism (Boma visits) • General increases in economic activity	• Possibly more pressure to increase protected land (where no grazing occurs)
Access to land	• Land use planning and land conflict resolution from conservation NGOs	• Land use planning and land conflict resolution from conservation NGOs

Current Relations between the Protected Area and Local Peoples

Relative to other parts of the world, people-park relations are good in the Ruaha Landscape. That is not to say that the area is free from conflicts, but the conflicts are intermittent and are almost never violent. The establishment of Pawaga-Idodi WMA has essentially given 21 villages their own protected area. Conflicts centered on PI-WMA generally focus on management decisions or ways to maximize benefits, rather than whether or not it should exist. Pastoralists do request access to the reserves in difficult dry seasons, but these are only requests, not calls to dissolve the WMA. RUNAPA, like all of Tanzania's national parks, practices "Support for Community-Initiated Programs" (SCIP). Budgets for SCIP are around $3-400,000/year and many communities are quick to mention these projects as a benefit of conservation and protected areas. One benefit of SCIP projects is that they tend to focus on infrastructure, which remains as testimony of the support. The overseeing authority for PI-WMA (MBOMIPA) also provides financial support directly to village governments, but these funds are less than what comes from RUNAPA, are less visible, and so are easily forgotten.

Conclusions

Generalizations are difficult for a landscape as large and diverse as Ruaha, but a number of salient points emerge.

Political resettlements and natural migration make the effects of protected areas difficult to isolate.

Many of the places from which pastoralists emigrated are badly degraded, so when conversation turns to land degradation, access, or land shortage, few people mention these other, earlier drivers of change; instead, most mention protected areas, which are nearby and remain tantalizingly intact. For this reason, initial impressions suggest that protected areas are the major drivers of land shortage. But protected area establishment, villagization, resettlement for a hydropower reservoir, and influxes of pastoralists from other parts of the country have all affected the patterns of settlement, livestock numbers, and resource availability in the Ruaha Landscape. Because these processes happened over decades, and because people continue to move within Tanzania, it is exceedingly difficult to attribute aspects of current land uses to any one of these drivers. In examining livelihoods in Ruaha, it is important to go beyond initial impressions, which might inflate the role of protected areas in shaping current land uses and current livelihoods.

Perceived lack of "tangible benefits" is actually a lack of visible benefits.

Another common misperception is that the protected areas of the Ruaha Landscape "lock up" resources. Closer examination reveals that these areas hold tremendous economic potential and that the perceived lack of benefits actually reflects a structural problem: the diversion of conservation revenues to central government and private entrepreneurs. It is understandable for local people to think there are no financial benefits from conservation because they are quickly whisked out of the landscape and disappear into the central treasury or offshore bank accounts. This is an important distinction because it means that protected areas and conservation have the potential to contribute to local livelihoods, but at present they are not doing so.

Extractive uses have significant negative effects on the "engines" of revenue generation.

The perception that protected areas were not producing anything of economic value has created pressure for extractive use. For example, Muhezi Game Reserve was designated a multiple-use reserve, allowing beekeeping and artisanal mining. The revenues from these two enterprises have been small and erratic, but the ecological costs in terms of fires, illegal hunting, and mercury pollution from gold mining have been large.

The Muhezi experience suggests that extractive use is not an appropriate method for integrating communities and protected areas or improving livelihoods. This strategy is akin to the owner of a productive factory choosing not to pay her workers reasonable salaries, but instead allowing them to take home pieces of the factory machinery to sell. Bits of machinery are of little value, and eventually the factory will break down. That breakdown is apparent in Muhezi, with an overabundance of fire (associated with illegal activities) and the lowest large mammal biomasses in the landscape.

Villages must be integrated economically, rather than ecologically.

The example from Muhezi highlights the difficulties of integrating communities ecologically through direct exploitation of resources. A more viable strategy is economic integration. Tungamalenga village is positioned as the sole gateway to Ruaha National Park. The village itself is thriving: economic activity is significantly greater than in other villages, the village is attracting investment in tourism enterprises, propogating benefits through the village economy. Tungamalenga runs the risk of getting too expansive, while other villages are not enjoying these benefits even though they also sit on the boundary of Ruaha.

An obvious solution is to help other villages become economically integrated with Ruaha National Park. Simply adding a second gate would decrease the pressure on Tungamalenga, protect the value of the existing investments there, and create new potential for investment and economic value in other villages. Given the difficulties with extractive use, this seems the most appropriate method for the protected area to integrate communities and improve livelihoods.

The Balance of Costs and Benefits

The costs and benefits of living with wildlife and protected areas are evident in the Ruaha Landscape, highlighting both the difficulties and the more fruitful prospects for improving rural livelihoods through conservation. Revenue from Tanzania's tourism industry will soon exceed one billion dollars per year, and local communities that pay the costs of living with wildlife deserve their share of this national resource. Such a strategy makes sense from ethical as well as practical points of view.

Academic discourse often presents local communities as passive victims, impoverished by protected area establishment. A deeper examination of resettlement and the development process in the Ruaha Landscape suggests a much more complex history and that local people may be poor *in spite of* protected area establishment, rather than because of it. Conservation in Tanzania benefits tremendously from the fact that wildlife has enormous economic value. Conservation managers should address the structural problems that effectively hide conservation revenues from local people, rather than trying to wring more benefits from protected areas through extractive use.

[1] We only consider local benefits here, but it is worth noting that at the national level, the Great Ruaha River supports central Tanzania's most significant fishery, and generates over 70% of Tanzania's electricity.

[2] An economic analysis of Tungamalenga's and other villages' economies is underway by M. Masozera.

1.3 The Evolution of Management and Impacts on Communities Adjacent to the Mombasa Marine Protected Area, Kenya

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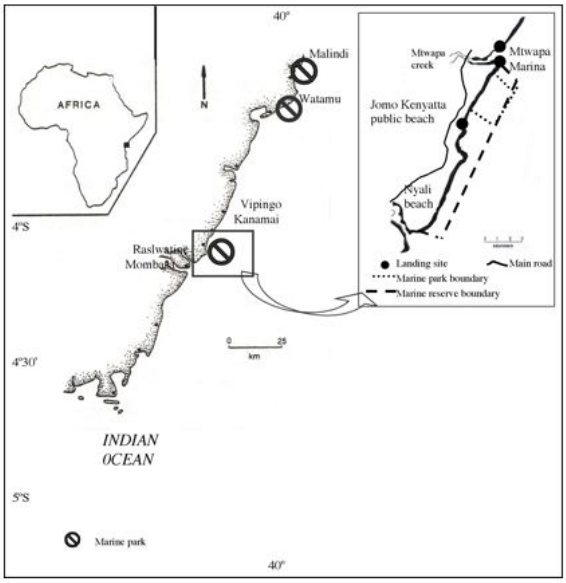
Marine protected areas (MPAs) are established for purposes of biodiversity conservation, fisheries management, and the management of tourism. In many cases, MPAs are established in areas that were historically utilized by local communities. Failure to adequately engage these communities at the inception of the MPA has often resulted in the creation of "paper parks" (Rubens 1996; King 2000). In the last decade, the Kenyan government has come to recognize the importance of incorporating community interests into natural resource management. The wildlife, forestry, and the fisheries policies that are currently at different stages of debate in the Parliament incorporate elements for encouraging community participation. This report documents the evolution of the youngest MPA in Kenya—the Mombasa Marine Park and reserve—and the impact of management on the local community. It discusses the challenges of implementing community initiatives in this part of Kenya, and the study site presents some characteristics that can generate useful lessons relevant at the regional and global levels.

Environmental and Biophysical Characteristics

The Mombasa MPA (**Figure 1**) is 200 km^2 and lies between Tudor Creek to the south and Mtwapa Creek to the north, in Mombasa District, Coast Province, Kenya. The climate and oceanographic conditions of the Kenyan coast are controlled by the northeast and the southeast monsoon winds (Bryceson 1982; McClanahan 1988). Average annual temperatures range from 26.3°C to 26.6°C and the long rains (March/April to July) average 100 mm per month while the short rains (October to November) average 90 mm per month.

Figure 1: The Kenyan coastline showing the Mombasa Marine Park and reserve and the main fish landing beaches (Marina, Jomo Kenyatta, and Nyali) in the MPA (Modified from McClanahan et al. 2005)



Coral reefs, seagrass beds, and mangrove forests are the main marine ecosystems, while sandy beaches and rocky coral cliffs characterize much of the shoreline. Due to the high tidal range, a large area of sand is exposed along the shore and serves as an important feeding area for shore birds (Seys et al. 1995). Shoreward from the high tide mark, patches of riparian vegetation are home to a wide range of terrestrial fauna.

Monospecific meadows of the seagrasses *Thalassodendron ciliatum* and *Thalassia hemprichii* are associated with reefs growing in the shallows and serve as important fishing grounds for local communities as well as feeding and breeding habitats for finfish and sea turtles. The fringing coral reef lies beyond the lagoon, and stretches almost unbroken from Mtwapa Creek to Tudor Creek. The inner reef is dominated by the hard coral *Porites* (McClanahan and Mutere 1994) and is interspersed by areas of sand, seagrass, and fleshy and calcareous algae. Many species of coral reef fishes, gastropods, and corals occur within these reefs. The fore reef has a high percent cover of hard and soft coral species and is a popular site for dive tourism.

Beyond the reef, large schools of pelagic fishes, whale sharks, and sea turtles are common, while humpback whales are occasionally sighted on their southward migrations (Wamukoya et al. 1996). Several species of dolphin, including the bottlenose dolphin *(Tursiops truncatus*) and the common dolphin (*Delphinus delphis*), occur in Kenyan waters (Wamukoya et al. 1996). Mangrove forests along the fringes of the Mtwapa and Tudor Creeks are important fisheries areas but are also a source of sediments and solid waste pollution into the MPA (Mwangi et al. 2001).

Social and Cultural Setting

The Mombasa district has ~ 2.5 million inhabitants (1999 census), or 9% of the national population. The earliest peoples of the Kenyan coast were the Cushitic speakers (Orma, Boni, Sanye, and Somali) that were later displaced by Bantu speakers (Mijikenda, Pokomo, Taita) and the Swahili (Middleton 2000). The coast experienced several colonial regimes—the Portuguese (1500-1700), the Omani Arab Sultanate of Zanzibar (1700-1895), and the British (1895-1962)—that all had a distinctive influence on the socio-economic and cultural character of the province (Cooper 2000). African religious beliefs and practices existed prior to colonization, Islam existed for centuries, and Christianity was introduced in more modern times (Sperling 2000). Over time, the socio-cultural profile has become fairly diverse (Coast Development Authority 1996) and is composed of ethnic groups from the coast (64.7%), groups from other parts of Kenya (25%) and immigrants from outside Kenya (3.9%).

The population of the coast has grown rapidly at an average rate of 3.5% between 1962 and 1979, but the growth rate has decreased to 3.1% (Wakajummah 2000). The fertility rate (5.3 per woman) is slightly below the national average (5.4) and male to female ratio is skewed towards males in the districts with large urban areas like Mombasa and towards females in the more rural districts, such as Kilifi and Kwale. Despite a decrease at the national level, all categories of mortality remain high in the coast province, compounded by factors including low levels of education and diseases, especially malaria (Wakajummah 2000). High birth and high death rates combine to create a young age structure. Migration to the coast, however, is very high (15% of national total), leading to a skewed male to female ratio and ethnic disparities.

History of the Protected Area

The Mombasa MPA was gazetted after hoteliers and local expatriate residents petitioned the government for an MPA along the Bamburi-Shanzu beach. The first surveys of the reefs indicated a high degree of degradation (McClanahan and Shafir 1990), but biodiversity conservation was not the main rationale for creating the MPA: The tourism boom of the 1980s brought more visitors to the area and security for tourists became a stronger justification for the establishment of the MPA. The MPA was gazetted in 1986 under the Wildlife Conservation and Management Act Cap 376 of 1977 and zoned into an area of 12 km^2 designated as a marine park (legal notice 315), a no-take IUCN Category II area, encompassed within a larger marine reserve (200 km^2), IUCN Category VI.

The fishing community opposed the establishment of the MPA and would not comply with its regulations to the extent that Kenya Wildlife Service (KWS) was unable to establish a management base near the MPA for several years. Sustained dialogue and initiatives targeting the local community, including support for the Mombasa Boat Operators Association (MBOA) and reducing the no-take area from 12 km^2 to 10 km^2 (Glaesel 1997), resulted in KWS being able to set up a management base in 1991 (McClanahan and Kaunda-Arara 1996). The current management plan was developed through a comprehensive consultative process in 2000 (Weru et al. 2001).

Resource Use

The marine reserve is an important area for artisanal fishers who land their catch at three beaches (Nyali, Jomo Kenyatta, and Marina) adjacent to the MPA (**Table 1**). Approximately 60 local fishers currently fish in the reserve (~12 fishers/km^2) using dugout canoes and gleaning (McClanahan and Kaunda-Arara 1996; Muthiga and Ndirangu 2000; Cinner et al. 2007). Finfish catches, estimated at eight tons/km^2/yr, are predominantly rabbitfish, parrotfish, and octopi (McClanahan and Kaunda-Arara 1996). Fishers make between 9.5 and 11 trips/day/km^2 earning an estimated $40 per month using (in order of importance) gill nets, hand-lines, seine nets, spear guns, longlines, basket traps (madema) and other nets (McClanahan and Kaunda-Arara 1996; Cinner et al. 2007). The fishers landing their catches at Marina had the highest incidence of use of illegal nets (beach seines) and nets of restricted mesh sizes. Sports and aquarium fishing occur in the reserve, but no reliable statistics of these fisheries are available.

Although the economic benefits of the Mombasa MPA have not been estimated, the direct and indirect benefits of shallow marine ecosystems to tourism —the main economic sector in the MPA—have previously been reported (Cesar 2000, McClanahan and Pet-Soede 2000). There are 25 hotels (~7,000 beds) and other tourist establishments and informal sector enterprises along the beaches of Shanzu, Bamburi, and Nyali that employ approximately 150,000 people (Coast Development Authority 1996). A recent socio-economic assessment of communities along the north coast of Kenya indicated that local communities are mainly involved in the informal tourism sector as "beach operators" and glass bottom-boat operators (Cinner et al. 2007). The MPA is also an important recreational area, and the water-sports activities concentrated around the coral reefs of the Mombasa Marine Park receive approximately 30,000 visitors a year. More than 200 vessels (deep sea fishing vessels, small boats [ngalawa], sailing boats, glass bottom boats), utilize the MPA (Muthiga 2006). The Mombasa Boat Operators Association (MBOA), a community association, dominates the glass bottom boat business with 20-30 boats that earn an estimated $30 per boat per day. Sailing, goggling, and SCUBA diving are offered by all the hotels.

Table 1: Socio-economic information on various aspects of the Mombasa Marine Park and Reserve as well as communities utilizing the MPA (Modified from Muthiga 2006)

Indicator	Factor	Comments
Population	207,862 (Kisauni division)	Kisauni division is 32% of the population of Mombasa district and 8.3% of the population of Coast province.
Population density	1650/km^2	The MPA straddles Kisauni and Bamburi locations of Kisauni division with a density of 1087 and 3150 persons/km^2 respectively. Mombasa district has a density of 2896 persons/km^2.
Number of hotels	25	The number of hotels increased from 5 with less than 1000 beds in 1971 to 25 with 7000 beds by 1993.
Number of persons employed in tourism sector	153,000	This number includes persons employed in small-scale tourism sectors. An estimated 13,000 persons are employed in the hotels (Coast Development Authority 1996).
Number of fishermen and CPUE • Kenyatta • Nyali • Marina	 45 (2.5) 40 (1.5) 50 (1.5)	Fishers that land their catch at the Jomo Kenyatta landing site use mainly traps, gillnets, and hook and line. Fishers at Nyali and Marina use beach seines recently banned in Kenya (CRCP unpublished data).
Number of boats based at hotels	25-30	This number fluctuates increasing to 30 during the high season (KWS pers. comm.).
Number of community boats	15-20	This number fluctuates depending on the season peaking between Nov. and Jan. (KWS reports).
Number of visitors to the MPA	~10,000 residents ~30,000 non- residents	The number of visitors was impacted by two main events: 1) Beach Management Program caused an increase by ~ 65%; 2) Likoni clashes caused a reduction by ~ 25% (Muthiga 1998).
Revenue to MPA	~$50,000-180,000 per year	The revenue was negatively impacted by the Likoni ethnic clashes in 1997 decreasing by more than 50%.
Community projects	• Rehabilitation of Jomo Kenyatta beach • Infrastructure for fishers and boat operators • Moorings and code of conduct	• ~3,000 local residents utilize this beach every weekend • This consists of a building housing the offices of the Mombasa boat operators and fisher associations as well as facilities for processing fish • Moorings and a code of conduct were installed for use by all boats in the MPA (Muthiga 1998)

Resource Use and Conservation Targets

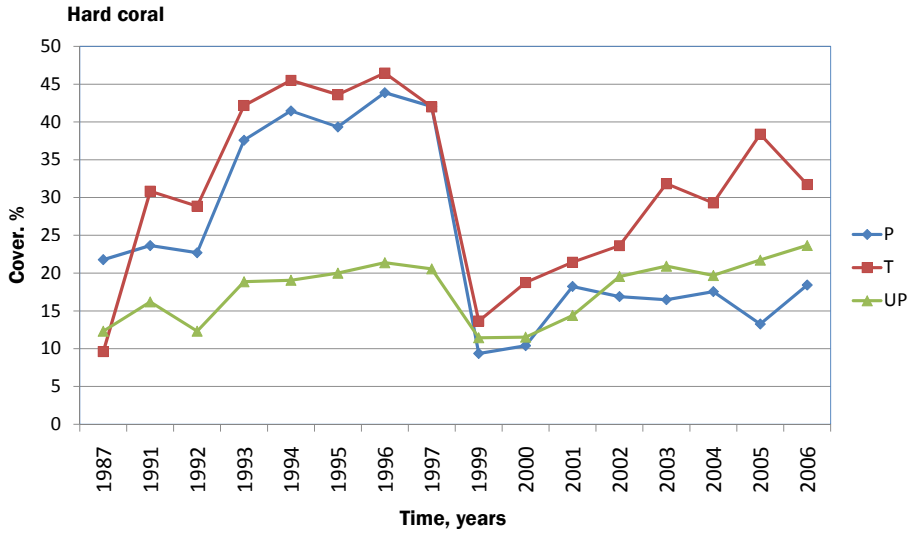
Although the management plan of the Mombasa MPA does not explicitly detail conservation targets, these can be derived from the broad objectives that include: 1) preservation and conservation of marine biodiversity; 2) provision of ecologically sustainable use of marine resources for cultural and economic benefits; 3) the promotion of applied research for educational awareness; and 4) community participation and capacity building (Weru et al. 2001). The main focus of management has been to restrict activities within marine parks and limit or manage activities within marine reserves that impact marine biodiversity and endangered species explicitly protected by law, such as sea turtles (Muthiga 1998).

In addition, since most of the tourism and fishing activities occur within the fringing reef of the reserve, the unwritten objective has been restoring the coral reefs to the "pre-exploitation" condition (Kavu pers. comm.). Fortunately,

data for indicators of coral reef health for Mombasa MPA can be derived from the Coral Reef Conservation Project's long-term monitoring of Kenya's reefs, which includes older MPAs (Malindi and Watamu), unprotected sites (Diani, Kanamai, and Vipingo), and the Mombasa MPA.

The reefs of the area were severely degraded prior to MPA establishment. After protection, coral cover increased from ~8% to ~45%—levels similar to the older MPAs (**Figure 2**). Coral cover was adversely affected at all reefs in Kenya due to bleaching-related mortality during the El Niño of 1997-98 (McClanahan et al. 2001), reduced from ~45% to ~10% in the marine park and 20% to 5% at Ras Iwatine, an area in the marine reserve (McClanahan et al. 1998). The rate of recovery of coral cover after the El Niño is variable amongst the MPAs with the fully protected Mombasa Park showing relatively faster recovery than some of the older MPAs, while there are no signs of recovery at Ras Iwatine in the reserve.

Figure 2: Coral cover in marine parks (Malindi, Mombasa, Watamu; solid circle), unprotected areas (Kanamai, Vipingo, Diani; open square) and Mombasa MPA (solid triangle) from 1987 to 2006. (Coral Reef Conservation Project)



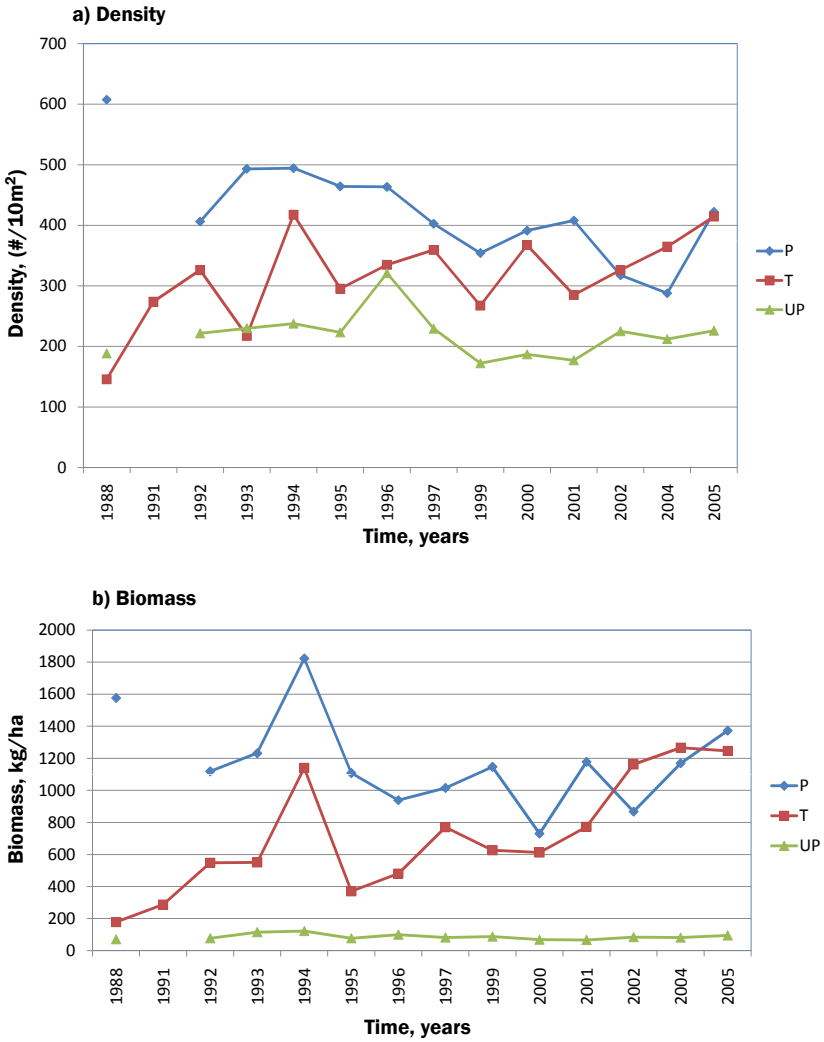
Protection from fishing had a large positive impact on the finfish density and biomass in the Mombasa Marine Park, increasing in 2005 from ~145 to ~400 individuals/10 m^2 in density and ~180 kg/ha in 1988 to ~1,200 kg/ha in biomass of key coral reef finfish families (**Figure 3**). (The trend in biomass shows a decrease in 1995 that was attributed primarily to the reduction in the size of the park from 12 km^2 to 10 km^2 [McClanahan et al. 1998].)

The biomass of the redline triggerfish (*Balistapus undulatus*)—an important predator of sea urchins—also showed a recovery in Mombasa MPA (McClanahan 2000) resulting in decreases in the sea urchin biomass from more than 6,000 kg/ha in 1987 to ~1,600 kg/ha by 2006 (**Figure 4**). Sea turtles are fully protected in the MPA through strict enforcement against poaching by KWS with the support of the Kenya Sea Turtle Conservation Committee (KESCOM).

Governance

The MPA is managed by a warden and rangers with support from a regional KWS office in Mombasa. Moorings have been installed for anchorage and to demarcate the park boundaries as well as the seaward boundaries of the marine

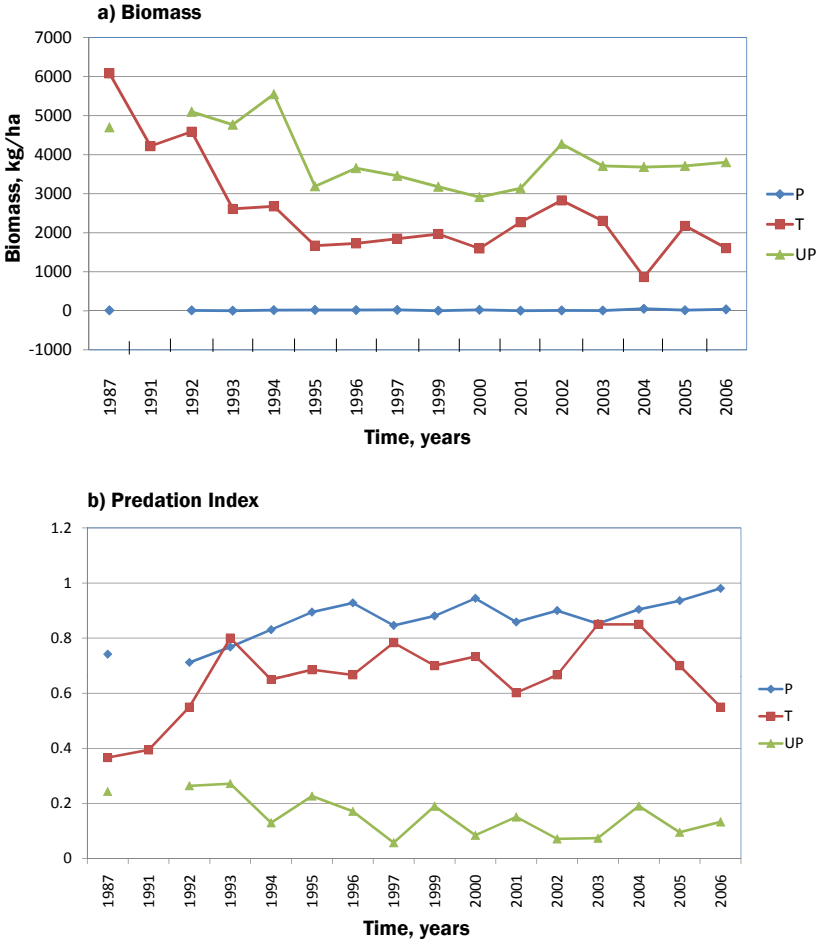
Figure 3: The a) density (#/10 m^2) and b) biomass (kg/ha) of finfish averaged for Kenyan marine parks (Malindi, Watamu; solid circle) and for the unprotected reefs (Kanamai, Vipingo and Diani; open square) and the Mombasa marine park (solid triangle) from 1988 to 2005 (Coral Reef Conservation Project annual monitoring database)



reserve. There are daily sea patrols and periodic beach patrols. The impact of the patrols can be derived from daily record of incidents and suspects in the Occurrence Book. Suspects include persons apprehended fishing in the park and poaching turtles, while incidents are mainly conflicts between MPA staff and users or between legitimate users and suspects. Between 1988 and 1998, there was a reduction in the number of suspects and incidents, indicating that compliance has improved. Whether the improvement in compliance is due to enforcement or acceptance of the status quo over time by the users of the MPA is not known. However, a study of perceptions by local communities of MPAs in Kenya indicated that perceptions generally improve the longer the MPA is in existence (McClanahan et al. 2005).

The first assessment of management effectiveness of the Mombasa MPA was conducted in 2003 as part of a regional assessment that included Kenya, Tanzania, and Seychelles (Wells 2004). Results indicated that the Mombasa MPA was relatively well-managed with implementation of management strategies that broadly met the requirements of the MPA, including liaison and

Figure 4: The a) biomass of sea urchins (kg/ha) and b) predation index on Echinometra mathaei averaged for Kenyan marine parks (Malindi, Watamu; solid circle) and for unprotected reefs (Kanamai, Vipingo and Diani; open square) and for Mombasa marine park (solid triangle) from 1987 to 2006. (Coral Reef Conservation Project annual monitoring database)



conflict resolution, enforcement, revenue collection, research and monitoring, awareness, and community projects. The marine park was also meeting the broad goals of biodiversity conservation based on recovery of key indicators of coral reef health (Muthiga 2006).

The effectiveness of marine reserve management was more difficult to measure because the objective of "sustainable fishing in order to improve livelihoods of local communities" lacked clear indicators. The community in question was not sufficiently identified at the outset and no socio-economic assessments had been carried out prior to establishment of the MPA. However, pre-establishment ecological data were available for Ras Iwatine, an important reef site within the reserve that lies almost at the center of the main fishing grounds. Ras Iwatine reef has shown poor signs of recovery with continued low coral cover, low fish biomass, and high urchin biomass (McClanahan et al. 1998). It is unlikely that this reef is providing a sustainable source of livelihood for the local fishers.

Apart from continued overfishing of the shallow reefs of the reserve, the use of illegal gear (beach seines) is a concern. Although there have been meetings between the fisheries department, the marine reserve fishers, and scientists from Coral Reef Conservation Project (CRCP) and KWS regarding this problem, beach seines continue to be used in the reserve. This can be attributed in part to jurisdictional conflicts between the KWS and the fisheries department.

Displacement of Use

It is difficult to quantify exactly how many local people were displaced by the MPA, first because no data exists for the various users of the area prior to gazettement, and secondly because a segment of the users of the MPA are transient, especially fishers, who have a 60% immigration rate (Cinner et al. 2007). Nonetheless, the fishers that land their catch at the three landing beaches adjacent to the MPA, the community boat operators, and the informal beach traders are considered as the main groups that were impacted by the MPA. These are also the groups that interact with KWS on an almost daily basis.

A major change in resource use was the reduction of fishing allowed in the MPA. An area of 10 km^2 is now off limits to local fishing communities (except for access and anchorage purposes). Given that the reserve is 200 km^2, this reduction in area may not seem large. However, because most of the fishing was artisanal and concentrated in shallow coral reef and seagrass bed habitats, making this area off limits may have had a larger impact than expected on the livelihoods and food security of the local community.

After gazettement, the number of fishers initially decreased from 102 to 33 (McClanahan and Kaunda-Arara 1996). Fishers at Shanzu (opposite the marine park) were the most negatively impacted and adopted an attitude of defeat. Marina and Nyali fishers were the least affected as they were fishing on the outer edges of the MPA, and Kenyatta beach fishers moved to Marina and Nyali landing beach, retired, or looked for other work (Glaesel 1997).

Currently there are 20-30 community glass bottom boats and an unknown number of beach traders. The dynamics of these groups was affected by the establishment of the Beach Management Program (BMP) by KWS in 1998, which was intended to harmonize MPA management operations while improving revenue collection (**Box 1**). The BMP reduced MPA fees, allowing the community boats to attract more visitors, and increased the number of boat operators. The number of beach traders decreased because of the requirement for registration and limits to designated areas of the beach. However, the dynamics of these groups changed again upon the collapse of the BMP (Mr. Wakaba pers. comm.) and unfortunately, despite the benefits that the BMP brought to most of the stakeholders, there is no indication that such a program will be initiated in the near future.

Box 1: The Beach Management Programme: An alternative concept in MPA management

The Beach Management Program was initiated as a joint agreement between KWS and hotels adjacent to the Mombasa MPA. Hotels signed an MOU to collect US$0.50 per bed night and remit the funds to KWS. In return, KWS maintained security on the beach and provided beach cleaning services in collaboration with the Mombasa Boat Operators Association (MBOA) and hotels. MBOA benefited through help with registration, boat equipment, and reduced annual boat fees. The hotels benefited through improved security and less harassment of their guests on the beach, lowered park fees for their guests, and cleaner beaches adjacent to their hotels. KWS benefited through a timely and less cumbersome method of revenue collection, thereby releasing their resources to concentrate on the primary task of protection of biodiversity. A BMP Advisory Committee was formed to provide oversight for the program. Though initially successful, the program developed problems when the tourism sector experienced reduced revenues after the Likoni ethnic clashes of 1997, which caused delays and default in payment of the fees collected. After several unsuccessful attempts to develop a legal framework to guide the BMP, the program was finally abandoned by KWS in 1999.

Relations between MPA and Local Community

The stakeholders of the Mombasa MPA are a dynamic group that includes fishers, boat operators, hotels, collaborating institutions and NGOs, and people employed in the informal sector or utilizing the waters and the beaches for recreation. It is difficult to clearly differentiate the "local peoples" of the MPA because the criteria of residency that can be used in terrestrial protected areas are not valid in the marine realm.

At the inception of the MPA, relations between the local community and the park service were very poor, to the extent of near violence on the beach (Opiyo pers. comm.). Fortunately, at the time of MPA establishment, KWS was undergoing a policy change under the Protected Area and Wildlife management program (PAWs), steered by the well-known conservationist Dr. Richard Leakey, which led to a general professionalism and improved management within KWS as well as the creation of an enabling environment for participation of communities living adjacent to protected areas (Norton-Griffiths 1998).

Relations between the MPA and stakeholders slowly improved depending on the particular stakeholder group and the initiation of community projects (**Table 3**). The boat operators—who were typically more educated and easier to organize—were first to improve their relationship with the MPA, probably due to the fact that they received tangible benefits within a short time (Muthiga 2006).

Table 3: Community initiatives at the Mombasa MPA

Component	Activity	Comments
Training	Basic marine biology; visitor handling; mooring installation; boat maintenance and repair; business management and code of conduct	Funded primarily by USAID ICAM project and the KWS/Netherlands Wetlands Conservation and training program
Awareness	Marine Environment Day (annual); International Coastal Clean-up (annual); turtle walks; brochures, posters, fact-sheets; school programs; periodic beach clean-ups	In partnership with Wildlife Clubs of Kenya, KESCOM, Baobab trust and other NGOs
Vessels	Provision of a fibreglass boat to the fisher community	Provided under USAID funding, the boat is intended for fishing
Boat repairs	Branding of MBOA; repair of fisher and boat operators vessels; provision of snorkelling and safety equipment; provision of boat repair tools	Funded primarily by USAID ICAM project and the KWS/Netherlands Wetlands Conservation and training program
Infrastructure development	Public access to the Jomo Kenyatta Public Beach; fishers storage and meeting office; MBOA booking office; rehabilitation of ablution block; rehabilitation of portable water facilities	Funded primarily by USAID ICAM project
Research and monitoring	Fisheries and ecological monitoring	In partnership with CRCP/WCS , KMFRI and CORDIO

Although relations also improved between the fishers and the MPA, when interviewed, fishers still express resentment about excision of their fishing grounds (McClanahan et al. 2005a). Fishers derived benefits from donor projects, such as the rehabilitation of landing facilities and repair of fishing boats. Although these facilities improve working conditions, as long as fisher livelihoods stagnate due to depleted fish stocks in the marine reserve, their perception of the benefits of the MPA will continue to be poor. In 2006, the Coast Development Authority (CDA) provided a boat to the Shanzu fishers association to allow them to fish further off the reef, but it is too early to tell how this release of fishing pressure will impact fish stocks and livelihoods.

The relationship between the coastal community at large and the government has evolved in an atmosphere of marginalization, first by the Arabs and Europeans and later by people from inland, referred to as "upcountry" people (Cooper 2000; Wolf 2000) that resulted in the loss of land, and increased competition for jobs and coastal resources. The continued poor performance in many social indicators such as health, education, and economy of the coast province and the amplification of the feeling of marginalization by politicians has led to increasing demands for "Majimbo" (regionalism) as well as political Islamism. Although there had always been tension between coastal and upcountry peoples, it had not turned violent until the Likoni riots/raids of 1997 (Wolf 2000). It took the government a month to quell the violence, which left 80 people dead and hundreds maimed and displaced (KHRC 1997). Revenue from tourism dropped by 40%, and thousands of jobs were lost, all of which increased the prevailing perception of government neglect. Coastal people had generally supported the ruling party Kenya African National Union (KANU) until the 2002 elections when the province voted predominantly for the opposition. This has created an understanding that the coast province can impact the general election and there has been intense lobbying to address the perceived imbalances in this province (Wolf 2000).

Lessons

Improving conservation and management of the MPA – Unfortunately, all of Kenya's MPAs were established without the usual management planning processes: Management plans were only developed in 2000, and management effectiveness assessments (MEA) were only carried out in 2003 (Wells 2004). Although the MEA reported the Mombasa MPA as relatively well-managed in terms of administration, mechanisms for higher-level strategic processes that support biodiversity conservation were poorly developed. This is due to the lack of a wildlife policy and regulations specific for MPAs, and a management plan that lacks endorsement and incorporation into district development plans. In addition, an advisory committee to improve stakeholder participation in decision making and conflict resolution was never implemented. Hence activities such as pollution, fisheries, and tourism that are outside the jurisdiction or overlapping with the MPA can still potentially impact the MPA.

In the last decade, the KWS has experienced changes in its administrative and management structure, including the move to three different ministries (Ministries of Environment and Natural Resources, Office of the President, and Tourism and Wildlife) and changes in strategic policies implemented by five different directors. This has had a destabilizing and demoralizing effect on the institution and on the management of MPAs (Muthiga 2006).

Understanding your target community – One of the major factors limiting the success of livelihood projects is a lack of understanding of the target community. Although a general description of the various stakeholders of the MPA is

available, no in-depth socio-economic assessment has been carried out and only recently has the fisher community been surveyed in some detail (Cinner et al. 2007).

Improving fishing practices – Improved management of the fishery in the marine reserve can be achieved primarily by removing the illegal and destructive beach seines and encouraging the use of traditional gears, such as traps that have been shown to have a higher catch per fisher while causing little habitat damage (McClanahan and Mangi 2001). There is also scientific evidence from Diani in the south coast of Kenya that removal of beach seines results in increased finfish biomass. Better management of fishing activities in the Mombasa MPA would improve fisher livelihoods and biodiversity conservation. However, although Mombasa fishers have been exposed to this evidence at meetings conducted by CRCP/WCS and the fisheries department, the fishers have not voluntarily stopped using this destructive gear. The solution requires a joint effort by KWS and the fisheries department to remove illegal gear, followed by surveillance in collaboration with the fisher community.

Improving fishing technologies – An understanding of the prevailing social conditions prior to introducing alternative livelihood mechanisms could help minimize conflict. A conflict is already emerging between the Shanzu fishers association and MBOA. The Shanzu fishers plan to use the boat they were given to fish further out in the reserve, as a tourism vessel during periods of inclement weather. The MBOA views this as competition from a group that has not put any investment into the boat operator business (Shanzu Fishers Association Chairman pers. comm.). Given that tourism activities bring higher earnings than fishing (Malleret-King 2000), this conflict may intensify. In addition, evidence indicates that fisher groups in Kenya are not skilled enough to take up offshore fishing in Kenya. For example, a project initiated by KWS in the Mpunguti marine reserve in southern Kenya that provided boats, engines, and nets in exchange for illegal gear failed after a few years, primarily because of the lack of capacity of the fishers to fish offshore or maintain the large nets and engines (Warden Kisite-Mpunguti).

Tourism development opportunities – The evolution of the MBOA is one of the success cases of communities benefiting from MPAs. The MBOA has grown into a viable community enterprise (Bess 1992) and currently dominates the glass-bottom boat business in the Mombasa MPA. The key ingredients that led to success were: 1) the support from KWS on an almost daily basis during the early days of its growth; 2) the cohesion amongst boat operators that allowed for ease in registration and management; 3) the ready supply of visitors; and 4) the early financial returns.

Summary

Successful MPAs are usually characterized by: 1) effective MPA management; 2) viable community organizations; 3) sources of livelihood; and 4) liaison with government and NGOs. All these factors are present at varying degrees in the Mombasa MPA. Despite difficulties at inception, the realization of the relationship between conservation and livelihoods, food security, and ecosystem services has led to improved collaboration between the management authorities and stakeholders.

1.4 Opportunities and Constraints for Protected Area Management through Increased Connectivity to Local Livelihood Needs in Surrounding Border Areas: Lessons from Luangwa Valley, Zambia

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Protected areas (PAs) in Zambia consist of 18 national parks, 181 national forests, and 304 local forests, representing 19% of the country's total land area, and provide the highest level of biodiversity protection by excluding human settlements and most other forms of human land use. Designated authorities manage these areas as government properties on behalf and for the benefit of Zambian citizens to protect selected species and habitats while promoting tourism and healthy watersheds. Performance is tied to laws and policies governing the use of PAs as well as professional staff capacity and support needed to implement these laws and policies. To sustain this process for national parks, the government instituted a semi-autonomous management authority in 2001—Zambia Wildlife Authority (ZAWA)—to generate its own financing for meeting PA management costs.

While the Zambian Forestry Department remains funded through government, ZAWA offers an interesting model emulated by other countries (Uganda, Tanzania) that provides a business approach to national park management. Fulfilling this self-financing directive has necessitated a shift in strategies and management priorities for ZAWA's mandate to conserve wildlife species and habitat. Consideration for how national parks might contribute to rural people's livelihoods in surrounding border areas has received a low priority relative to more urgent needs of meeting ZAWA's own operating costs.

ZAWA's management approach remains largely focused on law enforcement in terms of keeping people out of national parks, rather than complementary strategies of keeping people on community land and environmentally acceptable land use practices. As ZAWA continues to build law enforcement and self-financing capacity for national parks (NPs), various agents promoting the commercial use of land outside NPs have attracted growing relevance to the needs of poor rural people. Agricultural, mining, timber and livestock interests typically promote land change away from wildlife-compatible uses, which can have unpredictable and high-cost consequences on wildlife resources, both in and outside NPs. Legal arrangements for mitigating these conflicts outside NPs are often unclear and politically unacceptable, making effective deterrents to these activities difficult.

The assumed solution to this problem is a well-managed park with a high volume of tourists that will generate enough revenue to promote better cooperation and conservation-centric values among surrounding communities. There are critical conditions to this assumption, and in most cases, including Luangwa's five NPs, they are not met: (1) PA commercial benefits are felt at the household level; (2) tourism benefits reach people in greatest need and thus most likely to degrade natural resources; (3) the transition to a NP becoming a successful tourism destination is relatively quick and supersedes competing land interests around the park; and (4) economic transfers to surrounding communities from NP-based enterprises are reliable and sufficient to compel households to abandon practices not compatible with wildlife management.

Current park management strategies in Zambia generally fail to address these livelihood connections and lack synergy with existing stakeholders. These strategies also focus almost exclusively on tourism-based markets and ignore opportunities of supporting non-tourism based markets that are perhaps more relevant to surrounding communities and their relationship to wildlife resources NPs seek to conserve.

This paper draws upon four years of field experience testing an approach in Luangwa Valley that uses markets in a broader context for organizing rural communities and conservation stakeholders into a stronger alliance to address both PA management and local livelihood needs. The approach, called Community Markets for Conservation (COMACO), uses a triple bottom-line business model that regards food security, household income, and conservation as inextricably linked and fundamental for sustaining rural development and cushioning the human "footprint" in a landscape. Results show that integrating non-tourism markets around critical conservation requirements is a viable approach to PA management. Results also suggest that the approach becomes increasingly viable as key PA stakeholders invest in it and secure additional returns to their tourism-based markets.

Physical and Ecological Setting of Luangwa Valley

Luangwa Valley lies between two escarpments, which delineate the elevational divide between the valley floor that spans about 10 km in width in most locations and the surrounding plateau. The valley itself extends for over 795 km. Luangwa's watershed is made up of many separate drainages that extend into the plateau area and feed into the Luangwa River. Across much of the valley floor, soils are generally clay and unworkable for agriculture, and thus settlements are largely restricted to alluvial soils along the tributaries of the Luangwa River. In contrast, farming is more evenly dispersed across the plateau where soils are better drained and more easily plowed.

The Luangwa Valley is an important stronghold for wildlife in part because chronic episodes of drought and floods have limited agricultural development, tsetse flies limit livestock, and poor soils constrain farming activities in many areas. With approximately 23% of the valley floor designated as national park, and approximately 80% of the surrounding area unsettled, the Luangwa Valley supports key populations of such charismatic species as elephants, hippos, lion, leopard, wild dog, buffalo, eland, and roan antelope. Luangwa Valley supports the largest hippo population in Africa and one of the largest lion and elephant populations in the region.

Socio-economic and Demographic Setting

Communities in both the valley floor and plateau areas remain traditionally organized around local chiefs and their respective village headmen. Residents are largely subsistence farmers with varying degrees of natural resource dependence, generating much of their income from small-scale farming of select cash crops. Mean family size is 5.5 and annual household income is below $150 (Lewis et al. 2000a).

Over the past decade, cotton and tobacco have gained an increasing share of farmers' time, providing on average 93% of household income for families living in the plateau and 59% for selected communities in the Valley (Lewis and Travis 2006). Due in part to such factors as soils, unfavorable climate, and crop damage from wildlife, valley households experience chronic food shortfalls.

Growing evidence suggests that the dependence on cotton as a cash crop does not improve food security and it may even reduce farming effort to produce food crops. From a random sample of 73 farmers who did not grow cotton and 39 who did, levels of food security were 56.2% and 51.2% respectively, suggesting that added income from cotton farming did not provide improved food security.

For both NPs and national forests (NFs), village settlements are in close proximity to protected area boundaries. In such cases, PAs provide important natural resources that help support the livelihoods for many families, and in some cases, families shift inside PAs to gain greater access to these resources. It is estimated that over 400 households currently farm in Lundazi National Forest, mostly cotton, and in 2005, 47 households farmed tobacco in Lukusuzi NP (D. Lewis, unpub. data). Illegal hunting, tree cutting, mining, and fishing are the more common forms of resource extractions practiced in Luangwa's PAs. For valley floor communities living close to NP boundaries, population densities are generally less than 10 people per km^2. One key exception is the Mfuwe region where commercial activities associated with tourism have contributed to an influx of people and the density exceeds 30 per km^2.

Protected Areas and Management Status

Luangwa Valley catchment area contains five NPs and eight national forests (NFs), which collectively represent approximately 35% of the total watershed area. **Table 1** summarizes their spatial features and current management status. During much of the 1970s, illegal hunting of elephants and black rhinos erupted on a commercial scale, resulting in the extinction of the black rhino and a reduction by more than a third of the valley's elephant population. An intensive law enforcement program, Save the Rhino Trust, operated to help contain this threat. During the 1980s and 1990s, government instituted multiple programs (LIRDP and ADMADE) to increase community support for wildlife management by returning wildlife revenues generated from safari hunting outside the NPs to local authorities to support community projects and hire community scouts. These efforts declined during the early 2000s when the wildlife management authority was restructured and the focus shifted to other priorities of supporting the operating costs of NPs.

Protected Area Conflicts with Surrounding Land Use Pressures

Both NPs and NFs are relatively effective at conservation because they exclude the adverse effects of human settlements. Border area disturbances that arise from increased human activities around PAs undermine this conservation potential and consequently limit opportunities for building markets that could pay for PA management costs. Border area disturbances affecting Luangwa's PAs include the following and represent real challenges to sustaining biodiversity conservation:

Wildlife snaring – Food insecure families living in areas where wildlife is an available resource sometimes compensate for poor farming results by snaring wildlife and using game meat for barter. This coping strategy is widely practiced in Luangwa Valley by relatively poor, unsuccessful farmers and in previous years accounted for annual losses of over 3,000 wild animals (Lewis and Travis 2006). Among those species affected are those with high aesthetic appeal for game viewing and trophy hunting (carnivores and large-bodied horned animals). Wire snares are typically set along game trails or at water holes, are difficult to detect by wildlife police officers, and do not require much skill to use.

Table 1: Status of protected areas in Luangwa Catchment

National Parks in Luangwa Valley Catchment			
Name	Hectares	Date	Status
South Luangwa	858,777		Stable
North Luangwa	466,420		Stable
Lukusuzi	261,516		Declining
Luambe	35,623		Declining
Nyika	1,1414		Stable
National Forests in Luangwa Valley Catchment			
Name	Hectares	Date	
Chire	2,765	1979	
Fibale	1,720	1977	
Lundazi	374,800	1978	
Makutu	38,849	1953	
Machinje Hills	5,581	1978	
Machinje	67,380	1970	

Wildlife poaching – Traditionally, local hunters in Luangwa Valley were controlled by their local chiefs, who accessed much of the meat. Today, hunting is less traditional, and hunters utilize the meat in various ways: for personal consumption, to barter for farm labor, or for sale. Valley hunters kill on average over seven animals annually, and prefer to hunt larger-bodied animals for more meat. Despite a relatively high risk of being apprehended by ZAWA scouts (52% of 25 hunters interviewed had previous arrest records), hunters continued to poach as they earn three times more than non-hunters, with approximately 60% attributed to the sale of illegal game meat (Lewis et al. 2001).

Fires – Fires are caused by local residents to clear agricultural fields, remove wild honey, clear cover along roads, etc. They sometimes spread across large areas, removing significant portions of groundcover and often killing trees weakened by the effects of bark browsing by elephants.

Tree-cutting and habitat loss – For families living near major roads, the conversion of trees into charcoal for quick cash has become a growing cause of tree loss in parts of Luangwa's watersheds. A more serious loss of trees comes from the need to clear new farmland as a result of poor farming practices that leave soils exhausted after three or four years, especially when planted with cotton. In the plateau area where cotton farming is more widespread, the need for fertile soils have pushed farmers to till crops on hill-sides where soil and rainwater run-off has likely contributed to a growing incidence of down-river flashfloods and crop loss on alluvial soils (Heatwole pers. comm.). The same demand for fertile soils contributes to encroachment into PAs.

Over-fishing and depletion of native fisheries – The Luangwa River is a boundary for three of Luangwa's NPs. It is also a common source of fish protein for household consumption and local markets. The river is an open-access resource with minimal controls on fishing practices, putting these native fisheries, which

support other key food chains associated with PAs, under increasing threat. Fishing activities are often in areas where wildlife is found. As fishing success declines, the opportunity of disguising fishing activities as a cover for wildlife snaring becomes more likely. Moreover, the mere presence of large numbers of fishermen in wildlife sensitive areas has potential negative effects for both game viewing and trophy hunting.

The COMACO Model: Adapting Market Incentives and Market Alternatives to Conservation

As illustrated from the examples above, conservation challenges facing Luangwa Valley are diverse, complex, and often rooted in basic livelihood needs of food security and income. Far too many people are engaged in destructive land use practices for government authorities to effectively regulate through conventional law enforcement. As these conservation-mandated authorities utilize their limited budgets to reduce illegal incursions into Luangwa's PAs, proactive efforts to address land use pressures outside PAs become constrained by cost and scale.

Many of the threats affecting Luangwa Valley involve tens of thousands of families across large landscapes. With limited road access, the potential cost of seeking out individual households to influence a change in land use behavior is high if not prohibitive. Moreover, the high level of illiteracy and lack of skills among many residents would challenge almost any effort to change livelihoods. The one unifying and overwhelming factor currently shaping land use practices around Luangwa's PAs are markets, driven by either illegal pursuits or external interests motivated by cheap labor and cheap land.

The key question that arises from this is whether this same market influence can be reconfigured to build positive synergies between farm-based commodities and conservation in ways that would lead to reduced threats around PAs. PAs will not provide sufficient inducement for communities to give up farming and ties to agri-business, whose production practices generally do not help conserve wildlife and watersheds. Therefore a reconfiguration of rural markets will need to be systemic, competitive, and conservation-based.

To meet these criteria, the Community Markets for Conservation (COMACO) business model was designed with the following key operational components:

- Promote commodities that minimize conflicts with wildlife habitat.
- Focus on commodities most all households can produce, especially unskilled producers.
- Give preference to commodities and production practices that also contribute to food security.
- Emphasize production practices that build soils, protect trees, and conserve water.
- Add value to desired commodities by processing raw commodities into finished, packaged, consumer-popular products.
- Pass on increased product value to producers as an incentive to remain compliant to better production practices while maintaining sustainability of the process itself.
- Target selected households with added incentives for achieving specific conservation results.
- Increase purchasing capacity through stakeholder alliances to leverage continued compliance to land use plan.
- Out-compete commodities or markets that threaten PAs and associated natural resources.

The model was built around a limited-by-guarantee, non-profit company registered in Zambia with liability shares held by participating communities and their implementing partners, namely the Wildlife Conservation Society (WCS). Called the Conservation Farmer Wildlife Producer Trading Centre (CTC), the company operates a franchise of regional trading centers, each of which are linked to a set of local trading depots that provide trade and extension support to over 30,000 farmers organized as registered producer groups in six districts and two provinces.

COMACO offers increased producer prices and improved production practices for groundnuts, rice, and soybeans to its producer group members. Parallel support in the form of extension training is also provided to improve production of key food crops, particularly maize and sorghum, through a combination of zero-tillage, composting, and crop rotation with legume cash crops, as well as through the introduction of other food crops, such as cassava. Further diversification of markets includes poultry, non-timber forest products like honey, and farmed fish.

In exchange for improved market benefits and extension services, producers are asked to abandon snaring, illegal hunting, and burning of crop residues and remain compliant to desired farm production practices. Access to improved prices offered by the CTC also requires participating communities to develop land use plans that work toward reducing threats to the PA. Initial start-up investments in this model came from relatively small grants with an annual operating budget of about $110,000 per CTC and from in-kind assistance of donated maize provided by World Food Program (WFP) to enable food insecure families to take the necessary time and effort to learn improved farming practices. From 2001 to 2006, WFP provided 11,399 tons of food to 46,973 households to help COMACO establish farmer-based producer organizations to trade farm surplus with COMACO CTCs.

Results: Business Performance, Conservation Gains, Sustainability

COMACO has operated since 2002, initially with the support of the WFP to help develop farmer producer groups increase crop yields to where commodity surpluses could support the business model. In 2004 the first trading center began operating, and in 2006 and 2007 two more were established with support from the Royal Norwegian Embassy.

Business performance – The COMACO business model employs key strategies for enhancing revenue growth to sustain trade incentives necessary to attract more rural producers to comply with COMACO-based conservation guidelines on a scale that will achieve a significant impact. These are:

- High quality, safe products[1] with a unique and well-advertised brandname, *It's Wild!* that consumers recognize are good for Zambians, help the rural poor, and promote conservation.
- Sufficient commodity volume to reduce transaction costs, making products competitively priced.
- Producer loyalty by promoting a diverse and environmentally safe set of commodities that producers can sell through their local depots at competitive producer prices.
- Sustainable extension services financed from commissions paid for transactions at depots.

- Accurate public updates through various media on COMACO's impact on food security, rural income, and conservation to leverage consumer support for *It's Wild!* Products.
- Strict operational controls and internal audits to reduce waste and risk of fraud.

Based on these principles, COMACO operates each of its CTC franchises with business management teams that coordinate commodity purchasing, storage, shipment, processing, inventory, accounts, and product distribution. The first CTC was in Lundazi in 2004 and Mfuwe and Fiera CTCs began operating in 2006 and 2007, respectively. Three years of business activity for Lundazi and early trends at the other two CTCs suggest net revenue gains are achievable in about three years. Further, start-up costs for new CTCs decline as cost-sharing opportunities increase as more CTCs are established. This can be seen in:

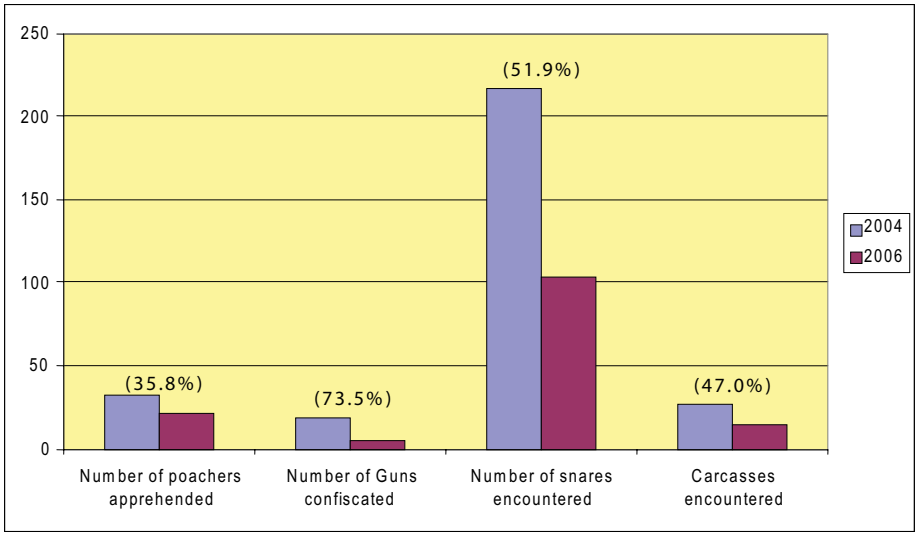
- Growth in volume of commodities traded at Lundazi CTC, which grew from 168 tons in 2004 to 486 tons in 2006,[2] when the Lundazi franchise made its first net revenue gain.
- Pricing of commodities against the US dollar has increased from between 100% and 300% for the different commodities traded versus prices offered to producers before COMACO.
- Urban market penetration of COMACO products has increased 20-fold in 2006 with a 30% price increase for *It's Wild!* rice.
- Product quality has increased appreciably based on an over 50-fold increase in retail shop requests for *It's Wild!* products in 2006.
- Increased production of certain grain commodities has made it cost-effective to recover and transport desirable seed varieties from Lundazi CTC to farmers at the other two CTCs.
- Transport coordination between the CTCs has reduced the cost of input deliveries for farmers and output deliveries to market distribution centers.

Conservation gains for PA management and species protection – COMACO actively trades with over 10,000 producers, of which 52% are women. Its policy of ensuring all transactions are done within the community at local trading depots has enabled women as well as men to access fair market prices not previously available. In addition to paying optimum prices for locally-produced commodities, COMACO offers bonus prices to producers when their respective producer groups demonstrate compliance to production practices that promote conservation, such as zero-tillage farming with compost or maintaining an apiary with a required-size firebreak. Because of COMACO's high visibility in the community as a friend and partner for trade, the program is able to more easily identify people who represent threats to selected resources. One such group includes local poachers who hunt without licenses. Another is farmers who depend on snaring to make up for food-shortfalls.

The combination of high volume trade, incentives to sustain producer commitment to improved production practices, and an effective outreach to producers has enabled COMACO to leverage significant conservation gains for both PA management and species protection. While some of these results were facilitated initially with the use of WFP maize, data suggest these results persist when market incentives replaced the WFP maize. Results describing conservation gains include:

- Significant reduction in local hunters actively poaching based on 317 hunters who surrendered their firearms, joined a producer group, and received training and inputs to derive alternative income. Only eight returned to poaching and total income from legal sources for those benefiting from COMACO has increased on average by more than 100% (Banda unpub. data).
- Over 40,000 snares were surrendered by farmer group members in compliance to conservation guidelines to abandon snaring in exchange for adopting better farming practices. Independent assessments show a significant reduction in use of snares was maintained when COMACO markets replaced the WFP maize (see **Figure 1**).
- Increased reliability and pricing of COMACO markets in compliance with conservation guidelines has contributed to growing numbers of farmers abandoning cotton and charcoal-making in preference to COMACO commodities. In the valley floor areas, 574 farmers have abandoned cotton farming in preference to rice, and on the plateau approximately 560 farmers have stopped making charcoal in preference to bee-farming and fish-farming.
- Incidence of fires originating from local burning of crop residues has declined in the valley floor areas as farmer groups remained compliant to farming guidelines in response to increased crop yields and bonus incentives.[3]
- Positive population growth trends for wildlife species monitored has occurred in COMACO areas adjacent to South Luangwa and North Luangwa NPs with significant increases for groups representing large-bodied, low-density species (Lewis and Travis 2006).
- Survey data suggest a reduced snare-related mortality of carnivores.[4]
- In the initial COMACO areas (four chiefdoms), the program has transformed 96% of all illegal hunters in these areas, essentially removing the local poaching threat from these areas.[5]
- Where COMACO does not exist, wildlife census results reveal greatly reduced and near depleted populations for most species (Lewis and Travis 2006)

Figure 1: Law enforcement trends from COMACO areas collected by ZAWA



Sustainability

There are two levels of sustainability relevant to this paper: actual financial sustainability of the COMACO model as a rural trading scheme and relative sustainability of COMACO's influence on conservation as compared to conventional management approaches. With regard to financial sustainability, COMACO has realized a slightly better than break-even sustainability at Lundazi in 2006 by increasing volume of sales, improving product value, improving consumer product brand appeal, and keeping transaction costs low.[6] Issues regarding costs related to insurance against crop failure during a natural disaster, property loss, capital replacement, or unexpected surges in commodity purchases remain problematic for planning future growth and sustainability.

By showing fairness in pricing and offering continued extension support in training for new life skills, producer loyalty is high and provides increased assurance that COMACO will maintain the critical volume of commodities needed to sustain CTC operating costs. Moreover, when snaring and poaching are reduced, it can increase community income derived from the legal sale of wildlife as wildlife numbers increase.[7] These win-win situations have further motivated community leaders to contribute substantial cost-savings to COMACO by allowing free access to community storage sheds and increased commitment to promote COMACO within their community.

As a by-product of its business model, COMACO contributes a significant cost-saving to conservation relative to more conventional ways of addressing conservation threats. COMACO targets potential producers who are low income and prone to being food insecure, who live in remote areas, and who are most likely to rely on destructive uses of natural resources as a coping strategy. By providing them with alternatives to poaching, snaring, over-fishing, or wasteful tree-cutting, the cost of mitigating these threats becomes converted into a net revenue gain as these producers pursue COMACO market incentives and add to the volume of COMACO sales.

In the case of local hunters, COMACO spends more to reduce their dependence on particularly destructive livelihoods and seeks grants to cover these costs. For example, converting a poacher to an alternative livelihood requires training and inputs, which costs approximately $600 per poacher. By having access to trade benefits from a CTC, the hunter has a greater than 90% chance of abandoning hunting. To arrest the same person by employing wildlife scouts and bringing him to court costs up to $3,500 per poacher. This illustrates the added value of how the COMACO model can make conservation more sustainable.

The COMACO process has proven flexible enough to adjust to newly emerging land use threats at varying scales. In addition, if one individual household is doing something unsustainable and contrary to the COMACO agreements, such as vandalizing bee hives, all the residents of that village can be denied incentives. Using this approach, the families and local leaders spend their own time and energy to resolve the problem to regain access to trade benefits, thus reducing the need for more costly external interventions.

Improved Stakeholder Relationships for Building Strategic Partnerships

As data suggest, COMACO contributes to the security of PAs and commercial interests associated with these PAs. Ironically, COMACO is not a direct beneficiary of commercial interests associated with PAs, though it contributes to

their economic success. The primary beneficiaries for wildlife-based tourism, for example, include ZAWA, tourism and safari operators, and community authorities who derive a share of license sales. None of these entities have the infrastructure, mandate, or means to sustain the scale of rural markets as practiced by COMACO. Innovative alliances and support among these stakeholders in promoting COMACO's success will strengthen its advantage over harmful, competing land uses.

With the addition of relatively minor financial capital to COMACO, CTCs could sustain well-targeted bonus incentives to enhance financial returns, offset potential threats, and give increased value to growing a desired commodity. For example, a safari operator could be facing a serious problem when a prime hunting area is disturbed by fishermen who are unwilling to shift. If the safari operator were to contribute an additional 20% mark-up to the price paid by COMACO for rice grown by these fishermen, the economic returns to growing rice would far exceed fishing and the net potential gains for all parties would include: 1) COMACO gains more rice for sales; 2) the safari operator has a less disturbed hunting area with more successful hunts at a small investment cost; and 3) fishermen become more prosperous rice farmers and agreeable to reducing wildlife disturbances. COMACO is negotiating such arrangements with three safari operators.

Increased trade drives COMACO's competitive strength in resolving conservation challenges around PAs and its ability to do this is based on CTC's capacity to center livelihoods around markets that lessen the risks to a selected PA. ZAWA is potentially the most important stakeholder in this regard and could serve its own interests by supporting COMACO in this task. Discussions have begun that explore the development of a wildlife scout food pack (Matokwani, pers. com.) assembled from various COMACO food products (soybean meat analogues, peanut butter, rice, and honey) that would sustain scouts on multiple day patrols. By reinvesting wildlife revenues back into conservation-compliant communities by buying commodities that go into the food packs, ZAWA helps reduce the pressure on the PAs to improve the PAs.

Expanding the Model for Broader Ecosystem Management Applications

As the initial CTC franchises provide data on the exact cost of replicating new CTCs and ways to build a shared and growing market for COMACO products, the COMACO model provides a strong foundation for an investment scenario that could expand its network to strategic locations throughout the entire Luangwa Valley ecosystem. Through such an expansion and by tailoring support for production practices and commodities, the expanded model becomes in effect a "firewall" against illegal or inappropriate market influences on the Luangwa Valley ecosystem. Moreover, the model supports a long term process for replacing household coping strategies that rely on local extraction of natural resources with a business approach that invests in developing household skills among poor families to foster food self-reliance and enabling them to become reliable producers for COMACO markets. This expanded vision will embrace a broader set of ecosystem interests, among them the rate of tree destruction now affecting the Luangwa watershed from growing commercial pressures to convert forests to cotton fields or to convert the free, open access supply of carbon by converting trees into charcoal.

Conclusion

The social and economic complexities of addressing livelihood needs around PAs have elevated the challenges for conserving natural resources in Zambia, particularly when so many rural people live with annual incomes below $100 and fail to grow enough food to support their year-round needs. Current PA management strategies place an increased emphasis on law enforcement and financial independence for responsible management authorities, leaving limited resources to support a more accommodating approach that makes a direct link between PA benefits and surrounding community needs. In reality, however, financial returns from PA-based income sources are in most cases not sufficient to support community development and it could be argued that private sector agents, such as agribusiness interests, operating outside PAs are better placed to fulfill this need. Unfortunately, recent history suggests these agents are also responsible for growing land use conflicts that can drive up the costs of managing PAs.

COMACO has demonstrated how a business model predicated on promoting food security and income among the rural poor can mobilize these same people into a critical mass of producers who respond to market incentives that drive land use practices on a scale capable of enhancing the conservation value of PAs. Conventional efforts that employ law enforcement are unsuitable for addressing many of the environmental threats that operate across the large landscapes bordering PAs. Results from the COMACO experience thus far show that an alternative approach need not be costly, politically unacceptable, or constrained by lack of human capacity. High quality, competitive products, as manufactured and sold by COMACO, can attract the interest of the urban buying public, and with sufficient sales, can shift sufficient monetary resources from urban consumers to rural producers to influence widespread compliance of conservation practices. The stronger this trade relationship develops, the more impact COMACO can have on PA management and biodiversity conservation.

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[1] Processing of COMACO products are reviewed by national health inspectors. External professional consultants from Cornell University provide additional technical guidance on food safety and processing standards.

[2] Business year for COMACO extends from 1 June to 31 May, when farm sales of the current year begin.

[3] In the valley floor areas where bonus incentives were paid, compliance to preferred farming practices exceeded 80% in most areas.

[4] 5% of all questionnaire respondents (600) who admitted to using snares prior to COMACO conceded they had accidentally snared a lion at least once.

[5] Based on detailed interviews with knowledgeable local leaders who know existing gun-owners who continue to hunt without hunting licenses (Banda unpub. data).

[6] This financial analysis is based on 2006 profit/loss projections with the inclusion of soybean processing. Delays in the installation of soybean processed left significant soybean stocks unprocessed during the 2006 fiscal year. The break-even assertion is based on the value of products tied up in inventory.

[7] Communities living in PA border areas derive a share of all revenues earned from the sale of hunting licenses for their area. Hunting quotas allow for increased revenues if population census data justify an increased quota.

PART 2
WCS CASE STUDIES – ASIA

2.1 Batang Ai National Park: The Different Conditions under which Local People Benefit or Do Not Benefit from Protected Areas in Malaysia

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Protected Areas in Malaysia

There are at least 65 Totally Protected Areas (TPAs) listed in Peninsular Malaysia by the Department of Wildlife and National Parks and in Sarawak by the Sarawak Forest Department/Sarawak Forestry Corporation (hereafter known as the SFC). In Peninsular Malaysia, although legally gazetted TPAs exist—such as the federally listed Taman Negara and the state parks of Endau Rompin and Royal Belum—there is major overlap between areas listed as protected areas at the Federal level and the actual classification on the ground. For example, the Federal government lists the forest concessions around Endau Rompin State Park as wildlife reserves, but they are actually logging concessions disbursed by the Johor State Government. In Sarawak, the number of officially listed TPAs is also often a gross overestimate as logging concessions still exist in "preliminary proclaimed" TPAs. As such, the actual numbers of PAs listed in Malaysia cannot be taken at face value.

Complicating the issue in P. Malaysia and Sarawak is that different laws exist for the creation of TPAs in each area. Within P. Malaysia, each state is now also creating its "state PA" laws with the objective of making sure that the TPA does not fall into the hands of the federal government.

Culturally, P. Malaysia is very different from Sarawak, with the former dominated by Malays. The main "forest-based indigenous group" in P. Malaysia is the Orang Asli, which is a collective term for 18 sub-ethnic groups generally classified for official purposes under Negrito, Senoi, and Proto-Malay. In Sarawak, there are at least 26 sub-races that can be classed as indigenous. Sarawak also recognizes Native Customary Law, e.g., Adat Iban Order (1993), Adat Bidayuh Order (1994) and Adet Kayan-Kenyah Order (1994). According to these laws, the indigenous groups have customary rights over land, to either farm, collect jungle produce, or fish. It is often assumed that the written laws of the state take precedence over the native customs if land claims cannot be substantiated or if the state government deems it necessary to take the land for development. In the latter case, compensation is often given. In other instances however, Native Customary Rights land is excluded from development or land-reclassification. Since 1999, however, due to increased pressure to develop rural land for agricultural plantations, there has been a surge of indigenous groups taking both the land developer and the government to court. By 2004, over 50 land disputes have appeared in Sarawak courts, with indigenous group plaintiffs (Thien 2004). In 2007, court cases exceeded 100 (Saccess et al. 2007).

In Sarawak's Batang Ai National Park (NP), Native Customary Rights land is excluded from the park. As a precondition to the local communities accepting the creation of the PA, they are allowed to hunt certain non-protected species within the park.

The reasons for creating TPAs differ, ranging from the need to protect orang utans (Batang Ai and Lanjak-Entimau), to giant caves and protection of bats (Mulu), and protecting tigers and elephants from logging in the Johor Sultan's ex-hunting grounds (Endau Rompin State Park). **Table 1** is a snapshot of some of the TPAs in Malaysia and apparent benefits and reasons for their creation. Meanwhile, threats range from legal overhunting of non-protected species (Batang Ai NP) to poaching (Taman Negara and Endau Rompin) and even illegal logging on a very large, uncontrolled scale (Maludam NP, Samunsam Wildlife Sanctuary) (Gumal and Rubis in press; Borneo Post Online 2007; The New Straits Times Online 2007), and lack of management due to understaffing at various TPAs (Maludam NP, Samunsam WS) (Gumal et al. 2007; Gumal and Rubis in press).

Table 1: Some TPAs in Malaysia: The legal status, benefits, and biological reasons for creating these areas

Protected Areas	Indigenous communities	Status of TPA	Benefits: Monetary and in-kind	Threats to wildlife and integrity of the park	Biological reasons for TPA
Batang Ai	Iban – 7 long-houses[1]	National Park	Money from working in tourism; Community Education Trust Fund from tourism; hunting of non-protected wildlife; intangible benefits	Shifting cultivation, erosion; overhunting; overfishing; poaching; lack of mangement and enforcement staff	Orang utans
Lanjak Entimau	Iban – over 33 longhouses	Wildlife Sanctuary	Hunting of non- protect-ed wildlife; intangible benefits	Overhunting; some shifting cultivation; poaching; lack of management and enforce-ment staff	Orang utans
Mulu	Berawan and Penan long-houses	National Park	Money from working in tourism, but not every-one in the longhouses benefits directly from it; hunting of non-protect-ed wildlife; intangible benefits	Overhunting; poaching; tourism; unlicensed/illegal collection of bird nests	Bats, caves
Bako	1-2 Malay com-munities	National Park	Money from working in tourism, but not every-one in the longhouses benefits directly from it	Some poaching; landscape changes around the park	Proboscis monkeys and 7 different floral habitats in 270 km2
Krau	Malay and Orang Asli Communi-ties	Wildlife Reserve	Money from working on the research projects; intangible benefits	Some poaching; hunting of protected species by com-munities	Elephant tourism, bat and primate research
Endau Rompin	Orang Asli	State Park	Money from working in tourism; collection of wildlife for sale	Poaching; legal collection of NTFP and wildlife for sale	Tigers, elephants, arowana fish, and forests

Batang Ai National Park

Physical/Ecological Setting

Batang Ai NP lies in the southwest of Sarawak, covering 24,040 ha in the headwaters of the Batang Ai River, upstream of the Batang Ai Hydroelectric Scheme. The dam is 250 km by road from Kuching, and from there access to the park is by outboard-powered longboat.

The terrain is extremely steep but with an altitude range of only 100 m to 760 m over most of the Park, rising to 820 m at Bukit Nimong in the east and to 975 m at Puncak Ensanga on the western boundary. Almost the whole area is forest covered, though a high proportion is old secondary forest or abandoned rubber gardens.

The park was constituted largely because of the need to protect orang utans. This area was recognized to be of major importance to these animals since George Schaller's work here in the 1960s. Other important totally protected and protected wildlife (Wild Life Protection Ordinance 1998) in this area included hornbills, gibbons, langurs, giant squirrels, argus pheasants, langurs, and sun bears (Bennett 1992; Meredith 1993).

Productivity of the systems in terms of goods and services used by humans has not been documented thoroughly. The park, together with the adjoining Lanjak-Entimau Wildlife Sanctuary, should have among the highest diversity and density of wildlife in Sarawak. However, due to excessive hunting, large mammals are deemed below carrying capacity (Bennett 1992). If we use the argument that tropical forests can only sustainably supply protein to communities dependent on wild meat at a rate of 1 person/km^2/year (Robinson and Bennett 2000), then wildlife within Batang Ai NP clearly would not provide this sustainable protein supply (592 people within an area of 240 km^2, i.e., 2.47 persons/km^2).

Cultural Setting

There are seven communities with rights and privileges within the park (hereafter known as local communities), as opposed to outsiders, which do not have such rights. The head of the community is usually a respected elder. To be legally recognized as the head, the elder has to be accepted for that position by the district office. Once legally recognized, the whole community is referred to as the "House" (in Iban language, Rumah or Rh) of the nominated elder: e.g., Rh Rimong refers to the "House of Rimong." The full list of communities is as follows: Rh Rimong, Rh Rimong, Rh Endan, Rh Griffin, Rh Ayum, Rh Changging, Rh Kasi, and Rh Ngumbang.

The communities are predominantly Iban although mixed marriages with other races such as Bidayuh do occur. In the larger watershed of Lubok Antu District, which Batang Ai NP comes under, the government of Sarawak estimated that 85% of the population is Iban.

In 2003, 592 people with rights and privileges lived in these seven longhouses (Braken 2004), whereas in 1992 it was estimated that there were only 350 people with such rights. The local livelihoods of these communities range from working as park staff, serving as tourist guides, tourist boat operators, waiters, farmers, fishermen with fish farms, wild-game hunters, primary school teachers, laborers on oil palm plantations, local business people, and also local politicians (Horowitz 1998; Braken 2004; Nyaoi and Bennett 2001, unpublished). There is also a rural-urban drift of local people moving to work in the petroleum, plantation, and timber industries. However, these people do return to their communities annually to celebrate festivals such as the "Gawai Dayak" (Rice Harvest Festival) (Horowitz 1998).

In interviews with 152 people at Batang Ai NP in 2003, Braken (2004) grouped the respondents into the following occupations: farmer, park staff, civil servant, self-employed, others, and not working (see **Table 2**).

Table 2: Occupation of respondents (Source: Braken 2004)

	Frequency	%
Farmer	129	84.8
Park staff	8	5.3
Civil servant	7	4.6
Self employed	4	2.6
Others	3	2.0
Not working	1	0.7
Total	**152**	**100.0**

A government supported primary school for students aged seven to 12 years, is a 20-30 minute boat ride from the boundary of the park. Braken (2004) carried out a survey of the education level of local people and the breakdown of their schooling is shown in **Table 3.** There is a government dispensary or clinic next to the school.

Table 3: Level of education of adult respondents

	Frequency	%
No formal education	84	55.2
Primary education (Year 1 to Year 6; 7 to 12 year olds)	26	17.1
Secondary education (Form 1 to Form 6; 13 to 18 year olds)	41	27.0
Tertiary Education	1	0.7
Total	**152**	**100.0**

There is no complete documentation of the income of these local people, but a survey of respondents' income was also carried out by Braken (2004). Incomes of respondents varied considerably, ranging from less than $28/month to above $429/month. The full breakdown of the income is shown in **Table 4.**

Table 4: Income of adult respondents/month in 2003

Income scales. US$1 = RM3.5	Frequency
RM100 (US$28) and below	84
RM101 – RM300 (US$ 86)	17
RM301 – RM500 (US$143)	33
RM501 – RM1,000 (US$286)	14
RM1,001 – RM1,500 (US$429)	1
RM1,501 and above	3
Total	**152**

Bennett and Nayoi (unpublished) found that tourism revenue can be quite substantial for those communities engaged in the tourism industry around Batang Ai NP. In Rh Ngumbang, the total annual revenue from tourism was $24,000, or an average of $857 per family. The revenue was generated from direct payment per tourist from a tourism company to the community, hire of boats, sale of handicraft, and salaries for guiding and boat driving (Nyaoi and Bennett 2001, unpublished).

Legislation

The park was legally established in 1991 after long and difficult negotiations with the seven communities. The inhabitants of these communities have wide privileges to hunt, fish, gather jungle produce, and take timber in the park. All land subject to Native Customary Rights is excluded from the park, even when it lies inside the boundary. This was estimated to affect as much as half the total area of the park (Lands and Survey Department, unpublished). Under the 1994 Guidelines for Protected Area Management Categories, Batang Ai NP would be classed as IUCN Category II.

The park was legally managed by the Sarawak Forest Department's National Parks and Wildlife Division from 1991 to 2003. After 2003, the park was legally managed by the Sarawak Forestry Corporation's (SFC) Protected Areas and Biodiversity Conservation Unit (PABC). The difference is that Sarawak Forest Department is a government department, whereas the SFC is a corporate entity.

Resource Use by the Communities

The natural resources used by the Iban communities range from wild meat (including fish), forest products such as Engkabang Jantong (*Shorea macrophylla*) fruits for the production of edible fats and oils known as illipe butter, and farmed products such as rice, pepper, bananas, and vegetables (Meredith 1993; Horowitz 1998; Braken 2004). According to Horowitz (1998), the communities use wild produce according to its availability. Braken (2004) further showed that 152 respondents carried out farming, 70% of them collected forest produce, and 65% stated that they do not hunt. (The hunting data has to be interpreted with caution as Braken is actually a park staff member, and respondents may be censoring their answers). In previous surveys, Nyaoi and Bennett found that hunting is predominantly carried out by men; this seems to be sup-

ported by Braken (2004) as he found that 43% (n = 41) of male respondents hunted, whereas only 16% of female respondents reportedly hunt. Most of the respondents hunted less than 1 day/week. (See **Table 3** for the breakdown by respondents; Braken 2004.)

Table 5: Time spent hunting (Source: Braken 2004)

	Frequency	%
Not at all	99	65.1
< 1 day per week	34	22.4
1 to 2 days per week	16	10.5
2 to 3 days per week	3	2.0
Total	**152**	**100.0**

Prior to 1998, sale of wildlife was commonly seen in the nearest market to the park, Lubok Antu. Bearded pigs were a regular item and sometimes large snakes such as pythons were seen. After the legislative change in 1998 banning commercial wildlife sale, wild meat was only sometimes seen in the Lubok Antu market (J. Rubis, personal observation).

Hunting non-protected wildlife still occurs in the park and it is not just for subsistence use (Gumal and Rubis, in press). Civil servants, plantation workers, and outsiders are sometimes seen "piggy-backing" on the locals who have rights, joining them on hunting excursions. The meat tends not to be sold, but is consumed by these outsiders. Some of these outsiders come from as far as 50-100 km away from the park (N. Ukur, pers. comm.). They tend to appear on the weekends as enforcement is weak and there are no forest guards or even administration staff at the park on weekends (J. Rubis, pers. comm.). Subsistence hunting within the park by the locals themselves is a common occurrence and is carried out at all times of the week. The frequency/week of hunting by locals and outsiders is not known.

Resource Use and Conservation Targets

The management plan for the site has one main conservation target, the orang utan. However, the plan has been purportedly superseded after the change in administration from the Sarawak Forest Department to the SFC, which brought with it a business philosophy with performance indicators. Not all the performance indicators appear to have been achieved, except for the large visible indicators such as Special Park Committee meetings. The last meeting was held in August/September 2006, and the meetings are supposed to be a bi-annual event. Apart from the orang utan, there is no other official conservation target set by the park authorities.

Unfortunately, there is a definite negative impact of human hunting on the orang utan. In 2004, four orang utans were killed. The carcasses of two of these animals were seen by the WCS orang utan survey team, and another two were reported close to a longhouse, but the remains of the animals could not be verified. In 2005, animals were killed supposedly by Indonesians crossing the border from Kalimantan on a poaching expedition (anecdotal information from headmen). Several hunting camps were found littered with Indonesian products.

The main animals hunted by the Iban are ungulates, with bearded pigs being the main prey (Bennett 1992).

Resource Use and Governance

The hunting surveys by Bennett (1992) have not been repeated. It is uncertain how the resource use is spread across the park and the areas outside the park. As there is a ban on commercial wildlife trade, data from the sale of wild meat is not available. The visible commercial wildlife trade sale in markets has largely disappeared. The disappearance of market trade is the result of roaming enforcement teams (1997-2003, from Sarawak Forest Department; 2003-2006 by the SFC). The roaming enforcement teams also respond to reports by the WCS orang utan survey teams on encroachment into the park and illegal sale of wildlife in Lubok Antu (The Star Online 2005).

This situation has resulted in the local people and outsiders exhibiting anger towards the park and the orang utans. As mentioned earlier, four orang utans were killed in 2004, and two of them were left directly on the river bank, so as to openly show the anger felt by the killers. These people expressed such emotions largely because they have not accepted the ownership change of the park from the Sarawak Forest Department to the SFC. Among the reasons mentioned by the communities were (J. Rubis pers. comm. and pers. obs.):

- They dislike the idea that the park is now perceived to be owned by a private corporation, as opposed to being owned by the government. Unfortunately, they associate management by the SFC as ownership, even though the SFC is just mandated to manage, whereas the park still legally belongs to the government.
- As the SFC is a corporate entity, it has greater emphasis on reducing losses, profit making, and increasing staff/work efficiency. With this business philosophy, they reduced the numbers of park staff throughout Sarawak, including at Batang Ai NP (Gumal, in press), and hired less permanent staff from the communities. There was also a reduction of community conservation and communications work at Batang Ai NP.
- Profits made at Batang Ai NP were seen to be only benefiting a corporate entity as opposed to benefiting the Government (based on an assumption that all Sarawakians would benefit if the park management remained with the government).

The combined reasons above led to general unhappiness among the privileged communities, and, for some of them, resulted in the killing of the orang utans.

Displacement of Use

There is no displacement of subsistence use of natural resources as locals can still hunt non-protected wildlife for their own consumption, though they cannot sell the meat. It is unclear how much money they made from sale of wild meat prior to this ban.

There have been several efforts to promote alternative resource use and to raise funds for the local communities, among them:

- Fish cage culture by ITTO and the State Agriculture Department (1997-2006).
- Growing of loofah for sale to BodyShop in their 'Trade Not Aid' program (1996-1999). These have largely not succeeded as there is minimal maintenance by park managers and local communities.

Eco-tourism activities also commenced in 1993 (Sochaczewski 1993; Nyaoi and Bennett 2001, unpublished), but this substantially benefited only one community at Rh Ngumbang. In fact, the ecotourism activities were awarded the internationally acclaimed British Airways, Tourism for Tomorrow Award in

1995. A cooperative society (Kooperative Sebaguna Ulu Batang Ai) was set up by the seven communities as a means to help bulk-purchase petrol and groceries with the aim of passing on the savings to the communities. This cooperative made a profit of $12,000 in 1995 (Gumal 1995, unpublished) but it is uncertain whether the profits were disbursed to all the shareholders, i.e., the villagers in the communities.

Current Relations between the Protected Area and Local Peoples

Prior to 2003, relations between the park management and the communities were good. By late 2005, however, there appeared to be a certain level of animosity between the two entities, hence the agreement by WCS Malaysia and the SFC to embark on a conservation education program with the communities. Meanwhile, the relations between the local people and the federal government are fine. The local people are also supportive of the state government.

Lessons Learned

- There is a need for the SFC to increase its public relations, conservation education, and enforcement activities. Prior to the SFC, the Sarawak Forest Department had greatly emphasized communicating with the communities and had a constant presence on site. This led to greater trust between the communities and the Forest Department, so much so that other communities (apart from the seven privilege longhouses) wanted to extend the park so that they could also be incorporated into the park and reap the perceived benefits.
- The level of commitment by the SFC is poor both in terms of staff and money. If the protection of orang utans is to be improved, this level of commitment has to increase. The park has one of the lowest ratios of staff/area of TPAs in Sarawak.
- There is still illegal hunting by outsiders and probably unsustainable hunting by the locals. Alternative livelihood projects should only commence after addressing this resource leakage, i.e., illegal hunting. Installing an alternative livelihood project at this stage could be perceived as, "The government still rewards us when we are breaking the law so why should we adhere to the law?"
- There is also a need to document the performance of the alternative livelihood projects. To date, there has been no systematic and useful documentation of successes or failures of alternative livelihood projects either qualitatively or quantitatively.
- The sustained tourism success at Rh Ngumbang by Borneo Adventure Plc (a travel agency) is probably due to the great effort to ensure buy-in from the communities and by the travel agency's sustained presence since 1988. To promote greater buy-in, Borneo Adventure helped set up businesses for the locals, a Community Education Trust Fund (at least two of the locals have completed their university education), and co-sharing of profits from their joint tourism endeavor. It is uncertain as to whether this joint effort has saved orang utans, as other wildlife species are still consumed by the inhabitants of Rh Ngumbang. However, it has certainly sustained the alternative livelihood project of tourism.
- There is also a need to ascertain whether the past alternative livelihood approaches by ITTO, Agriculture Department, Sarawak Forest Department, and even tourist agencies actually promoted protection of the conservation targets.

2.2 Conservation, Wildlife, and Security: Afghanistan Case Study

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Environmental degradation, wildlife declines, and poverty are locked together in Afghanistan in a vortex that threatens both wildlife and human communities. The collapse of Afghanistan's economy and the failure of the international development community to address basic issues of poverty have exacerbated environmental degradation in a country impacted by nearly 30 years of conflict and war. The absence of the rule of law, the dearth of effective measures of monitoring the state of the environment, challenging security, and the low level of capacity make it difficult to determine the rate or extent of environmental degradation in Afghanistan. Further, Afghanistan's wildlife and wildlands are strongly affected by outside countries and groups that take advantage of Afghanistan's instability to exploit its natural resources.

Afghanistan's harsh environment provides only a narrow band for human and wildlife survival. With over 80% of Afghans dependent on the country's natural resource base, long-term stability and security will be directly dependent on sustainable management of natural resources and provision of economic opportunities to the rural sector. If not, the continuing degradation of environmental conditions will contribute to growing poverty, the dissolution of communities and cultural practices, increased rural migrations, and further instability. This will worsen stability and security not only in Afghanistan, but also in neighboring countries.

Physical and Ecological Setting

Afghanistan's wildlife is spectacular, unique in its assemblage, and under threat. Afghanistan's flora and fauna highlight the presence of a major biological crossroads. These different ecological worlds include the Paleoartic (Europe/North Asia, represented by brown bears, Asiatic black bears, lynx, and wolf), Afrotropic (gazelle, hyena), and Inodmalayan (leopard cats, and giant flying squirrels). In this way, Afghanistan's biodiversity mirrors the diversity of its ethnicity and reflects a history that has brought together different civilizations, and representing a human and biological crossroads between major empires and realms.

Afghanistan's ecological setting is also distinguished by its topography, which has created a disjointed diversity in one of the last great isolated and wild places on earth. Afghanistan contains some of the most dramatic and distinctive mountain ranges in the world. These ranges punch into the center of the country, shattering the landscape into faults and uplifts. In the northeast, Afghanistan's Wakhan region forms a "knot" of mountains that brings together the western Himalayas, the Hindu Kush, the Karakorams, the Pamirs, the Tien Shans, and the Kunluns, creating unique habitats and biological barriers that favor allopatric speciation. Those areas that are free from the push of geology provide very different niches, including semi-arid steppe.

Afghanistan contains a unique variety of habitats and microclimates. These include deciduous and coniferous forests on its eastern borders, the vast dry grasslands of the central plateau region, and the sand deserts of the southwest, which hold gazelles, bustards, and a great variety of bird and small mammal

Figure 1: Proposed protected areas in Afghanistan

species. Extensive wild pistachio woodlands once stretched across much of the middle of the country, but have largely disappeared. The steppe habitat of the northwest along the Iranian border once supported herds of gazelle and cheetah. Huge shallow wetlands (Dashte-Nawar, Abi-Estada) recently supported enormous numbers of waterfowl, pelicans, and breeding flamingos, although the wetlands have suffered from drought and overuse of water for agriculture (much like the Aral Sea north of Afghanistan's border). Afghanistan's mountains—the Pamirs in the Wakhan, the rugged Hindu Kush across much of the east-central region, and a number of smaller ranges and isolated peaks throughout the rest of the country—provide habitat and protection to snow leopards, Marco Polo sheep, markhor goats, ibex, golden eagles, snowcocks, snow finches, and other animals.

This diverse habitat has allowed for a diversity of species, including carnivores. In *Felidae,* Afghanistan is home not only to snow leopards, but also to Persian leopards, Himalayan lynx, caracals, jungle cats, wild cats, leopard cats, Pallas' cats, and probably sand cats. The United States and Canada combined only has three cat species, compared to Afghanistan's nine. There used to be even more: The Asiatic cheetah once ranged over the entire western part of Afghanistan, but there have been no sightings since the 1970s, although it is presumed that individuals may be crossing into Afghanistan from Iran or may be resident at very low levels. The Caspian tiger has been extinct since

the 1970s, with the last siting in Afghanistan along the Darquad River in Takhar Province near the Tajik border in 1967. This population represented the western-most distribution of the tiger, and was isolated from other tigers by the Himalayas. The same diversity holds true for other groups of animals, with two bear species, five canids or wild dogs, and a huge variety of smaller mammals and birds.

WCS is working in three important habitats in Afghanistan under its USAID grant: the Wakhan District of NE Afghanistan, Hazarajat encompassing the central plateau of the Hindu Khush and the provinces of Ghor and Bamiyan, and the Eastern Forests Complex, particularly in Nuristan. These areas are described individually:

Wakhan

Wakhan has some of the last relatively pristine wildlife habitats and populations left in Afghanistan. It is a strategic location, bordering Tajikistan to the north, Pakistan to the south, and China to the east, and will form the basis for WCS' efforts at creating a transboundary protected area between the four countries. The Wakhan can be divided into three important regions for biodiversity conservation. These are the Big and Little Pamir Mountain ranges, and the Waghjir Valley. The Big Pamir Range extends over about 5,500 km^2 and contains peaks rising up to 6,900 m. The Wakhi (who are Ismaeli, the second biggest Shi'a group) occupy the western Big Pamir, a considerable part of which was once included in the so-called Big Pamir Wildlife Reserve encompassing about 679 km^2, while the Kyrgyz (Turkish speaking nomads) occupy the eastern part of the Big Pamir Range.

The Little Pamir occupies the eastern-most region of the Wakhan district. At present, this area may not be used by the Kyrgyz, and thus the habitat is purportedly in excellent condition and does not conflict with human use. There is also no geographical barrier between it and the proposed Shaymak Reserve in Tajikistan, enabling Marco Polo sheep to move freely back and forth. Finally, the eastern tip of the Waghjir Valley (about 300 km^2) is uninhabited and used only for yak grazing in winter. Marco Polo sheep cross the Yuli Pass between China and Afghanistan here in winter. WCS is seeking to preserve all three areas as part of its biodiversity conservation project, as well as to provide benefits from this conservation to the entire Wakhan region.

Hazarajat

The Hazarajat Plateau holds some of the most important existing natural and cultural protected areas in Afghanistan (where the giant Buddha statues were destroyed) and two important proposed protected areas: the Ajar Valley Wildlife Reserve and Band-e-Amir National Park. Band-e-Amir is often described as one of the great wonders of the world. Consisting of six crystal blue lakes separated by a series of natural white travertine dams in a unique step-like lock system, Band-e-Amir deserves protection as a major source of future revenue from international ecotourism. WCS has been leading the effort to list Band-e-Amir as a UNESCO World Heritage Site. While Band-e-Amir was identified as a national park in 1973, it still has no formal legal status for protection.

Ajar Valley is a spectacular gorge created by the Ajar River and the Jawzari Canyon. The surrounding area was once home to robust populations of ibex, urial, Bactrian deer and other wildlife, and for many years it was a royal hunting reserve. Although Ajar was gazetted as a wildlife reserve in 1977, there is only a preliminary management plan that has never been implemented. Unfortunately,

recent conflict-related events have resulted in a lack of protection for the area, and wildlife populations have suffered dramatically—Bactrian deer are now locally extinct, while ibex and urial numbers have declined. WCS found a 98% decline in the Ajar ibex population between 1977 and 2006.

Eastern Forest Complex

The Eastern Forest Complex in Afghanistan contains some of the last remaining deciduous and arid conifer forest in the Greater Himalayan mountain chain. The Complex runs from the border of Badakhshan in the north to Paktika in the southeast and contains mixed oak, juniper, and coniferous forests. Tree cover tends naturally to be more continuous in this region where precipitation is far higher and less erratic than elsewhere. This habitat, a Global 2000 Ecoregion (Western Himalayan Temperate Forest), is rich in biodiversity, including historical populations of snow leopards, leopards, jungle cats, Himalayan lynx, leopard cats, wild cats, Pallas' cats, jackals, striped hyenas, martens, Asiatic black bears, Siberian ibex, markhor, urial sheep, and wild boar. It is under tremendous deforestation pressure, particularly from outsiders seeking to get access to timber that is illegal to harvest from Pakistan's forests across the border. Further, its location in the conflict-prone border region between Afghanistan and Pakistan also makes monitoring of deforestation difficult. WCS surveys in 2006 indicate that the forests still contain important key species, including Persian leopard, snow leopard, ibex, and markhor.

Productivity of Ecosystem Services

Initial WCS surveys of Afghanistan suggest that natural resources in the country are fragile and overexploited. Afghans are directly dependent on three types of natural resources (although there are many indirect ways that they are dependent on ecosystem services, such as protection against desertification: 1) rangelands, while necessary for ungulates and carnivores, are also essential to the maintenance of large livestock herds, an important source of livelihood and wealth in Afghanistan; 2) wildlife provides a source of income through wildlife trade, including furs and hunting birds used by Saudi Arabians; and 3) the Eastern Forests provide extensive timber resources for cross border trade, although much of it does not financially benefit local people.

Rangelands

The extreme climatic and geomorphological conditions of the area create conditions where soil and vegetation are very vulnerable to human impacts. These extreme conditions have likely reduced past human pressures by keeping both the humans and livestock low. This situation may no longer hold true due to the recent return of refugees and changes in local economies. Livestock populations are susceptible to large winter losses and likely these occur during winters with greater snow cover or ice as herders keep little reserve forage (hay). WCS surveys in 2006 indicate that rangeland degradation may be associated with overgrazing and use of shrubs for fuel. The ecosystem health team found that the principal cause of recorded mortality in ruminants was poor nutrition, which affected all species during winter. Infectious diseases were the second cause of death, especially gastrointestinal and respiratory tract disorders. It is difficult to ascertain whether the majority of use is unsustainable and to quantify impacts of grazing on vegetation and wildlife, but the mortalities from malnutrition provide circumstantial evidence that it is indeed unsustainable.

The WCS rangelands team also saw a number of other livestock impacts on the rangelands. These include trailing on slopes, grasses "hiding" in shrubs, low vegetation cover and production at sites away from camps, and little or no litter biomass. Likewise, impacts on riparian areas and meadows are often very noticeable. These include low vegetation height (from grazing), low species diversity, low litter biomass, increased weeds, and often increased soil cover. However, for all these "signs" of degradation, it is difficult to speculate how bad the degradation is because there is no benchmark for comparison (no sites that have not been impacted). As such, it is also difficult to speculate on the potential impacts on wildlife.

Hunting and Wildlife Trade

Hunting appears to be both an opportunistic and a determinative source of pressure on species. There is unregulated sport hunting in Afghanistan due to the high number of weapons remaining in the country from decades of civil war. There is retaliatory persecution of carnivores that prey on livestock in the winter, a result of declines in their prey base. Hunting may have already had a significant impact in some parts of Afghanistan, either alone or in parallel with other factors such as overgrazing.

Wildlife trade may also be a second source of direct pressure on wildlife populations. Birds of prey are a continued source of illegal trade from Afghanistan to other parts of the Middle East. Animal components—such as snow leopard and wolf skins—are sold in large numbers to westerners in Kabul. There is also a potentially extensive fur trade within Afghanistan, and across the border to China and Pakistan. The bird market facilitates trade in certain avian species for ornamentation or fighting. Particularly, there is trade in Saker falcons—CITES recorded nearly 30 forged permits in 2006, but it is clear that the trade is more extensive. These hunting falcons are illegally smuggled to the nations of the Arabian Peninsula, where wild-caught females from Afghanistan are preferred to hand-reared falcons. Further, Saudis and Emirates come to Afghanistan for falconry, using tens of Saker falcons and other birds of prey to hunt the threatened population of Houbara bustards.

Deforestation

Afghanistan also has some of the highest rates of deforestation in the world. In the Eastern Forests Complex, extensive logging is quickly reducing the forest cover wherever deodar cedar, pine, spruce, or juniper still exists. A UNEP (2003) Landsat analysis found that forest cover in Nuristan has decreased by 53% and in Kunar by 29%. Residents predict similar losses for the forested regions in the provinces of Paktia, Khost, and Paktika. If this rate of deforestation continues, estimates suggest that most of the remaining forested valleys could be completely stripped of trees within five to ten years. This has already occurred in the western dry forests, which have disappeared from more than 95% of their range.

Cultural Setting

Afghanistan is ethnically diverse, and this is also true for the protected areas. Wakhan is characterized by two main populations: the Wakhi and the Kyrgyz. The Wakhi are listed as Tajiks, but have their own language (a dialect of farsi) and religion (Ismaeli, followers of the Agha Khan), and are heavily dependent on livestock. The Kyrgyz are Turkic-speaking nomadic herders who live in remote regions of Wakhan and are entirely dependent on their livestock.

The Kyrgyz are split into two distinct populations. The first resides in the Big Pamir (they emigrated to Turkey during the Soviet invasion, but have partially returned). The second group has lived somewhat continually in the Little Pamir. Although traditionally the Wakhi were poorer than the Kyrgyz, this relationship (represented by livestock and the number of grazing areas under their control) reversed after the end of the US invasion.

Poverty, coupled with opium addiction, is a major issue for both communities. Although the total number of livestock grazing in the Big Pamir appears to have changed very little in the last 30 years, the number of Wakhi households using the Big Pamir has risen significantly. Maternal and child health are dismal. Badakhshan Province, in which the Wakhan district is located, has the world's highest recorded maternal mortality. In Wakhan, the death rate of children five years and younger was 52% (low when compared to Badakshan province, which was 70%).

The Eastern Forests area is divided between the Nuristani and the Pashtuns. Nuristan, the "land of the enlightened," was as recently as 100 years ago distinguished by its own religion, and still maintains its own languages and culture. This sense of identity may be the reason behind lower deforestation rates as compared to areas with Pashtun populations. The people of Nuristan closely identify with the forests and their products.

The Hazara, who inhabit the Hazarajat plateau, which includes proposed protected areas in Band-e-Amir and Ajar, are remnants of Mongolian invaders and are predominantly Shi'a. They were heavily prosecuted by the Taliban.

The nearly three decades of warfare has resulted in the mass migration of much of Afghanistan's populations to neighboring countries. A new generation has grown up in Pakistan and Iran, and traditional systems of management have been lost. The population increased by 5.4 million people between 2000-2006, mainly due to returning migrants. Although this return is disproportionate to the cities, there is renewed pressure on Afghanistan's natural resources.

The economic status of Afghan populations is desperate. Although life expectancy has increased from 39 to 46.2 years between 1970 and 2003, it is still low by international standards and reflects the challenges of this environment. Adult literacy is only 28%, 13% among women. There is little access to medical care. Much of the land adjacent to roads and villages has been rendered unproductive by landmines; Afghanistan remains the third most heavily mined country in the world.

History of Protected Areas

There are no protected areas in Afghanistan. Historically, King Zaher Shah established game reserves in Ajar Valley, Nuristan, and the Big Pamir regions that currently form the basis for Afghanistan's proposed protected areas. Most of Afghanistan's proposed protected areas will displace individuals, particularly with respect to grazing rights.

Resource Use

Rangelands

Afghanistan's most crucial resources are its rangelands, which are used by all groups across the country, and its forests, which are predominantly used by the Nuristanis and the Pashtuns. The issue of who has access to the rangelands is highly contentious since ownership is an unsettled issue, especially after years of migration and warfare. Traditionally, there was a complicated system of grazing rights (passed by descent) for the rangelands, where ownership was less

important than access and use. This issue is important to economic success of the Wakhi, where malnutrition and disease account for up to 50% mortality of livestock. WCS' efforts at rewriting the rangeland and forestry laws have avoided ownership and focused on protection.

Timber Trade

Similar issues exist with the forests of Afghanistan. Communities have agreements as to their use, but the lack of security in the east has led to the wholesale stripping of forests of their wood, with the most valuable product—the deodar cedar—going directly to Pakistan. Much of the recent impact may be due to Pakistani involvement in cross-border smuggling of timber. Timber trade data analyzed thus far provides a strong indication that timber harvests are continuing at a rate that exceeds the capacity of the forests to recover from past abuses.

Over a three month period in early 2007, WCS conducted an extensive survey of the timber trade market in Kabul and gathered additional anecdotal information specific to timber trade in the eastern forest region. We assume that as the largest city in the country, the Kabul market is the largest timber and firewood market in the country; it draws upon forest resources from at least 13 provinces (including the eastern forests) and two other countries (Russia and Pakistan). There are a minimum of at least 1,500 individual woodlots throughout the city, operating as stand alone lots or combined into one of the many larger wood bazaars. These woodlots are split into construction and firewood. As many as 100–150 trucks loaded with wood arrive into the city on a daily basis.

Based on data collected and analyzied during the study, we estimate a total timber trade volume exceeding 230,000–250,000 m^3 per annum for Kabul, with trade values of more than $15 million. This is a very conservative estimate and does not focus on trade in cedar, which bypasses Kabul. This amount does not approximate the total trade for the country, including amounts that may have been sold to other countries. An estimated 32% of the total volume comes from agro-forestry, but the majority (63%) is comprised of oak and juniper species (41% and 22%, respectively) primarily from the Eastern Forest Complex. Assuming 5–7 m^3 per hectare for juniper and 25–40 m^3 per hectare for oak, we estimate the current rate of harvest is affecting more than 11,000 ha of forest per annum. This is particularly troubling as these species are slow growing and difficult to regenerate. This will be compared against satellite imagery for more precise estimates.

Initial survey results indicate that construction wood has the highest economic value and that lombardy and himalayan poplar species (*Populus pyramidalis* and *P. ciliata*), both prevalent in Afghanistan's agro-forest system, are the most common. However, additional analysis revealed that firewood, in particular oak (*Quercus dilata*) and Greek juniper (*Juniperus excelsa*), has the largest trade volumes.

The absence of cedar products in the Kabul markets, despite its high value, suggests that the Afghan market cannot compete with prices commanded in Pakistan or elsewhere (possibly the United Arab Emirates). Interviews with US military personnel operating in the region and security incident data describe a highly visible and continuing trimber trade moving east across the border. Our own survey staff have observed trucks loaded with deodar cedar from the Kunar province, eastern Afghanistan. From their observations we tentatively estimate a trade volume of as much as 55,000 m^3 of cedar per annum. According to interviews, the cedar observed in transit is heading for sale at timber markets in Dubai.

Two eastern provinces, Khost and Paktiya, figure prominently in our estimates for Kabul timber trade volumes, with a market share of 25% and 22% respectively. Surprisingly, timber originating from Nuristan and Kunar (two of the most timber rich Provinces) were not found in the Kabul markets. WCS satellite analysis looking at forest cover changes from 1992-2002 indicates minimal changes in Nuristan's forests, mostly at lower elevations. This may be due to a combination of community forestry practices, Nuristan's strong sense of community identity, and mistrust (ranging to xenophobia) of outsiders.

Given the area and security constraints, it is unlikely that anyone will be able to accurately measure the volume of this trade in the near term. The long years of conflict have effectively prevented the Afghan government from exercising any real control over harvest levels or trade routes. Although there is currently a ban on all logging, our survey, interviews, and other reports all indicated that timber trade continues.

Afghan carrying a stuffed Persian leopard in Kabul that he bought to decorate his house.

Hunting and Wildlife Trade

Furs are collected by traders in Afghanistan who resell the furs to "factories" in Afghanistan. Birds and mammals come to Kabul from a variety of regions, including the provinces of Badakshan, Panjsher, Nuristan, and Herat. Porous borders with Pakistan also facilitate wildlife trade—furs are exported and treated and brought into Afghanistan from Pakistani factories, and birds are trapped in Pakistan and India and brought all the way to the Kabul Bird Market ("Ka Farushi"). Further analysis of other international trade routes needs to be conducted to determine if species are being sent to China, Tajikistan, and other neighboring countries.

There is a new major market for furs in Afghanistan created by the presence of international military forces and the international development community. WCS studies found that members of the military may be having a tremendous impact on furs. One order by a member of the US military involved the culling of 10,000 lynx for the production of comforters that would be mailed and potentially sold in the US.

The trade in Saker falcons goes via Pakistan to Saudi and UAE. WCS field teams are trying to help establish population data for Saker falcons in the Wakhan. This species is endangered and is of high concern to CITES as there has been heavy export from all around Asia to the United Arab Emirates and Saudi Arabia for use in falconry.

Conservation Targets

Although Afghanistan has no established protected areas beyond the former hunting reserves (which have only minimal protection if any), resource uses described above would have a significant impact on any proposed protected areas. Predation on livestock has led to retaliatory persecution and increasingly opportunistic hunting of predator species. Overgrazing, which WCS studies have indicated exists throughout much of the Wakhan, would decrease available resources necessary to local populations of ungulates: It already reduces the area available to Marco Polo sheep. It is possible that wolves and snow leopards will continue to be forced to shift to attacking livestock in the winter.

Resource Use and Governance

Although Afghanistan suffers from the absence of data collected after 1977 (which forms our baseline), WCS research indicates that those resources are degraded, in some cases dramatically. In Ajar Valley, ibex populations have crashed from 5,000 in 1977 to only 100 in 2006. Nearly all of the proposed protected areas contain coveted resources that are currently heavily used. The absence of the rule of law due to 30 years of conflict and mass migration, and the lack of established protected areas and an antiquated environmental legal infrastructure, has made the enforcement of any existing rules difficult. Although President Karzai has banned hunting through a presidential proclamation, and the recent environmental law limits wildlife trade, these laws are routinely ignored, or are unknown by local populations. Moreover, the language of the proclamation is not imperative.

There are two government agencies in charge of enforcement: the National Environmental Protection Agency (NEPA), headed by the grandson of former King Zaher Shah, and the Ministry of Agriculture Department of Natural Resources (DNR). Although NEPA has focused more on "brown" regulations and DNR has focused on "green" regulations, neither agency has sufficient capacity to enforce regulations, even within Kabul. The situation outside of the capital is even less impressive. The focus of the Ministry of Agriculture is on agriculture and replanting trees, rather than on monitoring, enforcement, and management of natural resources. NEPA has few resources outside of the capital with the exception of its main hub in Herat. The district offices in Badakshan —which encompasses the Wakhan region—had only a single staff member.

Protected areas, in conjunction with the development of a legal framework, education of local communities, and development of governance structures in communities that may better manage natural resources, may potentially reduce the rapid degradation of Afghanistan's natural resources. Afghans are a diverse and independent people; therefore, the success of future protected areas will require substantial community involvement and consultation. Recent projects instituted by the Asian Development Bank in Band-e-Amir National Park have been heavily looted by local communities who were not closely consulted in the process. WCS has sought to avoid this by involving the community at every step.

Displacement of Use

Outside of the King's hunting reserves, there has been little displacement of resource use. Nuristanis around forested areas have stated that they are willing to restrict hunting if they are provided with alternatives. However, there is great suspicion of any program that could threaten the ability to survive, particularly if it is imposed by the outside. The question is what alternatives would provide a workable solution? WCS is looking at ecotourism, trophy hunting, wildlife loss compensation schemes, and more effective management of grazing/forests as alternatives. Ecosystem health—essentially assisting locals in increasing survival of their herds—could also reduce the need for larger herds, but may contribute to overly successful herds, causing more overgrazing. An increased number of livestock in Big Pamir could be damaging to a land already significantly degraded.

Protected Areas and Local People

The national government operates frequently in isolation from any consultative process with local people. Although the National Solidarity Program (NSP) has sought to set up consultative bodies (shuras) in local communities as governance structures, and some ministries have regional offices, many times these offices are ignored and underfunded. The lack of consultation may be due to insufficient resources and control over the regions by the central government, rather than an attempt by the government to exclude local people. The result is that power is dispersed among different sources (such as former muhajadeen commanders), but still not effectively transferred to the people.

WCS is working on two levels to permit a transfer of some power from the central government to the provinces by setting up (through the NSP) community conservation committees to strengthen their abilities and authority over natural resources, and in parallel, developing national legislation and policy that will support the devolution of power over natural resources to local communities.

Successful biodiversity conservation requires that local communities benefit from conservation. Revenues that may be generated from tourism or tourism-related activities (entry fees, conservation fees, and hunting fees) can contribute to community funds on an equal sharing basis. These funds can be initially established through donor contributions and sustained through shared revenues. National laws, however, mandate that all revenues must go directly to the Ministry of Finance. One key success for WCS has been getting agreements to permit the finances from protected areas to return to local communities.

Addressing Livelihoods

Wakhan has immense potential for adventure, culture, and eco-tourism, but the region is impoverished. WCS must ensure that the benefits of our conservation efforts flow directly to local communities. To diversify and broaden the region's economic base away from activities that negatively impact the landscape and its wildlife, WCS will work with local communities to develop, guide, and manage tourism growth. WCS will encourage and facilitate responsible tourism to Wakhan by coordinating with Afghan governmental institutions, NGOs, and donors. Particularly essential is the Afghan Tourism Organization, which seeks to develop ecotourism activities without harming the local environment and overwhelming traditional communities. In particular, WCS will develop voluntary guidelines and codes of conduct for all tourism stakeholders (communities, visitors, the government, and private operators) which may serve as a model

for other tourism sites in Afghanistan. WCS will work to develop marketing products, such as posters, maps, and a guidebook, identify trekking sites with opportunities to view wildlife, inventory cultural sites, and provide extensive training. Finally, WCS is creating a transboundary peace park that encompasses Afghanistan, China, Pakistan, and Tajikistan, which will permit better management of transboundary migration of wildlife as well as support the regional promotion of ecotourism and cross-border trekking.

Ecotourism itself, however, will not be sufficient to maintain local communities. WCS must facilitate the improvement of natural resource management in Afghanistan and help restore traditional methods of management that have previously allowed Afghanistan to live in accord with its wildlife. This requires a long-term commitment to building capacity both at the government level and with the local people.

2.3 Are Efforts to Conserve Biodiversity in Conflict with Those to Reduce Poverty? A Case Study from Bukit Barisan Selatan National Park, Sumatra

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After de-colonization, industrialized nations advocated forest conversion and industrial timber extraction to promote development (Pretzsch 2005) without paying attention to the environmental impacts (Adams et al. 2004). Indonesia followed this model and, by 1979, became the world's leading producer of tropical logs (FWI/GFW 2002). In the 1970s-80s, a conservation and human rights global movement appeared on the international scene and the 1982 Bali World Parks Congress prompted Indonesia to promote forest conservation by expanding its network of protected areas (PAs).

In this study, we investigate how the shift of attitude by the Indonesian government from pro-forest conversion in the 1970s to pro-forest conservation in the 1980s and 1990s has affected livelihoods of smallholder farming communities surrounding PAs and whether PAs have benefited from this shift. We chose the World Heritage Bukit Barisan Selatan National Park (BBSNP) because BBSNP was the site of large-scale mechanized logging during the 1970s and of tough pro-conservation law enforcement interventions during the 1980s. In addition, BBSNP protects southwest Sumatra's last lowland forests; it is buffered by high-conservation-value traditionally managed agro-forests, and lies within Indonesia's main robusta coffee producing region. We carried out an analysis of incentives and disincentives for smallholder coffee growers around BBSNP to either promote forest conversion or forest conservation during times when the Indonesian government advocated forest conversion (1972-1982) or forest conservation (1982-2004).

Our approach employs high-quality satellite-based data and extensive field and socio-economic surveys (Gaveau et al. 2005, 2007). First, we provide an accurate picture of deforestation patterns in and around BBSNP, across a wider landscape of 1.17 million ha in southwest Sumatra, for the period 1972-2004 to quantify the impact. Second, we identify spatial drivers of deforestation in the wider landscape for the period 1972-1982 and for the period 1982-2004 to test whether in-park logging activities of the 1970s benefited smallholders by granting them easy access. Third, we measure the rates of deforestation and of re-growth inside BBSNP for the period 1972-1982 and for the period 1982-2004 to test whether law enforcement efforts of the 1980s benefited BBSNP by halting forest loss and depriving evicted households of their livelihoods. Fourth, we sample in-park deforestation rates over 10, almost equally spaced time intervals for the period 1972 to 2004 to test whether smallholder coffee farmers have responded to coffee prices and whether they benefited economically. Fifth, we investigate whether illegal (in-park) farmers are investment-poor, i.e., lack capital to invest in out-park land resources, and whether this condition drives farmers into the national park.

Study Area

Our study area extends for 220 km along the South Barisan Mountains in southwest Sumatra, and encompasses 1.17 million ha of land stretching across Sumatra's southern provinces of Lampung, Bengkulu, and South Sumatra. Southwest Sumatra contains one of the largest remaining tracts of lowland and hill rainforests, home to at least 118 species of mammal, 425 species of

bird, 45 amphibian and reptile species, and 649 species of higher plant. These include large threatened mammals, such as Sumatran tigers (*Panthera tigris*), Asian elephants (*Elephas maximus*), and Sumatran rhinoceroses (*Dicerorhinus sumatrensis*) (O'Brien and Kinnaird 1996). In 1934, the Dutch colonial power established three reserves there to conserve the fauna, flora, and hydrological functions of southwest Sumatra. These comprised: the 324,494 ha South Sumatra I Nature Reserve (SSINR); a 47,782 ha wildlife sanctuary (WS); and a 256,620 ha network of hydrological reserves (HR). In 1982-84, the government of Indonesia declared the SSINR as the Bukit Barisan Selatan National Park (BBSNP). In 2004, UNESCO declared the BBSNP a biodiversity World Heritage Site.

An estimated 1.2 million people live around the border of BBSNP and adjacent PAs representing a human population density of 100 inhabitants per km^2 (Indonesian Bureau of Statistics 2000). These comprise indigenous communities and migrant groups from nearby Java. The population is predominantly rural, with 82% working in farming (Indonesian Bureau of Statistics 2003). Since the late 1970s, coffee growing has represented the dominant economic activity for indigenous and migrant groups, with an estimated 350,000 tons produced annually in southwest Sumatra and exported to 52 countries (Danzer 2006; WWF 2007). However, in the Krui region, to the west of BBSNP, indigenous groups plant coffee only as the first stage of an agro-forest. They intercrop coffee with young *dipterocarp* tree seedlings, which soon mimic natural forests. Locally known as *Damar*, the Krui agro-forests (50,000 ha) buffer the natural forests of BBSNP, provide a habitat for some of Indonesia's most endangered species, including Sumatran tigers and rhinos (Michon and de Foresta 1992; Thiollay 1995), and produce a resin which is commercialized to create incense, varnish, paint, and cosmetics (Kusters et al. 2007).

Methods

We produced satellite- and field-based maps of deforestation and of re-growth rates from 1972 to 2004. A GIS map was created to overlay road, logging trail, and river networks, topography, and park boundary onto the maps of forest and of deforestation. Logistic regression modeling was applied to identify spatial drivers of deforestation for 1972-1982 and for 1982-2004.

We assembled local price statistics for robusta coffee from the local southern Sumatra Indonesian Bureau of Statistics. We deflated the local price time-series by the southern Sumatra's Consumer Price Index (CPI, 1998=100) to account for the growth of local consumer goods and input agricultural costs over time. We gathered socio-economic information on out-park land assets for a total of 1,173 households interviewed in 2006 in five locations inside and outside BBSNP.

Results

Deforestation Statistics (1972-2004) Across the Study Area

Of the 1.17 million ha study area, over half (692,850 ha) was covered in natural forest in 1972. This forest area constituted one large contiguous area of forest that included lowland forests and hill forests. By 2004, the overall size of the forest had been reduced by nearly half at an average rate per original forest cover of 1.69% y^{-1}.

In 1972, the combined area of PAs made up by the former SSINR, the wildlife sanctuary, and hydro reserve protected 75% of the forest. In the subsequent 32-year period, unprotected forests were reduced by 145,264 ha, representing

an 84% loss of original forest cover, at an average rate of 2.86% y^{-1}. In the wildlife sanctuary, forests shrank by 28,696 ha, representing an 81% loss of forest cover, at an average rate of 2.74% y^{-1}, while forests in hydro reserve were reduced by 113,105 ha, representing a 62% loss of forest cover, at an average rate of 2.13% y^{-1}. The forest area of the current BBSNP was reduced by 60,500 ha, representing a 19% loss of forest cover, at an average rate of 0.64% y^{-1}.

Spatial Drivers of Deforestation for the Pro-forest Conversion Period (1972-1982) and the Pro-forest Conservation Period (1982-2004)

The logistic regression model for 1972-1982 (R^2=0.60) shows that smallholder farmers cleared forest areas preferably near abandoned logging trails, near roads, and the forest edge, outside of BBSNP and on flatter areas of land (**Table 1**). The logistic regression model for 1982-2004 (R^2=0.38) shows that smallholder farmers cleared forest areas preferably near roads, outside of BBSNP, and on flatter areas of land (**Table 2**).

Table 1: Results of logistic regression models for N=200 points randomly dispersed on maps of forest cover and of deforestation.

1972-1982	B	S.E.	Wald	df	Sig.	Exp(B)
Slope	-.093	.030	9.706	1	.002	.911
Distance to forest edge	.000	.000	10.743	1	.001	1.000
Distance to logging trails	.000	.000	14.768	1	.000	1.000
Presence of BBSNP	2.298	.534	18.543	1	.000	9.955
Distance to main roads	.000	.000	12.425	1	.000	1.000

Table 2: Logistic regression for the period 1982-2004. A total of N=200 points were randomly dispersed on maps of forest.

1982-2004	B	S.E.	Wald	df	Sig.	Exp(B)
Slope	.097	.028	11.672	1	.001	1.101
Distance to roads	.000	.000	9.474	1	.002	1.000
Presence of BBSNP	-.849	.140	37.018	1	.000	.428

Deforestation and Re-growth Statistics inside BBSNP for the Period 1972-1982 and the Period 1982-2004

During the pro-forest conservation period (1982-2004), in-park deforestation rates were reduced by 40% compared with deforestation rates during the earlier pro-forest conversion period (1972-2004), while re-growth rates increased from 0 to 530 ha y^{-1} (**Figure 1**).

Time Series Deforestation Rates inside BBSNP and Coffee Prices (1972-2004)

Annual international and local coffee prices have been inter-correlated (**Figure 2**), but in 1998 the effect of the exchange rate outweighed the influence of international coffee prices on local coffee prices. Following the 1997-98 Asian economic crisis, the sharp devaluation of the Indonesian Rupiah against the US dollar raised the local price of coffee to a record high in 1998, while international coffee prices remained low. Therefore, we only tested the relationship between in-park deforestation rates and the local coffee prices because farmers are more

Figure 1: Deforestation and re-growth rates inside the park for two distinct periods.

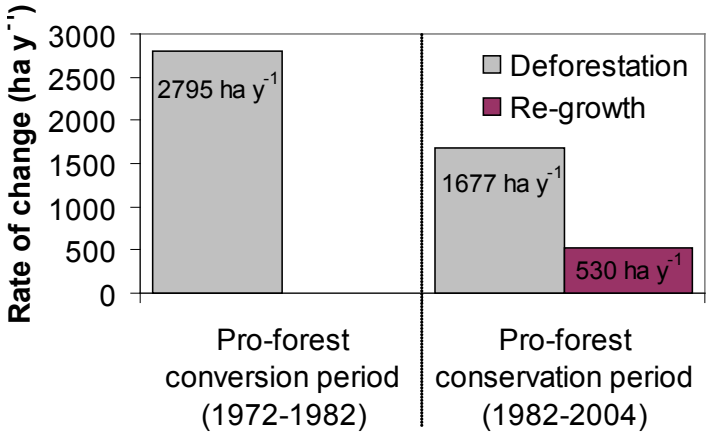


Figure 2: Fluctuations in international and local coffee prices over time.

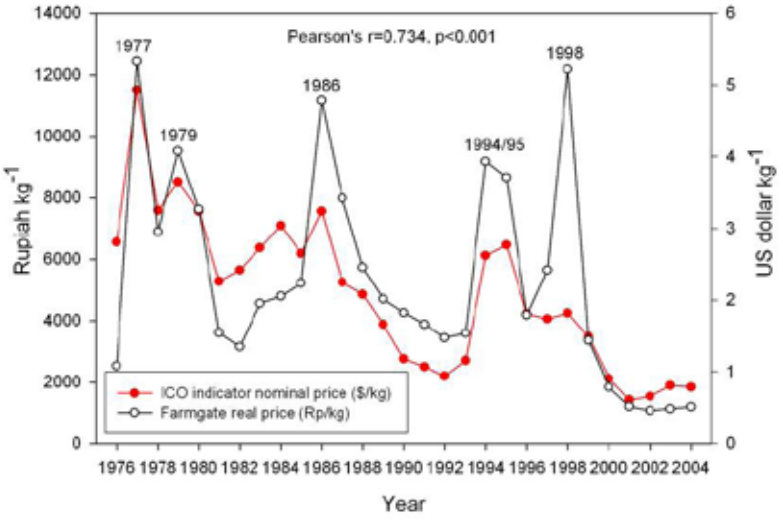
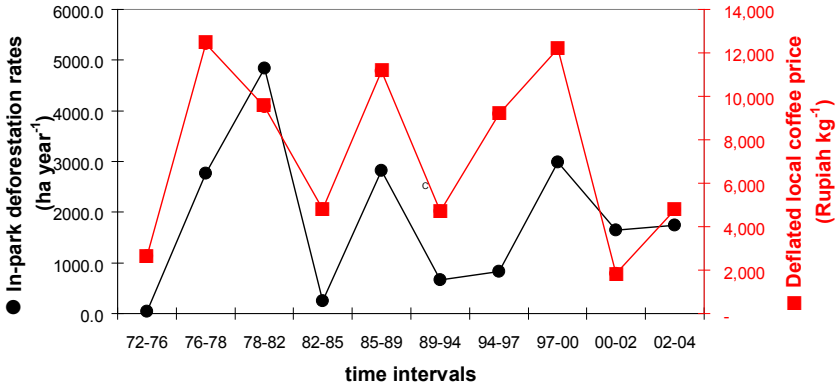


Figure 3: Fluctuations of in-park deforestation rates and maximum local coffee prices over time.



likely to respond to changes in local currency than to changes in international currency. The Spearman's correlation test suggest that in-park deforestation rates very likely correlated with local coffee prices (rho=0.588, p=0.074).

Out-park Land Ownership Characteristics for Illegal and Legal Farmers

We subdivided our sample farmer household population (N=1,173) into three groups:

1. Legal households (N=303) who own and cultivate farmland outside the park;
2. Illegal households (N=255) who own farmland outside the park, but cultivate inside the park;
3. Illegal households (N=615) who are landless outside the park, but cultivate inside the park.

Legal households own more out-park land surface area than illegal households (**Figure 4**); 71% of illegal households are out-park landless while 29% own out-park farmland, but have abandoned out-park cultivation because out-park land is no longer productive or too small to provide sufficient income (**Figure 5**). Illegal households claim that they lack capital to invest in out-park farmland resources, and so have little option but to resort to extensive farming inside the park where land is considered open access. In 2006, illegal farmers generated on average an annual income of $400 while farmland (1 ha) outside the park costs between $500 and $1,000, and fertilizers and herbicides cost $80-90 per year.

Figure 4: Surface area of land owned legally outside the park for three categories of farmers

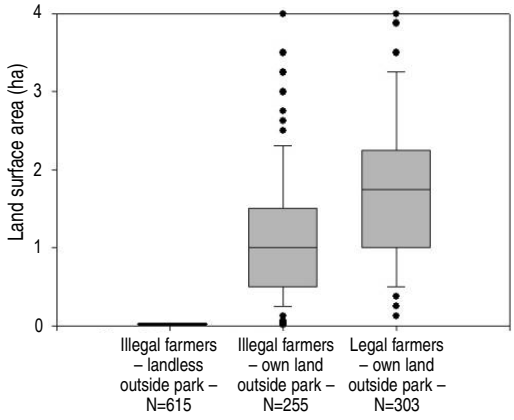
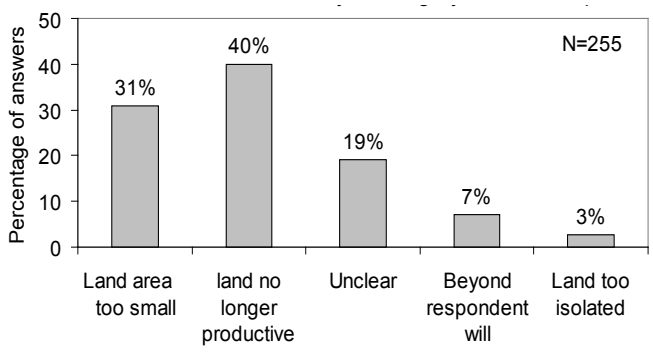


Figure 5: Reasons stated by illegal farmers for abandoning cultivation in the land they own legally outside the park



Discussion

Coffee price reached an all-time high on the international market in 1977, following heavy frost during the 1975 Brazilian winter that caused a national harvest failure (ICO). This record high price triggered mass spontaneous migration to southern Sumatra during late 1970s (Benoit et al. 1989; Verbist et al. 2005). At the same time, government-owned logging companies extracted timber inside BBSNP. In 1978, logging companies ceased to operate, leaving a 123 km network of logging trails unattended in the south-eastern portion of BBSNP. High coffee prices combined with greater accessibility by abandoned logging trails provided strong incentives for farmers to expand coffee inside the park. BBSNP experienced record deforestation rates (4,834 ha y^{-1}) during the period 1978-1982 while coffee production in southern Sumatra underwent a boom in late 1970s. Therefore in-park selective logging activities of the 1970s benefited smallholders from 1978 to 1982 but at the expense of biodiversity.

The 1982 Bali World Parks Congress was a decisive moment for conservation in BBSNP. The Indonesian government declared the former SSINR a national park (BBSNP) in 1982-1984 and banned commercial logging within all Indonesian PAs. In the early 1980s, the newly founded BBSNP office established an inventory of illicit occupation, following which officials carried out evictions of pioneer farmers, in particular of Javanese migrant communities who had settled in the former logging concessions. Likewise, an inventory of illicit occupation was established in the hydrological reserves adjacent to BBSNP, and this led to the relocation of over 65,000 families to a transmigration site in North Lampung between 1989 and 1995 (Benoit et al. 1989).

These law enforcement measures successfully enabled forest re-growth in the former logging concessions of BBSNP and reduced in-park deforestation rates for the period 1982-2004. But these measures also generated conflicts between rural communities and the government and this has had severe consequences for the livelihood of evicted populations (Kusworo 2000). Therefore, law enforcement efforts of the 1980s benefited in-park biodiversity at the expense of people's livelihood. Since President Suharto fell from power in 1998, Indonesia has entered a new era of reforms, and the resentment of farmers towards the Suharto regime saw them claim new-found rights inside BBSNP (Suyanto et al. 2004).

Despite law enforcement, coffee prices remained a powerful incentive for in-park deforestation. However, illegal farmers did not benefit from peak local coffee prices. The highly volatile market increased the likelihood that farmers who planted during peak price times would then sell their coffee during a low price time, three to five years later. In addition, illegal farmers did not maintain in-park coffee plantations for more than five years (Levang pers. comm.) and so could not reap the benefits of subsequent rises in the coffee price. Today, illegal farmers are investment-poor, which limits their ability to diversify into off-farm activities or to intensify out-park farming. The household is then left to resort to extensive farming, implying the need to push into the national park (Reardon and Vosti 1995).

Table 3: Summary of incentives and disincentives for smallholder coffee growers around BBSNP to either promote forest conversion or forest conservation in southwest Sumatra during times when the Indonesian government advocated forest conversion (1972-1982) or forest conservation (1982-2004).

In-park	Pro-forest conversion period (1972-1982)	Pro-forest conservation period (1982-2004)
Incentives to convert	Accessibility from logging trails Peak coffee prices of late 1970s	Peak coffee prices of 1986, 1994-95 and 1998
Disincentives to convert	Accessibility (slope, dist. Roads)	Law enforcement Accessibility (slope, dist. Roads)
Incentives to conserve	None	None
Disincentives to conserve	unknown	Lack of investment capacity (investment-poor) Conflict-related new-found rights since 1997-1998 economic crisis

Conclusion

This study has added to the body of evidence that increasing efforts to maintain biodiversity are in conflict with those to reduce poverty in southern Sumatra. The question is whether it is possible to combine poverty elimination and biodiversity conservation. A strong body of opinion maintains that poverty elimination and conservation can happen together. The term "pro-poor conservation" has been used to identify conservation strategies that are designed to deliver both poverty reduction and biodiversity protection (IUCN 2002). However, lasting positive outcomes of pro-poor conservation projects are elusive (Hulme and Murphree 2001). Projects that seek to integrate conservation and development have tended to be overambitious and underachieving (Adams et al. 2004). Different agencies are likely to wish to adopt different positions. For the special case of BBSNP, we recommend that WCS promotes projects that provide financial incentives for in-park households to gain access to out-park farmland resources or to diversify into off-farm activities, for example, by providing access to micro-credits and to community-based law enforcement around the park.

PART 3
WCS CASE STUDIES – LATIN AMERICA

3.1 The Kaa-Iya del Gran Chaco National Park, Bolivia

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The Kaa-Iya landscape in Bolivia encompasses the northern sector of the Gran Chaco ecoregion. The 34,400 km^2 Kaa-Iya del Gran Chaco National Park (KINP) was created in 1995, and contains the largest area of dry tropical forest under protection in the world (Taber et al. 1997). The second key element of the landscape is the 19,000 km^2 Isoso TCO (indigenous communal land), neighboring the protected area. This communal land includes private properties owned by ranchers and Mennonite farmers. A second TCO, Santa Teresita, encompasses 140,000 ha to the northeast of the KINP, and is titled to the Ayoreo community of the same name. There are Chiquitano communities to the north of the protected area, and additional ranch properties to the east in Bolivia and to the south in Paraguay.

Physical Setting

The Gran Chaco is a tropical dry forest with relatively low primary productivity and slow recovery following disturbance. Chaco forests are generally short (4-15 m with emergents to 20 m) but dense and thorny with an abundance of *Cactaceae* and *Bromelia*. In areas of sandy soils, for example in the southwest where sands were deposited over geological time by the Parapetí River, Chaco grasslands were created and/or maintained by anthropogenic and natural fire. To the east and northeast with higher rainfall, forests transition into Chiquitano dry forest (12-20 m of relatively continuous canopy) and Cerrado vegetation types. Annual rainfall ranges from under 400 mm in the southwestern section of the KINP to 850 mm in the northeastern section (Kaa-Iya Project 2001; WCS et al. 2005).

Resource Use

Rainfed commercial agriculture at the edges of the landscape is practiced by Mennonite colonists in the west (cotton, sorghum) and industrial-scale soybean farmers in the northwest. However, the latter also utilize borehole irrigation. Subsistence agriculture in the Isoso communities along the Parapetí River also depends on irrigation, using traditional canal systems to draw water off the river during the six months (January-June) when the river is flowing. The river dries up completely during the dry season, when rainfall is also minimal. A single commercial rice farmer also depends on river irrigation in the Bañados de Isoso inland delta of the Parapetí. Extensive livestock ranching is the principal economic activity throughout the landscape, practiced by private ranchers as well as by indigenous communities. Only about half of private properties

are fenced, boreholes are drilled but very little artificial pasture is planted, and instead cattle are set loose in the native vegetation, depending considerably on browse during the dry season.

Hunting produces 25-40% of the meat consumed by Isoseño communities, principally from ungulates (gray brocket deer, tapir, white-lipped peccary, collared peccary), armadillos (nine-banded, three-banded, yellow, large hairy, and small hairy), the Chaco chachalaca, and various *Columbidae*. Standing biomass of mammals is estimated to be as high as 500 kg/km^2 in non-hunted areas, and several species (brocket deer, collared peccary, armadillos) are resilient to current hunting pressure. Game meat is complemented by domestic livestock, while fish represent a seasonal resource during the months that the Parapetí River flows. In the Bañados de Isoso, some seasonal lagoons permit fishing in other months by communities in the northern end of the Isoso. The Chiquitano and Ayoreo indigenous communities also hunt for subsistence purposes, as do ranch hands.

Cultural Setting

Three indigenous peoples live in the landscape: the Guaraní-Isoseños, the Ayoreo, and the Chiquitano. They benefit from the on-going land reform process that is consolidating land claims into indigenous communal lands or peasant communities. Although colonization by highland groups moving to the lowlands is significant, the Chaco region has not been a preferred destination. Nevertheless, one or two colonization attempts have been made in the northern portion of the Isoso TCO and have been successfully blocked by collective action by the Isoseños and local ranchers.

The Guaraní-Isoseños have occupied communities along the Parapetí River since the late 1400s-early 1500s, following general migrations induced by the colonization of Brazil and Uruguay. The Guaraní's search for the "land without evil" brought some groups to the Isoso where they absorbed the resident Chané and adopted their system of irrigated agriculture along the river (Beneria-Surkin 2003; Combès 1999). In addition, they keep livestock (6,000 cattle, 26,000 goats, pigs, chickens) loose in the communities for subsistence and for sale. Externally-funded projects have established eight community cattle ranches (2,200 cattle) that replicate the scale and practices of private ranch properties in the area (Barahona et al. 2005). The Isoseños also hunt for subsistence purposes and for sale when markets are available: spotted cat (jaguar, ocelot, Geoffroy's cat) and fox (pampas fox) skins through the 1980s, parrots (blue-fronted Amazon, monk parakeet). Seasonal labor is a major economic activity as well, involving emigration of large portions of some communities for six to eight months of the year to participate in the industrial sugar cane harvest north of the city of Santa Cruz. Other wage labor opportunities closer by include harvesting crops for the Mennonites and year-round work as ranch hands (Beneria-Surkin 1998, 2003).

The current population of Isoseños is estimated at 12,000, distributed in 27 communities of the Isoso TCO along the Parapetí River and roughly 30 km to the west of the KINP boundary. In 1996 the Isoseño organization Capitanía de Alto y Bajo Isoso (CABI) demanded indigenous communal land ("Tierra Comunitaria de Orígen" or TCO) of 1.9 million ha that is contiguous with, but does not overlap, the KINP. The on-going review and titling process has so far titled 560,000 ha to CABI.

Most communities have elementary schools, or share one with a neighboring community, while the central community of La Brecha has a high school with dormitory facilities, graduating its first class in 1998. Education is bilingual

Spanish and Guaraní, and most teachers are Guaraní speakers from Isoso or nearby areas. La Brecha also has a hospital. Several communities have clinics or health posts, though attention and supplies are not dependable. Traditional healers have been incorporated into the medical system and attend urgent cases.

The Ayoreo population includes one group of approximately 50 who remain in voluntary isolation within the park, migrating periodically back and forth to northern Paraguay. The vast size of the KINP was in part justified as a means to provide them with space so they could maintain their hunting-gathering and nomadic lifestyle. Another group of Ayoreos within what is now the KINP was contacted by missionaries in 1962, and settled in the community of Santa Teresita, to the northeast of the park. In the land reform process, this community requested a TCO of 78,000 ha, which was titled in 2002, for its current population of roughly 230 residents. The community practices minimal agriculture and livestock raising, hunts for subsistence, and has logged some of their valuable timber (Martínez 1998; Nostas 1998; Testino and Linzer 1998). Their activities are concentrated within the TCO and they do not currently exploit resources in the KINP itself. A small school operates in the community, but the community relies principally on health and education facilities in the nearby municipal seat of San José de Chiquitos (30 km away). Santa Teresita is represented politically by Centro Ayoreo Nativo del Oriente Boliviano (CANOB).

The Chiquitanos were "created" beginning in 1692 through an amalgamation of over 30 indigenous groups under the "reduction" process of the Jesuit missions, and currently occupy numerous communities across a large area north of the KINP. Only two communities, Natividad (in its current location since 1935) and San Juan del Norte (founded 1968), with a total population under 250 persons, are within 25 km of the KINP boundaries. These communities depend principally on agriculture for subsistence, with a little family livestock and some hunting, but they do not currently exploit resources within the KINP itself. Natividad received title to 4,000 ha in 2002. These communities also rely principally on health and education facilities in the nearby San José de Chiquitos (30 km away). Both communities are represented politically by the Chiquitano organization Turubó.

The Mennonites began moving to the Isoso TCO in 1990, and their population now numbers some 8,000 in five colonies to the west of the Parapetí River. They practice intensive commercial agriculture requiring clear-cutting of over 16,000 ha of forest to date for some 21,000 head of cattle (Barahona et al. 2005; Linzer 1998; Nostas 1998). Though they are located outside the KINP, the complete replacement of native forests with crops affects wildlife over extensive areas—driving ungulates such as tapirs and white-lipped peccaries into hunting areas, attracting *Psittacids* and *Columbids* to cultivated areas, etc. Additional negative environmental impacts may come from use of pesticides and fertilizers, overuse of soils, diversion of river water for irrigation, and deforestation of riverine forest right up to the river bank. The Mennonites operate their own schools and health care system. In addition, they support the clinic in the Isoseño community of Isiporenda. Business relations with the Isoseños include commerce, seasonal labor, and recently, rental of Isoseño land for cultivation.

Some 300 ranch properties are located within the Isoso TCO itself (with over 80,000 head of cattle), eight within the KINP, and others along the eastern boundaries of the park. While land clearing is minimal, overgrazing by cattle in native forests and grasslands has severely degraded these habitats, and the lack of fencing on many properties means that livestock ranges into the KINP itself

and onto communal Isoso lands. To date, as part of the land reform process, 160,000 ha of private properties have been titled within the Isoso TCO. The ranches that existed within the KINP boundaries when it was created are also recognized and allowed to consolidate their land rights, though the land titling process has not yet addressed their cases. The ranchers are organized into associations (in each of the municipal headquarters Charagua, San José, Roboré, and in Santa Cruz).

History of Protected Area Establishment

The Kaa-Iya del Gran Chaco National Park and Integrated Management Areas was created in 1995 by presidential decree. The original core area (IUCN Categories I and II) and multiple use areas (IUCN Category VI) were subsequently modified by the protected area management plan (Kaa-Iya Project 2001) which integrated biological information with socio-economic information to zone the protected area into the following use categories: fully protected (IUCN Categories I and II), extensive non-consumptive use (IUCN Category II), extensive consumptive use (hunting, fishing, and gathering, IUCN Category VI), intensive consumptive use (livestock ranching areas, IUCN Category VI), special use (gas pipeline right of way, IUCN Category VI), and recovery (IUCN Categories II and IV). In 2001 two Ramsar sites were declared—the 615,882 ha Río Parapetí and Bañados de Isoso site includes portions of both the KINP and the TCO Isoso, and the 670,000 ha Palmar de las Islas y las Salinas de San José site entirely within the KINP. No specific management activities have been implemented for these sites.

The park's management committee includes representatives of the three indigenous groups (Isoseño-Guaraní, Chiquitano, Ayoreo), the three municipalities whose jurisdictions overlap the protected area (Charagua, Pailón, San José), and the Department of Santa Cruz.

Kaa-Iya is the first national park in the Americas created at the request of an indigenous organization. The proposal for the creation of the protected area was in fact part of CABI's two-pronged territorial strategy: 1) the 3.44 million ha Kaa-Iya protected area, and 2) the 1.9 million ha Isoso TCO. The protected area serves in part as buffer against the expanding agricultural frontier, guaranteeing the physical and cultural integrity of the Isoseños' resource base, which are threatened by the environmental, socio-economic, and cultural consequences associated with regional commercial ranching and farming practices (Redford and Painter 2006; Winer 2003a). Indeed, the single largest benefit of the KINP is the placing of 3.44 million ha of traditionally claimed land beyond the reach of ranchers and the agro-industrial sector. Together, the KINP under CABI administration and the titling of the 1.9 million hectare TCO create a coherent territory recognized both traditionally and in terms of local governance at the municipal level. This forms the basis upon which the Guaraní Izoceños intend to develop their capacity to both retain their identity as an indigenous tribe while building stronger and more equitable economic links with the expanding market driven economy of Santa Cruz de la Sierra (Winer 2003b).

"Kaa-Iya" means "spirit guardians of the forest" in Guaraní, while the Bañados de Isoso inland delta of the Parapetí is known as "Yande yari," or "our grandmother," illustrating the importance of the protected area as a source that generates wildlife, fish, and other resources which are exploited in the neighboring Isoso TCO by Isoseño communities (Combès et al. 1998; Oehrlich et al. 2002). In the creation and management of the KINP, the Isoseños also emphasize that environmental conservation is essential to their quality of life, and to their identity as a people (Redford and Painter 2006).

No indigenous communities were affected by the creation of the park in the sense that all are located at least 20 km from the park's boundaries, and none of the communities were or are actively exploiting wildlife or other resources inside the park's boundaries, with the exception of the uncontacted Ayoreos who maintain a nomadic hunting-gathering existence between portions of Kaa-Iya and Paraguay. The park proposal also sought to minimize overlap with existing private properties, and less than a dozen remained within the park's boundaries or overlapping its borders. These landowners were allowed to remain and to consolidate their land rights, though formal titling has not yet taken place.

Resource Use

Resource use within the Kaa-Iya National Park is limited to the uncontacted Ayoreo group of hunter-gatherers, the above-mentioned ranch properties which pre-dated the park's creation, and the Bolivia-Brazil gas pipeline right-of-way. The gas pipeline was constructed in 1998-2000, following the creation of the park, but its construction was anticipated and has subsequently been managed and monitored so that indirect effects such as colonization or hunting have not occurred within the park's boundaries. On ranches, in addition to grazing by cattle, the ranch hands also hunt for subsistence needs.

Within the Isoso TCO, resource use includes farming, cattle ranching, small livestock (goats, pigs, chicken), firewood gathering, timber for local construction, hunting, and fishing. Women are involved in all these activities except cattle ranching, hunting, and construction timber, though their access is limited to resources near the communities and near the river. The Isoseño women's organization, Central Indígena de Mujeres de las Comunidades de Isoso (CIMCI), is developing projects that promote traditional knowledge and the sustainable use of natural resources for sale locally and in the city of Santa Cruz: fish meal, coffee from "cupesí" (*Prosopis chilensis* or mesquite, Leguminosae) fruits, shampoo from "timboi" (*Enterolobium contortisiliquum*, Leguminosae) fruits, and honey from native stingless bees (*Melipona*).

Access to farm land is divided by community and by household, with multiple families sharing irrigation canals and dividing time for water. Access to livestock grazing land is common, except in the case of community-scale donor-financed projects which emulate private ranches by building fences and borehole infrastructure, though multiple households contribute stock and commit time/money to these projects (Barahona et al. 2005; Villaseñor 2007). Access to wildlife, firewood, and fish is common, with no divisions within the Isoso by community.

At this time with a land reform and land titling process underway, land is the principal resource, including deals with private landowners regarding the size of properties to be titled privately versus communally, and lease arrangements allowing the Mennonites to cultivate communal lands.

Within the Chiquitano communities and the Ayoreo TCO of Santa Teresita, resource use similarly focuses on small-scale agriculture for subsistence use and local sale, family livestock, hunting, and gathering (Linzer 1998; Martínez 1998; Nostas 1998). Santa Teresita also has sold some timber. San José de Chiquitos, the municipal center 30 km away from these communities, is the principal market for agricultural and timber products.

A number of hydrocarbon exploration concessions have been granted in the KINP and Isoso TCO, leading to exploratory wells in both areas. Although they were subsequently dismantled because they are not economically viable under current conditions, they could be exploited in the future. A private individual has also solicited a mining concession to extract minerals from the salt pans in

the KINP, without success to date. Spotted cat and fox skins were extremely valuable in the past, fueling hunting across the current KINP where oil companies had opened road grids for seismic testing. Should another wild animal or plant product become valuable in the future, pressure would increase quickly among local and non-local collectors. Finally, the land colonization pressure which currently focuses on other lowland areas could shift to the Chaco when other lands are occupied, conflicts elsewhere intensify, or when technological changes facilitate agricultural production in the dry Chaco conditions.

Resource Use and Conservation Targets

Conservation targets for the Kaa-Iya landscape are: 1) viable populations of species important for communities (ungulates, armadillos, tegu lizards) and threatened species (jaguars, Chacoan peccaries, Chacoan guanacos, blue-fronted Amazons); 2) to maintain the structure and functionality of representative habitats; and 3) to maintain the integrity of the protected area and improve the connectivity with other ecosystems. Given the minimal use of resources within the protected area, combined with its vast size, viable populations of most species of wildlife appear likely to persist over the long term inside the KINP. The principal exception is the Chacoan guanaco with less than 200 individuals remaining, concentrated on private ranch lands outside the KINP. The gas pipeline through the KINP and the bi-oceanic highway corridor north of the KINP linking Santa Cruz to Puerto Suárez both threaten connectivity between KINP and other ecosystems, though mitigation measures along the gas pipeline have minimized its actual effects. Ranching activities threaten the structure and functionality of native forests and grasslands at the small number of ranches inside the KINP, and on virtually all lands outside the KINP, because livestock is everywhere. In contrast, subsistence hunting of wildlife is for the most part sustainable, with the exception of tapir and white-lipped peccary which have disappeared from portions of the Isoso TCO.

Resource Use and Governance

As described above, resource use within the protected area is virtually nil. Commercial hunting for spotted cat, fox skins, and parrots that occurred across much of the current park ended by 1990. Thus the creation of the park did not curtail resource use by any indigenous communities or other local residents. No indigenous communities or private landowners were displaced by the creation of the park. Although indigenous communities were not and are not utilizing resources from the park—with the occasional exception of fishing in the Bañados de Isoso—the park management zonification plan permits utilization, including hunting, fishing, and gathering in appropriate areas and according to a specific management plan. Should such use take place in the future, park guards will be responsible for monitoring and enforcement.

The principal change in resource use in the landscape has been associated with the land reform process and the titling of private and communal lands within the Isoso and Santa Teresita TCOs, and to the Chiquitano communities. Subsistence use of wildlife and other natural resources by indigenous and local communities was already permitted, but formal land titling clearly defines the area where each landowner (private or communal) can conduct his/her respective activities. In the case of private ranchers, this has encouraged them to fence their properties and thereby restrict the effects of grazing. In the case of the Santa Teresita and Isoso indigenous groups, land titling has significantly increased the area of land that they respectively own and manage—from 1,500 to 78,000 ha in the case of Santa Teresita, and from 67,000 to 560,000

ha in the case of the Isoso (Castillo 2007). While these lands are outside the KINP, the protected area contributed to their formal titling via funds generated through negotiations with the Bolivia-Brazil gas pipeline sponsors in the measures designed to respond to environmental and socio-economic impacts of the pipeline's construction and operation. The government requires each indigenous organization owner to develop a management plan for its TCO. In the case of the Isoso TCO, this management plan is currently being designed, and will include a zonification into areas for settlement, for livestock, for hunting, and for conservation. Specific wildlife management plans are being prepared by Isoseño technicians, including quotas by species, which in turn will be reviewed by the council of community "capitanes" or leaders, and approved by the Isoso General Assembly. Enforcement will in turn be ensured by these same community leaders.

With respect to alternative economic activities, CIMCI seeks to promote activities within the Isoso TCO to increase household incomes while promoting the conservation of riverine forest. WCS and the national bio-commerce program are also supporting pilot commercial wildlife use programs to add value to animals hunted for subsistence purposes and/or to benefit from resilient species, such as collared peccaries and tegu lizards. Finally, the Kaa-Iya Foundation is promoting pilot tourism projects in the KINP that link to visitors from Santa Cruz, San José, and Roboré (Testino and Linzer 1998; Winer 2003a, 2003b).

Relations are generally positive between local peoples—indigenous groups, ranchers, Mennonites—and the protected area. Not only did CABI propose the creation of the protected area, but the Isoseño organization also assumed responsibility for co-administering the KINP from its creation to the present. For over a decade now this has generated direct economic benefits in the form of full-time employment as park guards for 20 Isoseños, four Chiquitanos, and two Ayoreos. Its role in the administration of the protected area has also allowed CABI to generate and benefit from large-scale projects including a USAID-funded biodiversity conservation program that employed Isoseño technicians and coordinators involved in management planning, applied research, and environmental education, in addition to supporting the institutional strengthening of CABI itself (Winer 2003a, 2003b). CABI's role and vision in the protected area also made possible the successful negotiation with the sponsors of the Bolivia-Brazil gas pipeline of a $3.7 million Indigenous Peoples' Development Program that included important resources for institutional strengthening, land titling (43 Chiquitano communities, 273,000 ha of Ayoreo TCOs, and 560,000 ha to date of the Isoso TCO), and productive activities (revolving credit systems to provide hand pumps for household water supply) (Redford and Painter 2006; Winer 2003a, 2003b).

The current political context in Bolivia has complicated relations at several levels. Although the presidential discourse is in favor of indigenous peoples, and in favor of local control over protected areas, CABI's shining example of successful administration of a national protected area (including the administration of public funds confirmed by independent annual audits) is being ignored because the governing party does not control CABI. Political instability has delayed the renewal of CABI's co-administration agreement, which expired in early 2006. The municipality of San José has also reinvigorated its claims on the protected area, demanding a major redrawing of municipal boundaries that would extend its control to the Paraguay border, and pushing to re-open a road (unused in over a decade) through the KINP to the Paraguayan border purportedly to promote tourism and international commerce.

Conclusions

The Kaa-Iya landscape program, and the CABI-WCS partnership, is based on the explicit recognition of complementary interests in promoting conservation through the creation of the Kaa-Iya National Park and its subsequent administration by CABI, and in consolidating CABI's institutional structure and land rights to a neighboring indigenous territory (Castillo et al. 2006; Redford and Painter 2006; Winer 2003a, 2003b). The protected area has generated certain direct economic benefits in the form of employment, while the zoning allows for increased future utilization of natural resources. Currently, tourism potential on behalf of local communities and the park is being explored through pilot projects. More importantly, CABI has successfully used the park to leverage additional resources for projects in the Isoso TCO, of which the most important by far has been the formal land titling of 560,000 ha to CABI. This land area represents an enormous economic value in assuring the long-term persistence of the Isoseño people, though again the land must be effectively utilized to leverage investments that promote appropriate economic development. Future development options on Isoso TCO lands include large-scale agriculture, livestock production, oil/gas exploitation, and environmental services associated with carbon sequestration, biodiversity conservation, soil conservation, and protection of water resources (Testino and Linzer 1998; Winer 2003a, 2003b). CABI has the necessary political and administrative capacity to develop and manage these projects, with continued technical assistance from WCS. In addition to the TCO Isoso and KINP management plans, WCS is also contributing to land-use planning at the municipal level, with the expectation of promoting conservation-friendly development across the entire municipality. Land tenure continues to represent the most fundamental guarantee for long-term livelihoods at the site.

Livelihoods, in this case and in general, cannot be reduced to mere economics. The concept itself of the TCO as indigenous territory provides indigenous peoples with the space they require to develop at their own pace and according to their cultural traditions and social systems, without being forced to adopt strict external economic development models. Though the KINP is not part of the Isoso TCO itself, the Isoseños conceive of it as a complementary part of their ethnic identity. While narrow economic benefits (income, employment, commodities, services) are being derived from conservation in the Kaa-Iya landscape, multiple actors in the landscape recognize additional social and cultural benefits, and this is the guarantee of effective long-term conservation. Conservation will never win, in the long term, the economic argument because at any given scale, an alternative use for wildlife and wild areas can be found that will generate greater short-term economic benefits to at least some local beneficiaries. If we enter this argument—whose derivative is that protected areas must pay for themselves—we will be trapped and doomed to failure. We are on the defensive, we are exclusive, we are negative and reactive, boxed inside park boundaries. Instead we must argue that wildlife and wild places are treasures that are not for sale (because they have no price), and that conservation is an essential part of any livelihood strategy. In turn, all relevant actors for any given landscape are responsible for generating the resources required to conserve it. Some degree of utilization may be possible, but all must recognize that any use has limits. Our goal is to promote a common conservation vision among these actors. We must go on the offensive, be inclusive, be positive and proactive, and extend outwards to connect parks with surrounding areas.

3.2 Mamirauá and Amanã Reserves – Involvement of Social Actors, Participation of Locals and Conservation Benefit Sharing in Two Protected Areas in Central Amazon, Brazil

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Mamirauá and Amanã are two Sustainable Development Reserves (SDRs) in the Brazilian Amazon where biodiversity conservation has been carried out by local environmentalists supported by WCS for the last 17 years. A Sustainable Development Reserve is a new Brazilian category of protected area, corresponding to IUCN Category VI. Mamirauá and Amanã are both located in the floodplains of Central Amazon, alongside the Solimões (Amazon) River.

Environmental Aspects

Mamirauá Sustainable Development Reserve (MSDR) is located at the confluence of the Solimões and Japurá Rivers and the Auatí-Paranã, a branch of the Solimões draining into the middle course of the Japurá. The seasonal flooding of the Solimões River raises the water level 10 to 12 m above the low water season levels. When floodwaters are at their highest point, virtually all lands at Mamirauá Reserve (1,124,000 ha) are completely submerged, and only the highest parts of the forest canopy can be seen above the water line.

This flooding pulse, typical of Central Amazon, defines large portions of seasonally flooded terrestrial habitats, locally called *várzeas*. MSDR is the largest Brazilian protected area devoted to the conservation of the biodiversity of flooded forests of any kind, and the only area conserving the *várzea* flooded forests, which are present along many Amazon white water rivers.

The geomorphology of Mamirauá Reserve provides a large number of aquatic habitats inside this protected area. They vary from open water habitats such as rivers, river branches, or *paranãs*, streams (or channels), and lakes, to other perennial habitats such as backwater areas, or temporary ones such as water holes (pools of water in the forest floor, or in the sands or mud of the beaches).

The differences in the height and duration of the flooding produces distinct terrestrial habitats with different vegetation structures and compositions in the *várzea* ecosystem. Approximately 10.2% of the area of Mamirauá Reserve is covered by permanent water bodies, and out of the remaining 89.8%, 44.3% comprises *restingas* (flooded forests located in higher levees); 31.3% is made of *chavascal* (flooded shrubby vegetation located in lower areas), and 14.2% is formed by other plant communities (palm groves, grasslands, beaches, and cleared lands and gardens).

The fauna found in Mamirauá show a high degree of endemism. There is also high biodiversity in fish fauna, which is more diverse than in the adjacent black or white water river sections. Mamirauá Reserve was created especially to protect the famous white uakari (*Cacajao calvus calvus*), the only neotropical primate. Almost the entire range of this primate is located inside the reserve. Another endemic and important primate species from Mamirauá is *Saimiri vanzolinii*, the black-headed squirrel monkey. Other threatened species are also present, like the black giant caiman (*Melanosuchus niger*), the Amazon manatee (*Trichechus inunguis*), the jaguar (*Panthera onca*), and the giant bony tongue fish (*Arapaima gigas*).

The mid- to large-sized vertebrate fauna of Mamirauá is basically identical to that found in the surrounding *terra firme* forests, although less diverse, since only tree-dwelling animals, or those that swim with some expertise, are able to survive in the *várzea* during the long periods of flooding (as long as five to six months in some years). Mammals such as tapir (*Tapirus terrestris*), white-collared peccary (*Tayassu tajacu*), paca (*Agouti paca*), cotias (*Dasyprocta* sp.) and armadillos (tatus) (*Dasypus* sp. and other genera) do not occur in Mamirauá (or are very rare) due to seasonal floods. However, animals that are markedly terrestrial in other localities, such as the tortoise (*Geochelone denticulata*), apparently find favorable habitat in the *várzea*, and can be found in Mamirauá throughout the year. Depending on the characteristics of the annual flooding, large animals can enter the area to take advantage of its food resources. Among these we find the white-lipped peccary (*Tayassu pecari*) and, probably, the brocket deer (*Mazama* sp.). These species are effectively found in the dry tall forests (*terra firme*) of the Amanã Reserve and in the vicinity of Mamirauá.

In total, about 340 species of birds are found in Mamirauá. The avian fauna are found within the High Amazon Province, in forest environments with an aquatic influence. To date, about 340 species of fish have been recorded in the reserve and in the immediately adjacent bodies of water, the greatest number of fish ever registered for a *várzea* environment. This diversity is likely due to the range of aquatic habitats available and the wide environmental fluctuations that characterise the hydrologic regime.

So far, almost 300 species of trees and lianas have been identified in Mamirauá, mainly inventoried in five independent studies which covered a total of 20 hectares. Nearly 60 species of submerged or true floating aquatic macrophytes have been recorded. The most significant macrophytes in Mamirauá are *Paspalum* sp., *Eichnochola* sp., *Salvinia* sp., *Pistia* sp., *Azola* sp., *Eichornia* sp., and *Utricularia* sp.

Amanã Sustainable Development Reserve (ASDR) is contiguous or adjacent to Mamirauá Reserve, and also protects large extensions of flooded environments. Located in the middle of two enormously important river basins—the Japurá and Negro Rivers—Amanã Reserve holds many of the aquatic and terrestrial habitats present in the most significant Amazonian ecosystems, such as the *várzea* and the *igapó* flooded forests (16% and 9% of the total protected area, respectively) and the non-flooded *terra firme* forest, covering 69% of the surface. Other environments, like *campinas* (shrub woodlands and grasslands) or *cocais* (palm trees groves), may represent about 5% of the area. Anthropogenic environments, like villages and gardens, are smaller than 1% of the total area of Amanã Reserve. The single most relevant morphological trait of Amanã Reserve is the Amanã Lake, the fourth largest ria lake of the Amazon, at 42 km long and 3 km wide. Amanã Lake, together with Urini Lake, another ria lake, form a watershed that receives small tributaries (*igarapés*) from the Japurá and Negro River basins, creating a very large and complex set of aquatic habitats.

Amanã Reserve is one of the largest Brazilian protected areas, comprising 2,350,000 ha of land and water bodies with little human intervention and almost no anthropogenic disturbance. Most importantly, Amanã links together two other extremely important protected areas: Mamirauá Reserve to the west and Jau Park to the east. In doing so, Amanã Reserve enables gentic flow through large extents of the Central Brazilian Amazon. Together, these three protected areas comprise one of the largest blocks of contiguous protected tropical rain forests on the planet (about 6 million ha). This is the core of the Brazilian Central Amazon Ecological Corridor, made of protected areas, Indian territories, and other territories forming a total of almost 24 million ha.

First-hand research of the Amanã SDR has indicated the presence of many rare and endangered species whose populations have been drastically reduced elsewhere in the Amazon. These include the black uakari (*Cacajao melanocephalus*), black caiman (*Melanosuchus niger*), yellow caiman (*Caiman crocodilus*), Amazonian manatee (*Trichechus inunguis*), red river dolphin (*Inia geoffrensis*) and river dolphin (*Sotalia fluviatilis*), jaguar (*Panthera onca*), harpy eagle (*Harpia harpya*), and pirarucu (*Arapaima gigas*). Other endangered species on the IUCN Red List may also occur, including giant otter (*Pteronura brasiliensis*), wattled curassow (*Crax globulosa*), black and white hawk eagle (*Spizastur melanoleucus*), horned screamer (*Anhima cornuta*), Orinoco goose (*Neochen jubata*), yellow-footed tortoise (*Geochelone denticulata*), yellow-spotted river turtle (*Podocnemis unifilis*), and six-tubercled river turtle (*Podocnemis sextuberculata)*.

In Amanã Reserve a large number of vertebrate species can be found. Due to the fact that the major ecosystems of the Amazon are present, the diversity of Amanã Reserve is particularly high. More than 450 fish species have been recorded to date, and approximately 200 bird species were found only in the portions of *igapó* and *terra firme* forests. Mammalian diversity is also much higher than that recorded for Mamirauá Reserve.

Both Mamirauá and Amanã Reserves are tremendously important to the Central Brazilian Amazon, and perhaps for the entire Amazonian Region. These two protected areas provide local towns (and distant Amazon cities) with relevant ecosystem services: large portions of pristine habitat and intact vegetation cover are important for carbon sequestration and climate regulation, and the flooded areas are vital for the control of the flooding pulse and fertilization of most of the agricultural land of the Amazon. Flooded areas in Central Amazon are also nursery grounds for most of the wildlife: Economically important fish species, caimans, and other game species are particularly abundant in flooded forests and other flooded environments; these areas act as a source for populations under constant removal for use elsewhere in the region. This high local productivity is a result of the high abundance of nutrients in the water, combined with a diverse forest, high temperatures, and humidity. This is most likley the reason why the flooded habitats have come under such intense human pressure, and have the highest human densities since pre-historical times. The Amazonian flooded forests are the most threatened ecosystem of this entire biome.

Social Aspects

Contemporary human settlements in the Mamirauá and Amanã Reserves date from the first half of the 20th century. Prior to this, the entire region was inhabited by various Amerindian groups, among which the Omágua super-group predominated. The Amerindian population was decimated by war and diseases introduced during European colonization, and the remaining indigenous peoples were incorporated into colonial society by means of miscegenation instigated by the Portuguese. At present, even the few remaining indigenous communities living in the region (two located inside Mamirauá Reserve and three near Mamirauá and Amanã Reserves) have a high degree of miscegenation, both cultural as well as biological. The dominant ethnic group in the area is the *Caboclo,* resulting from the miscegenation that took place from the 16th century on. The American Indian ethnic groups present in the reserves today represent less than 10% of the population.

About 26,500 people live inside Mamirauá Reserve or immediately outside its limits. These people are grouped in about 125 small villages, ranging from 35 to 560 inhabitants each. At Amanã Reserve there are about 2,400 people in 38

small villages, most of them located in the *várzea* forests (16% of the reserve). Consequently, most of the Amanã Reserve is completely free from human intervention. In both reserves, traditional populations are deeply involved in the management of the protected areas and in the conservation of local biodiversity by the sustainable use of local natural resources.

The human factor in Amanã did not imprint the landscape, but new archaeological information indicates that Amanã Lake, one of the largest Amazonian lakes existing today, supported a much larger human population in pre-Columbian times. Some evidence suggests that eight centuries ago, a large human population lived at the banks of the lake.

In Mamirauá and Amanã Reserves, most of the populations are linked with the flooded environments. A small part of the population is associated with the *terra firme* forest, where a specific set of subsistence activities are linked more with agriculture and exploitation of non-timber forest products (NTFPs). In the flooded environments, subsistence is based on a multi-task seasonal calendar, where activities linked with fisheries, hunting, and gathering of aquatic game species, timber extraction, and agriculture are mixed in accordance with the seasonal inundation. People living in the flooded forests are involved in a large number of traditional management systems and have a diverse knowledge of traditional techniques for sustainable use of natural resources.

Despite the abundance of natural resources and the expertise in the technologies of exploitation, income is on average very low for local households. Due to the unfair insertion of these populations to the regional and national markets, extractive products never pay a fair amount to the local traditional producers because a share of the value is retained by the economic links of the market in the local towns and by middlemen. Consequently, poverty is common, material goods are scarce, and local access to public services is almost non-existent.

Local people are faced with difficult relationships with the market as they have limited buying power. Invariably all villages in the area have very limited resources and personnel for education and health care. Consequently, there is an elevated rate of displacement of the local work force from these small villages to regional town centers and to large cities in the Brazilian Amazon. On the other hand, the two reserves are also very influential on the lives of four small towns (total population of more than 120,000 people).

The Creation of Mamirauá and Amanã Reserves: Some Historical Remarks

Mamirauá Reserve was created in 1984 as an ecological station of the federal government to protect white uakaris, one of the most threatened primate species in the Amazon. This was a result of a proposal made by José Márcio Ayres, a WCS biologist, to the Brazilian environmental authorities. However, this protected area had a short life, was lost in the middle of big administrative changes at the end of the 1980s, and in 1990 was turned into an Amazonas State ecological station. Ecological stations are protected areas devoted solely to protection, environmental education, and scientific research. This was not compatible with the traditional occupation of the area and the economic activities of its inhabitants. To bring the management of the protected area to a more realistic level, it was proposed to transform it into a new category created by the Amazonas State government, the Sustainable Development Reserve, of which Mamirauá Reserve was the first attempt. In this new category, the presence of traditional human population is allowed in accordance with a system of zones of sustainable use and zones of total protection. This allows only the sustainable removal of natural resources from the local biodiversity, and all human

activity falls under a management plan approved by locals and by the state environmental authorities.

When this category was first created in 1996, it was seen as one of the new solutions to the problem of traditional human populations inside protected areas. The category puts a larger emphasis on the scientific bases for the establishment of management plans and plans for sustainable use. The emphasis on the involvement and participation of local people in the process of conservation was very strong and informed the decision making for the protected area. As the experiences of Mamirauá Reserve proved successful, Amanã Reserve was created as a Sustainable Development Reserve at the request of the local inhabitants in 1997. The decree for the creation of Amanã Reserve was signed in 1998.

The impact of this new category of protected area in Brazil was considerable, and Márcio Ayres and his group had a very positive impact in the national system of protected areas. This system, approved by the Brazilian Congress in 2000, brought the category of Sustainable Development Reserve—where the presence of human settlements and the maintenance of traditional activities under the regulation of management plans are allowed—to the federal level. Now SDRs occur all over the Amazon, in the Atlantic Forest and the coast. The SDRs created more recently by all levels of governmental administration (federal, state, and municipalities governments) suggest that it is considered a valid and effective form of protected area in Brazil.

Resource Use and Management

Mamirauá and Amanã Reserves provided adequate (or improved) levels of protection to local biodiversity associated with a strong alliance with the local human population. This alliance was based on the empowerment of locals (by their involvement and participation in all levels of decision making) and the assumption that adequate management of sustainable use of biodiversity could promote a better quality of life.

At present, the human settlements or villages (known as *comunidades*) in both reserves are organized into political sectors of neighbor communities. This organization was strongly supported by the Catholic Church in the mid 1970s and early 1980s in many parts of the Amazon, and provided a base for the current system of representation. Those villages and sectors have representatives that organize and participate in bimonthly meetings for each sector, and annual assemblies for each reserve.

The representatives discuss and decide on the most important management actions for that particular sector, and provide a very effective means of local community participation. Until 2005, the annual assemblies were organized by the leadership and representatives, and constituted the most comprehensive forum for discussion and decision making concerning the whole reserve. After 2005, in accordance with the new Brazilian environmental legislation, a management council with about 20 seats was established to make decisions regarding the reserve. While in the previous decision making system of assemblies, decisions were reached by vote of the village representatives, in the current system, decisions are reached by the vote of representatives of the villages and representatives of other social groups (such as the government, universities, and research institutions).

The definition and regulation of the zoning system or of the management rules for a particular natural resource have to be discussed, voted, and decided on by this management council. Involvement and participation are also important in other levels. There is always the need for approval by the local representatives for any activity carried out in a particular village or group of villages.

Scientific research, visitation, guarding, and management in itself have to be approved by locals or their representatives. This system of involvement and participation, together with a continued service of environmental education and circulation of relevant information, translate to improved representation over time, and a good level of commitment to conservation of the protected areas.

Reserve governance is based on an alliance with locals. This alliance assumes that the involvement of village members can be assured if those members have a clear understanding of the benefits derived from the protection of the areas, the conservation of local biodiversity, and the sustainable use of local natural resources. This raises more constituencies among local villages in both reserves, gathers local political support, and ensures that a large part of the local population will contribute to the enforcement of rules and regulations.

The definition of which natural resource is to be managed is based on a few principles. First, an economic survey identifying components of biodiversity important for livelihoods identified certain species of fish, trees, and game animals as targets for sustainable management. Second, an evaluation of techniques or management systems is applied to the traditional use of a particular resource. If those techniques could cause harm to local biodiversity, they have to undergo review, usually converting or adapting to more sustainable techniques and systems. Finally, the ecological role of the species and its relevance to the maintenance of the ecological and evolutionary processes in the protected areas are crucial to defining it as a target for sustainable use. But in all cases, managed species are also conservation targets. They were selected as conservation targets exactly because they were important components of local biodiversity threatened by unsustainable use.

Nowadays many species are part of the portfolio of managed natural resources. Although Mamirauá and Amanã are known for the management of pirarucus, a large Amazonian fish, more than 10 species of fish are managed in a sustainable way. All of them are fish species used as food by locals, but they reach especially high market values in the Amazon and other parts of the country. In the same way, locally managed timber comes from more than 30 species, valued both locally and regionally.

More recently new management systems have been built. The first is the management of ornamental fish species that are highly valued internationally, but for which removal is not sustainable in many parts of the Amazon. The first experimental sustainable removal will take place in the second half of 2007. The second is the management of game species. This is difficult to implement, since the Brazilian legislation still forbids the management of wildlife. But there is a large possibility for changes in the laws, so the experimental management of reptiles (river turtles and caimans) has been implemented.

The management systems implemented so far in Mamirauá-Amanã do not differ according to the ethnic background of the villages. *Caboclos* and Native Americans, or Amerindians, both may take part in all management systems as long as they agree with the basic regulations proposed. Nevertheless, Amerindians have sought a more independent path in the last two years, as part of a process of empowerment which is becoming important in the Brazilian Amazon. This reduced the participation of members of Native American villages, and it is not certain that these groups will continue to support participatory management systems.

There is also a great incentive for the involvement of women and teenagers in the sustainable use of natural resources. Traditionally, those activities are more associated with men and are still very unbalanced. Women have been supported to get involved mainly on other related tasks in the formal associations of man-

agers (fishers, timber extractors, service providers, etc.) that act as partners of the management systems.

The many actions for sustainable use provide opportunities for the involvement of locals that do not have expertise in the production or extraction of a particular natural resource. Teaching, capacity building, bookkeeping and accounting, administration, and monitoring are among those opportunities that are open to all members of the local villages. Local producers and members of the management associations use the managed natural resources themselves for consumption, but most of the production is directed to the market (to small towns in the vicinity of the reserves, and to large cities in the Brazilian Amazon and other parts of Brazil). Currently there are about 40 formal associations in Mamirauá and Amanã, all of them registered to work legally and trade the natural resources exploited in the protected areas.

When the management programs were first planned as a conservation strategy in 1995-1996, it was considered that local production inside the reserve would be greatly reduced if the management plan were to be enforced. Local producers would have to reduce their off-take to sustainable levels and the economic impact would be high. But, if the sustainable use were implemented, the access to a new market and new prices would be possible, offsetting this negative impact.

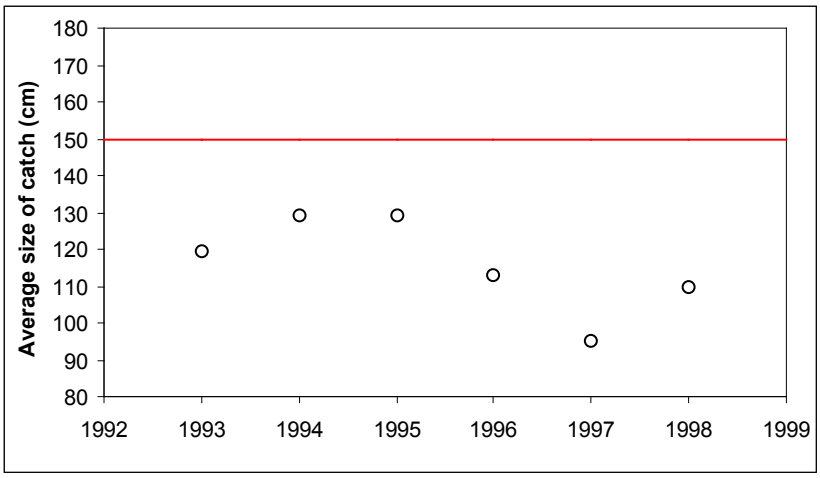
As proved to be the case, the market for natural products managed adequately in protected areas is increasing in Brazil. It is already a large market and evidence suggests it will expand even more in the coming years. This can produce a negative effect on protected areas, if production is not under strict control. To avoid this risk, one alternative is to multiply management systems, replicating the management regulations.

In Mamirauá and Amanã Reserves, the access to the management systems of natural resources is restricted to local inhabitants, organized in associations. These associations receive technical advice and counselling, and have their formal organization and operational arrangements provided by the staff of Mamirauá Institute. During the last few years, these pilot systems have led to the creation of similar systems in the vicinity of the reserve. So far, some of these new experiences have failed to produce adequate regulation and control, but they can be improved if properly conducted. As this successful system grants access to other groups, benefits can be more widely distributed among other social actors.

The Development of Management Systems Implemented

As mentioned earlier, conservation targets were under intense pressure from unsustainable use. For some natural resources the levels and intensity of traditional use of natural resources were carefully monitored. The need to implement sustainable ways was made clear to all social actors involved. The kills of game animals, the catch of most important fish species, and all timber extraction in the area are examples of time series data built with the participation or collaboration of local residents. **Figure 1** presents an example of the monitoring of pirarucu fisheries from 1993 to 1998, before sustainable use was established.

Figure 1: Average size (total length in cm) of pirarucus caught from 1993 to 1998 at Jarauá Sector, Mamirauá Reserve, represented by the open circles. The red line represents the minimum size of catch established in the current legislation.

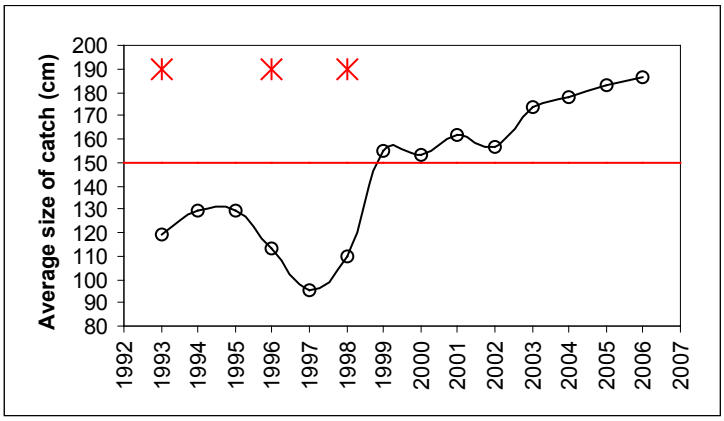


From this time series data it was possible to demonstrate that more than 70% of all pirarucus produced in the monitored part of Mamirauá Reserve were below the minimum size of catch established at the time by the Brazilian environmental authority (IBAMA): 150 cm. This evidence of bad traditional management galvanized the attention of local social actors, especially the fishermen inside the reserve, and led the way to the agreements about new regulations and modifications in the behavior of local fishermen.

The need for large-scale change was obvious, and the best way to promote this was from the inside out. Following the publication of the Mamirauá Reserve Management Plan, best practices of sustainable use was promoted in pilot management systems. Consequently, in 1998, the most important pilots were put in place, including the promotion of sustainable fisheries of pirarucus and the sustainable extraction of timber.

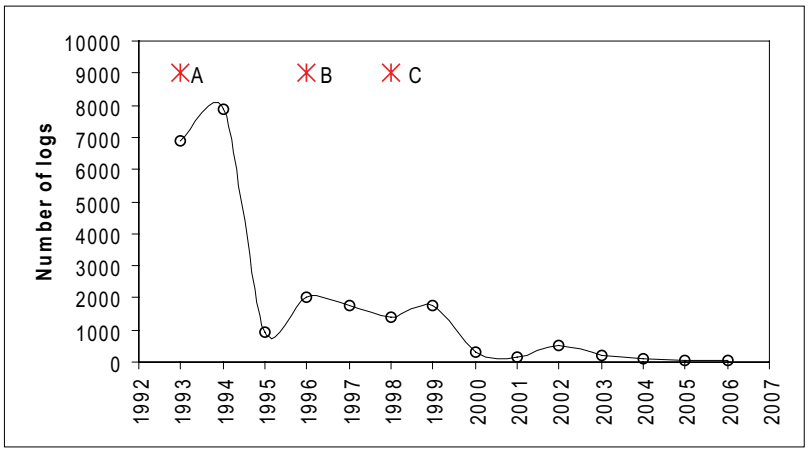
It has been a success so far. The populations of managed resources present good demographic parameters, production has been increasing, and the producers were able to reach better markets and get better prices for their products. After a few years it was clear to all local associations that those involved in management systems were better off. It should be noted that the pattern of natural resource use did not change immediately after the implementation of public awareness and environmental education (1992-1993), nor after the discussions with local leadership on new regulations for protected area use and publication of the management plan. Change occurred immediately after the beginning of productive management and when financial results of the new trade were obtained (**Figure 2**).

Figure 2: Average size (total length in cm) of pirarucus caught from 1993 to 2006 at Jarauá Sector, Mamirauá Reserve, represented by the open circles. The red line represents the minimum size of catch established in the current legislation. Red stars represent important moments in management history. Moment A (1993) is the start of campaigns of public awareness and environmental education. Moment B (1996) is the publication of the management plan with the agreed, voted, and approved regulation for sustainable use of pirarucus. Moment C (1998) is the beginning of the productive management system of pirarucus fisheries at the reserve.



Something similar happened to the management system of timber extraction. Besides the fact that a program of awareness and environmental education took place since 1993, and that the local producers agreed on the need to stop unsustainable off-take of many species of trees (including threatened or rare species), and voted in agreement with the new regulations of the management plan in 1996, it was only when the productive management of logging started, in 1998, that the illegal timber extraction was really reduced inside the protected area (**Figure 3**).

Figure 3: Number of logs illegally removed from Mamirauá from 1993 to 2006. Red stars represent important moments in management history. Moment A (1993) is the start of campaigns of public awareness and environmental education regarding illegal timber extraction. Moment B (1996) is the publication of the management plan with the agreed, voted, and approved regulation about logging inside the protected area. Moment C (1998) is the beginning of the productive management system of timber extraction at the reserve.



In the case of timber management, effective protection was realized after two major measures. At first, awareness and education proved to be very effective, but a high number of illegal loggers were still operating inside the area. Secondly, when the productive management was put in place, almost all the illegal logging was abolished inside the protected areas. It is expected that the same effect will be accomplished in relation to non-timber forest products, to ornamental fish, and to game animals when the respective management systems are put in place in the near future.

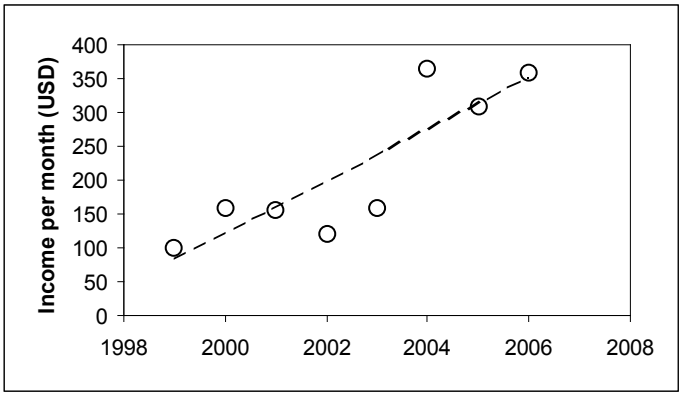
Livelihoods and Quality of Human Life: Achievements and Challenges

Access to the natural resources of Mamirauá and Amanã Reserves has been granted only to the local associations. As these management systems prove to be successful, and the widespread demand to join the systems increases, it will create a pressure difficult to restrain. Most locals living outside these protected areas want to move inside it to take part in the sustainable use of the resources. Migration pressure to the reserves is strong.

So, after less than two decades, the protected areas, once seen locally as a problem and as something negative that would make livelihoods difficult, became centers of attraction. They are perceived as places to have a better life.

There are many different ways to represent the improvement of the quality of life in these areas of natural resource management. The idea itself of "quality of life" is enormously difficult to precisely quantify, and a great deal of indexes and indicators have been created to describe it. In general terms, households inside the protected area improved their income by almost 110% in only a decade (1994-2004). For those households directly involved in the managed fisheries of pirarucus, this improvement reached much more than that (**Figure 4**).

Figure 4: Income (in US dollars) per capita per month of fishermen involved in the management systems of pirarucu fisheries at Mamirauá and Amanã, from 1999 to 2006.



Pirarucus are managed in Mamirauá-Amanã only for about two months every year (October-December). More than 400 fishermen participate. Despite the fact that "quality of life" can be measured by many other points of view, this improvement in income has impacted other aspects of social life, like heath and education of the villages.

Replication of these management systems is in demand all over the region. Nowadays, most of the local associations outside the protected areas ask for replication and expansion of the system, and most communities in the vicinity of the reserves are also interested in implementing such systems. It is a large improvement in the relationships with the people of the reserves and the people living around them. These relations went from suspicion and disagreement in the first year after the creation, to involvement, agreement, and attraction in the last years. This sort of improvement in public relations is yet to be achieved by the national environmental authority, IBAMA. Despite the fact that management of timber extraction and pirarucu fisheries is legal, most of the other uses of natural resources are not yet regulated. Nevertheless, all these uses continue to be carried out without regard for the current regulations and the efforts of IBAMA, worsening this difficult relationship.

Replication of Management Systems: Possibilities and Difficulties

For some time, these replications of the management systems were carried out by Mamirauá Institute, by building capacity among the local villages and associations, investing in basic infrastructure, and promoting a link between local producer and other market components to aim for "fair trade." But there are limits to Mamirauá Institute's capacity to fund all needed replication and to provide appropriate advice to the many associations in the entire region. Local leadership and other institutions could be involved in the efforts. Two of the new activities of Mamirauá Institute are to build the capacity of other institutions and train personnel to fulfil the needed roles.

It is vital that all new systems implemented consider the technical criteria developed so far. The clear identification of the stock to be exploited, the constant monitoring of this stock, the definition of sustainable rate for removal, and a very effective participatory system (to ensure equal/fair distribution of benefits, and to grant means of governance for regulation enforcement and control) are crucial aspects if the system is to be successful. Recent experiences of replication of pirarucu management in nearby areas suggest that the risk of failure is great when stock assessment and involvement of locals are not adequate.

Another important aspect to consider regarding the replication of management systems is that one of the consequences is the increase in the availability of managed products in the markets. This could depress values and prices. Despite the fact that the demand is very high in the region and in other parts of the country, if the distribution or transportation of the product is in the hands of few, they will be able to control the strategic parts of the market, and therefore control prices, possibly lowering them.

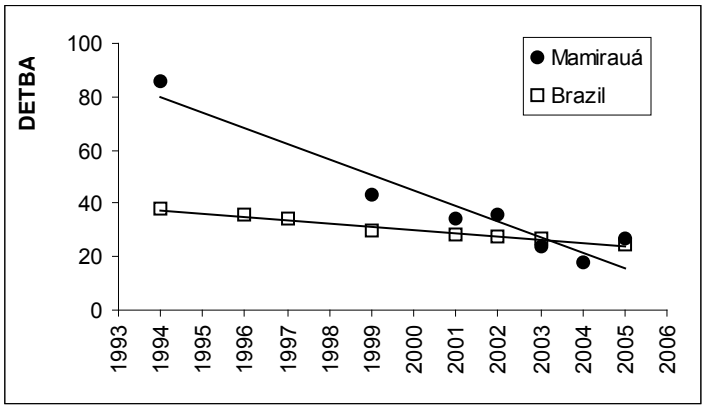
Experience on the marketing and trade of managed pirarucus since 2003-2004 showed that market issues are relevant and have to be put in the hands of experts. In one instance, the associations decided to sell their entire production to a single person, based on a higher proposal. After many months waiting for payment, producers got only 65% of the value. This induced the associations to have a more mature attitude towards negotiations, and implement more business-like tools, like adequate contracts.

Other market problems were also identified in these last years. Potential buyers are acting together to offer the same prices that are lower than prices obtained by the local producers in the past. Other social actors, including the government and other links in the chain of production and trade, have to be involved in the management systems as soon as possible. This expansion could reveal other business opportunities, introduce new buyers, and achieve better prices. People with experience and knowledge on the market can offer important contributions to the conservation of these components of biodiversity.

Social Benefits and Future Perspectives

Maybe one of the more important impacts of the income improvement in the protected areas is that infant mortality was was reduced by more than four times in the last 15 years (**Figure 5**). The implications of that in the improvement of health conditions and education levels are obvious.

Figure 5: Infant mortality (measured as the number of deaths for each thousand born alive, DETBA) at Mamirauá and in the country.



However, it also implies another problem. Compounded by the influx of others to the protected areas, the population growth rate recorded in the last decade is higher than the rate recorded before the implementation of management and sustainable use. In 1994 the population living in the focal area of Mamirauá was growing at a rate of 2% a year, and in 2005 it grew at an annual rate of 3.2%. In only 11 years the population increased by 37%.

Based on these numbers, different scenarios can be built. If it were possible to keep the population growth rate constant, increasing at an annual rate of 3.2%, the population would double in 24 years (1994-2018).

If we were able to reduce growth rate to the 1994 levels and after 10 years, population growth was back to a 2% annual rate, population size would increase less rapidly, and double after 28 years (1994-2022). But if the population growth rate continues to increase at the same rate as it has so far, it would double in only 20 years (1992-2014).

In all cases, population growth is a reality. It means, among many other things, that the amount of humans using components of the local biodiversity will increase. If carrying capacity of the reserve was increased when management systems were implemented, it is unknown if it will be able to sustain twice the human population. Public services, mainly in health services and education, which are not offered in adequate levels now, could represent a big challenge for this future scenario.

One potential solution is to encourage other people and institutions to act as promoters of management systems outside protected areas. Conservation action directed to such areas would provide better levels of biodiversity conservation in general, and expand benefits for a larger group. In doing so, new areas of attraction would be available, importantly, outside protected areas. This could also provide higher levels of governance, and government agencies could share good positive support to manage larger portions of the region.

This could help to decrease new pressures and ensure a good perspective for the protected areas now under threat as consequence of their success. This illustrates how protected areas are only one of the strategies to provide good levels of biodiversity protection and conservation in tropical environments.

3.3 Costs and Benefits of Madidi Protected Area for Local Human Livelihoods

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Physical Description of Madidi Protected Area

Madidi is recognized as one of the most biodiverse protected areas in the world: Globally Outstanding according to the World Wildlife Fund Conservation Assessment of Terrestrial Ecoregions of Latin America, Global 200 (Olson and Dinerstein 1998); and Biodiversity Hotspots (Mittermeier et al. 1999). This diversity is the result of an amazing altitudinal gradient from majestic snowed mountain tops at 6,000 m, where you find condors (Rios-Uzeda and Wallace 2007), vizcachas, and pumas; down to the paramo through globally endangered patches of *Polylepis* forest and cloud forests with spectacled bear (Rios-Uzeda et al. 2006), through the most biodiverse vegetation type of the world; tropical montane and piedmont forests and the lowland Beni alluvial plain, home of jaguars (Wallace et al. 2003; Silver et al. 2004), spider monkeys, tapir, and white lipped peccary. Furthermore, there is a swath of dry forests around the area of Apolo (Hennessey 2007) formed by a "rain shadow" caused by the Andes. In the northernmost tip, large areas of pristine grasslands are surrounded by gallery forests with important populations of maned wolves and marsh deer (Boris Rios pers. comm.).

Madidi Protected Area fulfills several ecological functions, for example soil and watershed protection, rain and moisture capture by cloud forests, and local climate regulation. It is also part of a bi-national protected area conservation corridor running from the Bolivian Andes to southern Peru which is part of an important bird migration route along the Andes.

In terms of goods used by local populations, the Puna and high Andes are centers of origin and diversification of Andean tubers and grains such as oca (*Oxalis tuberosa*), papalisa (*Ullucus tuberosum*), potato (*Solanum tuberosum*), quinoa (*Chenopodium quinoa*), and canihua (*Ch. pallidicaule*). In the montane forests people depend on native species such as Caccharis, Fabiana, and Parastrephia for firewood and on several species for medicinal purposes based on ancient Kallawaya knowledge (SERNAP, WCS 2005). In the piedmont and lowland forests, the Tacana and Quechua-Tacana people hold an impressive traditional knowledge of hundreds of species which can be used as food, handicrafts, building materials, and medicinal purposes, including several palms. These habitats are also particularly rich in precious woods such as cedar (*Cedrela odorata*), mahogany (*Swietenia macrophylla*), sandbox tree or possumwood (*Hura crepitans*), South American oak (*Amburana cearensis*), rosewood (*Aniba canelilla*), goncalo alves (*Astronyum graveolens*) and others (CIPTA, WCS 2001).

In terms of wildlife use, fish such as the Pseudoplatystoma, Zungaro, and Phractocephalus cat fish, the tambaqui or pacu (*Colossoma macroponum*), and the bocachico or sabalo (*Prochilodus nigricans*) are important for subsistence and commercial purposes, particularly in the lowlands. The *Podocnemis expansa* and *P. unifilis* turtles are hunted for meat and their eggs, sold commercially. Peccaries, agoutis, deer, monkeys, and armadillos are used mainly for subsistence but some local trade exists (SERNAP, WCS 2005).

Historical Changes in Natural Resource Use

This area has been inhabited by several ethnic groups since pre-Hispanic times by some of the Arawak linguistic families such as the Tacana and Araona (Silva et al. 2002). This area had important economic and cultural exchanges between the lowland and highland indigenous cultures and also was accessed by several Inca and pre-Incan trails, linking Cuzco with Pelechuco, Moxos, Pata, Santa Cruz del Valle Ameno, and Apolo. During the expansion of the Inca Tupac Yupanqui in the last third of the fifteenth century, coca production and gold mining took place around the head waters of the Tuichi, Amantala, Queara, and Camata rivers (Saignes 1985).

In 1536 the Spanish colonization of this area began in search of El Dorado or Paititi using the same routes that the Incas had previously used, and 12 missions were established. This had huge impacts on the spatial, social, and productive organization of the indigenous population and on natural resources as agricultural production of coca, tobacco, cacao, peanuts, quinine, incense, vanilla, feathers, wildlife skins, and monkeys intensified. At the beginning of the republican era (1825-1880) there was another extractive boom linked to the use of the quinine bark (*Cinchona officinalis*), which resulted in the disappearance of the species from extensive areas and overhunting and fishing in the area to which many people had migrated. Additionally, areas for intensive agricultural production were established to supply the quinine collectors with grains, meat, and cane alcohol (Soux et al. 1991).

Rubber replaced quinine bark as the next best natural resource, fueling an economic boom that resulted in the establishment of rubber concessions in over 1.5 million ha, as well as private "haciendas" producing goods for the rubber concessions. The "haciendas" continued to proliferate from 1917-1964 and specialized in coca, sugar cane, and cattle production for the markets in Peru and the mining areas in Larecaja. Later, in the mid-sixties, wildlife in the region (in particular affecting caimans, peccaries, cats, otters, macaws, and parrots) suffered the effects of a quarter century of commercial trade in live animals and skins. In the 1970s a development policy called "March to the North" began; it focused on developing an agricultural center based on cane sugar production around San Buenaventura, the construction of a hydroelectric dam, and hydrocarbon exploitation. In order to facilitate exploitation of these three natural resources, an aggressive campaign of new roads and colonization resulted in a large influx of Quechua and Aymara people, the establishment of forestry concessions, cattle ranches, land speculation, and a large informal trade in precious woods such as mahogany and South American oak (Silva et al. 2002).

All these historical processes resulted in indigenous groups of the lowlands gradually losing ancestral land and natural resources, and only since the state reforms of 1994—such as the agrarian reform, forestry, environmental, and popular participation laws—have the indigenous people been able to demand actions to build a more just and equitable society, respectful of the environmental and cultural characteristics of the region. In particular the recognition of their rights over their natural resources and territories are a result of the efforts of the indigenous movement which culminated in their historical national level march for "Territory and Dignity" in 1996.

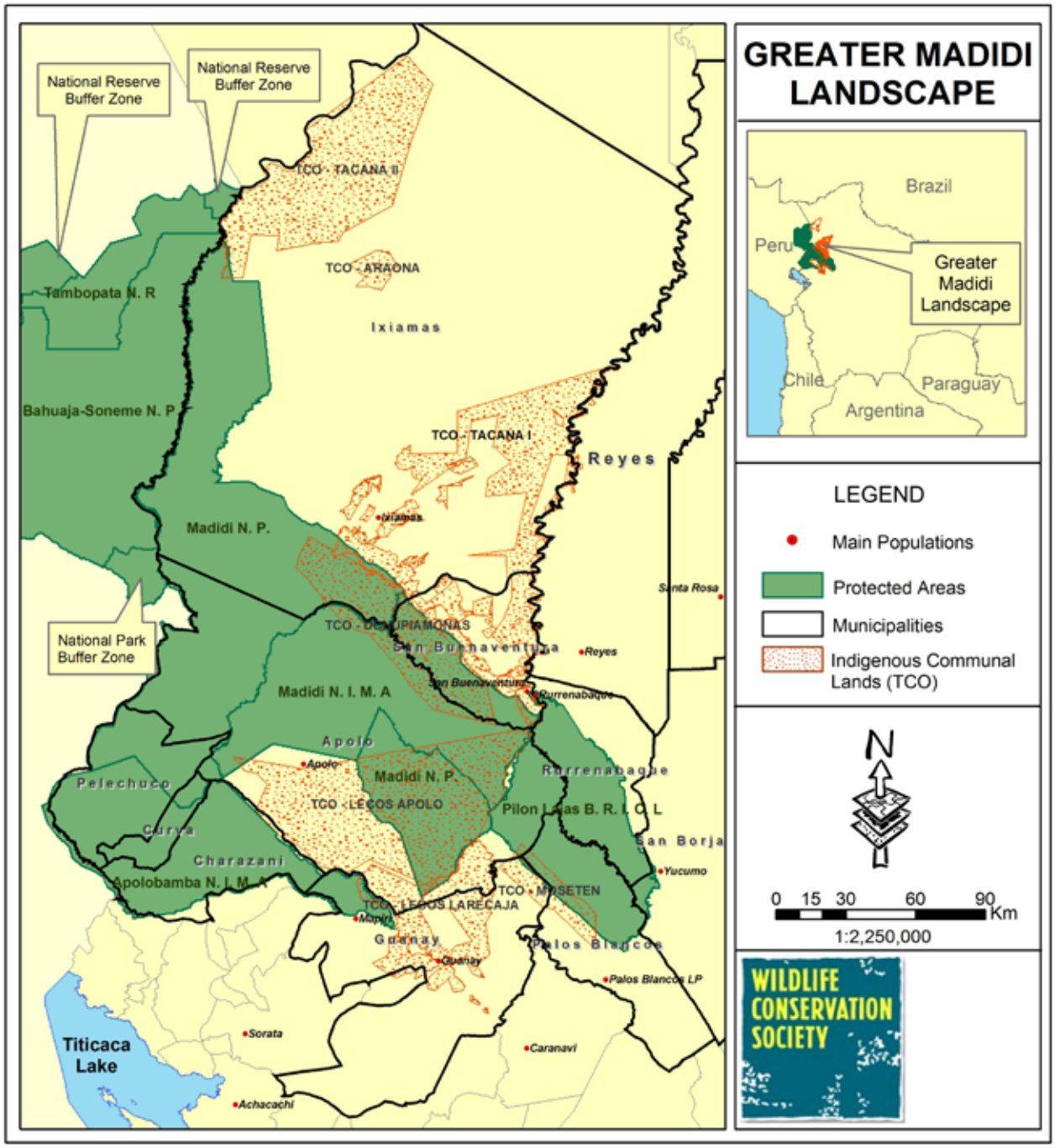
Cultural Setting

This area holds great cultural diversity because of the historical processes described above: There are Tacanas in the east, Lecos in the south, traditional Quechua settlements in the Apolo and Pelechuco region, and colonists along the San Buenaventura to the Ixiamas axis. The urban centers of Apolo, Pelechuco,

San Buenaventura, Guanay, and Ixiamas are made up of people who identify themselves largely as "mestizo" (Lehm et al. 2002).

Within Madidi protected area there are nine communities in the national park and 22 communities in the integrated management area, totaling close to 4,000 people. Additionally, the protected area overlaps with four indigenous territories which are in different degrees of consolidation (**Figure 1**). Around 11,500 indigenous people are within these territories, whereas the Mestizo, Quechua, and Aymara population is twice that (National Population Census 2001, INE National Institute of Statistics).

Figure 1: Greater Madidi landscape.



All municipalities overlapping the protected area had positive growth rates between 1992 and 2001, particularly Ixiamas and San Buenaventura. These increases in population result in a growing demand for land and natural resources and increasing social conflicts (**Table 1 and 2**).

Table 1: Inter census population increase rates in Municipalities of Madidi Protected Area. (Source: INE National Statistics Institute, Bolivia)

Municipality	1992	2001	Inter census growth rate	Annual Growth Rate
Ixiamas	3.618	5.625	55%	5%
S. Buenaventura	4.608	6.203	35%	3.3%
Apolo	12.877	13.271	3%	.3%
Pelechuco	4.742	5.115	8%	.8%
Guanay	27.319	28.365	4%	.4%
Total	53.164	58.579	21%	1%

Increases in provincial populations since 1950 shows the same tendency, in particular in Abel Iturralde and Larecaja, where the population tripled in half a century. Though population density is low, clearly there is growing pressure on resources.

Table 2: Provincial population increase. (Source: INE National Statistics Institute, Bolivia)

Province	Extension in Km^2	Census 1950	Population Density	Census 1976	Census 1992	Census 2001	Population Density
Franz Tamayo	15.900	13.666	0.9	16.437	17.619	18.386	1.2
Abel Iturralde	42.815	3.076	0.07	5.132	8.226	11.828	0.28
Larecaja	8.110	30.684	3.8	46.269	68.762	68.026	8.4

Social Services

The communities within Madidi protected area do not have good access to health services. Only some communities have small health posts and most of these do not operate because of lack of medicines or trained personnel. Access to basic sanitation has improved via investments by development organizations such as CARE in integrated conservation and development projects. Currently, 37% of communities within the protected area have drinking water and 30% have latrines. Only the urban centers have constant electric supply, those communities (53%) which have solar panels only have it in the schools. Only 20% of all communities have communication radios and only 10% have telephone coverage. Most communities only have primary schools (73%), some go up to middle school (23%), and 4% have no school (SERNAP, WCS 2005).

Establishment of the Protected Area

Madidi National Park and Natural Area of Integrated Management was established on September 21, 1995, by Supreme Decree No. 24123. It was created for the conservation of biological diversity, natural landscapes, archaeological sites, geomorphological formations, ecological processes and services, indigenous knowledge, and also to respect the rights of traditional communities over their natural resources and to promote sustainable natural resource use, environmental education, research, ecological monitoring, and ecotourism.

The protected area includes two categories: National Park, corresponding to IUCN Category II, and Natural Area of Integrated Management, corresponding to Category VI. The national park covers 1,271,500 ha and prohibits extractive use of renewable or non-renewable resources but permits scientific research, ecotourism, environmental education, and subsistence activities of traditional populations, dependent on recommendations in the zonification management plan and specific regulations of the protected area. The Natural Area of Integrated Management covers 624,250 ha and aims to balance the development needs of the local population with conservation objectives.

When the protected area was established, some intensive use areas of traditional communities and even whole communities where erroneously placed within the national park area. Furthermore, certain areas without any human population and important biological attributes where placed within the integrated management category. Because of this there is a proposal to re-categorize the protected area.

Current Resource Use and Tendencies

In the high valleys the main economic activities are ranching cattle, llamas, and sheep, and on average each family manages around 700 ha of communal lands. Small animals such as chickens, pigs, and guinea pigs are raised for subsistence purposes and occasionally wildlife is hunted to supplement the family diet. Small agricultural plots are placed next to streams and rivers where the best soil accumulates. The most important agricultural product is potatoes, followed by other Andean tubers and broad beans; in the lower valleys maize, manioc, beans, and rice are also planted. Accessible precious woods such as *Junglans australis* and *Podocarpus cf. oleifolius* have been extracted, and currently species such as *Inga* sp. and *Cedrela odorata* are only used for furniture and as building materials. The highest forests of *Buddleia* sp., *Polylepis* sp., and *Baccharis* sp. have disappeared from the most accessible areas because of over harvest for firewood. Gold panning is a traditional activity and mercury pollution associated with it affects the Tuichi River. A modest flow of 100 tourists a year walking the pre-Columbian routes linking Pelechuco to Apolo generates ready cash to buy school materials and attend medical emergencies (SERNAP, WCS 2005).

Most of the communities are found in the lower montane valleys, some in areas which have suffered the results of inappropriate resource use and are on severely degraded soils and hence have limited options. In these areas people survive on marginal agricultural production based on coffee, sugar cane, beans, bananas, maize, yucca, rice, coca, and citrus fruits. Every family works on 0.5 to 1 ha per year. Some families have cows that are managed very extensively because of the historical soil degradation. Small animals such as sheep, guinea pigs, and pigs are raised for domestic use and some local trade. There are some conflicts with wildlife such as foxes, spectacled bear, pumas, and peccaries that predate on crops or domestic animals. Fishing of *Prochilodus nigricans* is an important activity during the dry season.

In the better conserved areas of the lower moist and dry montane forests, the sale of firewood to merchants who transport it to Apolo, illegal timber extraction, and collection of incense broadens the economic options for local people. Shade-grown coffee production has also been successful for these communities on soil which is still fertile. In the better conserved areas, people focus more on small animal production than on cattle. Their access to palm fruits and medicinal plants as well as abundant fish increases their well-being.

In the piedmont and Beni alluvial plains along the San Buenaventura and Ixiamas road, the colonist communities depend on agricultural production of rice, maize, banana, and manioc. This is complemented by small animal production and, to a lesser degree, cattle production. Some communities have participated in programs to promote agro-forestry, and there is interest in changing to these systems because of the limited economic benefit of traditional agriculture. Additionally, a large portion of the population works in sawmills or in illicit timber operations.

In contrast, the Tacana communities are also settled outside the protected area, but have important hunting, palm, and medicinal plant use areas, as well as sacred grounds within the protected area. Agriculture is the main activity for the Tacana families, followed by hunting, fishing, small animal rearing, and forestry activities, mostly legal and under management plans. The Tacanas have a wide and varied use of forest resources for food, building materials, medicinal purposes, dyes, ceremonial uses, and handicrafts. Organic and native cacao groves are also being managed and sold to certified markets. Finally tourism is an important activity for the communities of San Miguel and Villa Alcira, close to San Buenaventura. The Quechua-Tacana community of San Jose de Uchupiamonas also relies heavily on tourism and manages the world class Chalalan lodge. The Tacana communities in the north of Ixiamas municipality rely mostly on Brazil nut harvest and gold mining in the dry season. The monitoring efforts WCS has supported in Tacana communities have shown that wildlife represents a subsidy from nature of $100,000 a year from fishing (100-200 tons) and $35-97/month per family from game (calculated by the replacement cost of beef). The protected area is an important source of game and fish for the neighboring indigenous territories (CIPTA, WCS 2001).

Resource Use and Conservation Targets

History shows that different economic booms based on natural resource extraction have benefited very few, have marginalized and displaced indigenous populations, and caused habitat and soil degradation. Because of its topography, the Madidi area does not favor productive activities which maintain forest cover: Only 37% of the area is found in areas of gradients of less than 15%. Additionally, most of the valuable timber has already been extracted from accessible areas and current remaining stocks are in isolated areas. Furthermore, the socioeconomic conditions of the local population do not present a favorable scenario for traditional local economic development as their capacity for capital investments and a significant labor force is low. Hence impacts on conservation from traditional small scale agriculture, hunting, and fishing are localized. However, increasing demand for valuable timber and political interests are fueling demand for several roads crossing the protected area. These roads would open up the protected area to greater illegal extraction of timber and colonization, particularly in the Apolo region. Should this occur it would cut the conservation corridor for spectacled bears and the altitudinal corridor for plants and wildlife, a corridor that is incresingly important as the climate warms. Illegal timber extraction particularly affects the dry forests of Azariamas which is a specific conservation objective of the protected area. Park guards were able to control most of the illegal timber extraction by establishing control and vigilance posts, resulting in important recuperation of wildlife after the removal of more than 40 logging camps in the Tuichi and Quendeque valleys. Also, important alliances have been developed with the local indigenous populations for joint patrolling of common critical areas.

The most worrying trend is the alignment of individual economic timber interests with local and regional political interests. For example, regional and local political figures have used the demand for large scale development projects as a way to gain the support of the population and develop their political profile by questioning the protected area. Parallel to this, people involved in illegal timber trade take the opportunity to promote raids on the protected area and illegally open new roads to facilitate access to precious timber clusters.

An important activity that has been promoted by the protected area service and their partners is ecotourism, for which there is a specific regulation. However, in particular in the Iturralde region, private tourism interests have also fueled conflicts against indigenous territorial demands overlapping areas of tourism interest (Salinas 2007).

Conclusions

Nationally, the main challenge is establishing institutional alliances based on respect of the rights of different stakeholders at all levels: community, grassroots organizations, local, regional and national government, and civil society. In order to achieve this there must be clarity in rights over different resources established through a transparent land titling process and long term institutional strengthening in order to build a solid foundation for promoting activities that improve local people's living conditions.

This region is characterized by many of Bolivia's social and environmental conflicts and amongst the most serious are those related to establishing clarity in land tenure, in particular over indigenous territorial demands: conflicts over legitimate representation of different local actors; jurisdictional problems between neighboring municipalities; illegal extraction of valuable woods; distribution of benefits arising from the protected area; political party issues; illegal tourism operations; and demands for the construction of large scale infrastructure (Salinas 2007).

The consolidation of Madidi as a protected area will only be possible if the different local actors become involved in its management. Community and municipal authorities, and the population as a whole, must be better informed. However, environmental education must focus on promoting debate and analysis of local development options through institutions with local legitimacy—a process to be supported by outside institutions (such as international NGOs) providing technical and logistical assistance while building local capacity.

There must be a legitimate consensus building mechanism that allows for interaction and consultation between the protected area administration and local actors. Those local actors with established or traditional rights over natural resources and land within the protected area should have co-management. There should be differentiated participation by other actors in the establishment of protected area management strategies and plans. This is stated in the Bolivian constitution, environment law, forestry law, popular participation law, land reform law, and the Bolivian adherence to the 169 International Labor Organization treaty.

Once clear land tenure rights are established and a basic institutional structure exists with clear rules for consensus-building and conflict resolution, there are several productive options available for the region that are compatible with the proposed zoning for the protected area. But this must be limited to those local actors with established or traditional rights over natural resources to avoid an open access scenario.

Conservation organizations can also help increase benefits. An often overlooked economic benefit comes from the direct purchase of goods and services in the northern La Paz region for protected area management activities. Park related spending contributed $1.21 million per year over the period 1999-2004, with an additional $1.38 million from tourism (Fleck et al. 2006). These figures represent a significant underestimate because they do not include other investments in surrounding communities or personnel working in La Paz and outside of Bolivia. Increasing local capacity for natural resource management and conservation is a priority. This will capture benefits arising locally from conservation by allowing a greater percentage of conservation funds to purchase goods and services locally, where most of the costs of conservation are borne. Nevertheless, even today these costs are only short term and, in the medium and long term, the presence of the protected area is in fact an opportunity to improve the local livelihood alternatives of the poorest and more marginalized populations.

International Multilateral Organizations have a role to play because there are geopolitical obstacles to increasing the benefits of conservation for local livelihoods. There are insufficient mechanisms in international markets to value public goods, so that the benefits of conservation can be distributed in a more just and equitable way to compensate for the local opportunity costs (Kremen et al. 2000). For example, though the deforestation of tropical forests represents 25% of carbon emissions to the world's atmosphere, most of the costs of protecting these forests are paid by the local forest people. One obstacle for the development of different market mechanisms is the absence of democratic participation in international debate. This participation is even less in multinational corporations where only majority stockholders have a voice, though their impacts are global. It seems that market mechanisms working through incentives and disincentives have the greatest possibility of success in promoting conservation while benefiting local livelihoods.

PART 4
WCS CASE STUDIES – NORTH AMERICA

4.1 How Landscape and Socio-economic Transitions Impact Human Livelihoods within a Mosaic of Wilderness and Communities[1]

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The 24,000 km^2 Adirondack Park in northern New York is a mosaic of public and private lands, wilderness and communities, and wildlife and people. During the last 200 years the areas encompassed by the Adirondack Park boundary—the blue line—have experienced numerous transformations. The land itself has evolved from virgin forests to clearcuts and exposed mountain slopes and then back to managed and protected forests with intermittent human settlements. It has transformed from a landscape home to the full suite of mammals native to the northeastern United States, to a landscape devoid of some critical members that once were there: wolf, cougar, golden eagle, and wolverine. The transitions have been integrally related to socio-economic changes: from a landscape with minimal human intrusions to one in which humans play a central and defining role; from an economy of resource-based extraction to an economy driven by amenity-based use; and, finally, from a forbidden wilderness to an accessible frontier with complex state protections in place. These transitions have had both positive and negative repercussions on the livelihoods of those living inside the blue line. Although the Adirondack Park was created in 1892, its designation as a protected area has created sustained and ever-changing impacts on human livelihoods that continue to evolve today.

Background

The Adirondack Park is part of the Champlain Adirondack Biosphere Reserve and a critical component of the Northern Forest in the northern regions of New York, Vermont, New Hampshire, and Maine. It is one of the best examples of northern temperate forest globally, and the largest protected area in the lower 48 states—larger than Yellowstone, Yosemite, and Glacier National Parks combined. It is ecologically diverse, with rugged mountains of spruce-fir forest, rolling hills, hardwood forests, lakes, bogs, vast freshwater wetlands complexes, and open agricultural lands mostly adjacent to Lake Champlain. The park has more than 40 peaks over 1,200 m, 48,000 km of streams and rivers, and 11,000 lakes and ponds. It is home to 90% of the species that exist in the Northern Forest, including many species of boreal birds, many birds that require extensive areas of interior forest, and a host of large mammals such as black bear and moose, which are returning on their own from New England and Canada after having been extirpated at the turn of the century.

Prior to the 1800s, the majority of the Adirondack region was largely devoid of permanent human settlements; however, members of the Iroquois and Algonquin nations regularly passed through and used the region as a hunting ground (Terrie 1994). During the early 1800s, Europeans began clearing the land for agriculture and creating small settlements based on traditional resource extraction. Extensive railroad systems enabled the proliferation of logging and mining operations as well as the development of stately hotels to serve the urban elite who summered on the lakes. Today, the human population of the park is approximately 135,000 full-time residents and over 200,000 seasonal residents, located primarily in small hamlets and around waterways. Nine to 12 million people visit the Adirondacks each year, and the park is within a day's drive of over 90 million people, making the potential for increased demands from the resources in the Adirondacks quite large. The park is becoming a popular retirement locale, as well as a place from which many people choose to telecommute.

During the first century of its existence, the Adirondack Park was touted as a conservation success model of humans and wilderness coexisting. Due to the extent of the public lands and restrictions on the private lands within the Adirondacks, some wonder why the park even needs additional protection. However, the Adirondack Park is an oasis of wildlands within the rapidly urbanizing northeastern United States. Pressures from development, tourism, and pollution threaten to alter the park dramatically. If the Adirondack Park model is to have another 100 years of conservation success, then more work is needed to protect the area's natural and cultural resources.

Socio-Economic Characteristics

The socio-economic characteristics of the park are fairly similar to those of other rural areas in the US. Culturally, the Adirondacks is relatively homogenous—roughly 96% Caucasian. What ethnic diversity the area has is largely attributable to Native Americans residing on the Mohawk reservation located in the northern Adirondacks and state and federal prisons located in the Adirondack Park. Today, economic class rather than ethnic background is the defining mark for park residents. The extremes of US economic stratification extend inside the park, with significant implications for educational access, health care, and access to amenities from neighboring urban areas. In general, park residents have adequate access to schools, and the percentage of residents who achieve a high school degree is only slightly lower than the national average (US Census Bureau 2000). Access to adequate health insurance and proximity of medical facilities varies for park residents. Northern New York has a higher number of uninsured residents compared to the nation as a whole due to the prevalence of small business and service sector employment related to tourism. However, those employed by the government receive full health insurance. Basic medical care is readily available in all areas of the park but access to special units such as dialysis, cardiology, or oncology often requires patients to travel one to two hours by car to larger facilities. Economically, the average per capita income for all 13 counties in the park is lower than both the average per capita income for New York State and the United States as a whole. Currently, government (local, state, and federal) is the largest employer in the park, followed by the tourism and services sector. Many of the government positions are directly related to maintaining the Park's natural resources or providing services to visitors. Other government jobs are in state and federal prisons and in the public sector, including schools and local government.

A Wilderness Protected

Prolonged clear-cutting in the Adirondacks in the 1800s had a profoundly negative impact on the waterways providing drinking water to residents in southern New York, including Albany and New York City. The state first purchased lands and designated a "Forest Preserve" in the Adirondack region in 1884, just 12 years after President Grant designated Yellowstone National Park. This was an effort to protect the watershed and downstream trade and transportation, with a stipulation that allowed timber harvest to support a newly formed Forest Commission. In 1892, the New York State Legislature designated the Adirondack Park as a 12,000 km^2 region within which eventually all private lands would be purchased as Forest Preserve (Terrie 1994). Between the acrimonious response from local communities and the economic impossibility of this plan in part due to issues of eminent domain, the state resigned to a park with a checkerboard of public and private lands. In 1894, the public lands of the Adirondack Park were afforded constitutional protection to be "forever kept as wild lands," effectively prohibiting the harvest or sale of timber from these lands. Today, the Adirondack Park is a 24,000 km^2 mosaic of public and private lands. Hunting and other forms of recreation are allowed on the public lands, but resource extraction such as logging or mining is not. Activities on private lands include logging, hunting, mining, recreation, and residential development.

In 1968, a state government-led study found that increased residential development and over-use of recreational resources was threatening the park. Starting in 1973, the newly formed Adirondack Park Agency (APA) began overseeing land-use and development on all private lands within the Adirondack Park boundary and created a State Land Master Plan to guide recreational use on public lands. The new Adirondack Land-use and Development Plan divided the private lands into six density-based development zone types and required landowners obtain a permit if they wished to subdivide land, build principle dwellings, or make substantial additions to an existing structure (**Table 1**). These regulations were intended to keep higher density development concentrated near hamlet areas and already existing development. Lower density areas were placed adjacent to the Forest Preserve with the idea that lands in resource management and rural use protection would remain as working lands in forestry and agriculture. The State Land Master Plan, which is now administered by the New York State Department of Environmental Conservation (DEC), designated seven management categories based on characteristics of the Forest Preserve lands: motorized use was restricted in some areas (Wilderness) and permitted in other areas (Wild Forest) and intensive use such as campground facilities were a separate designation (**Table 2**).

Table 1: APA Land Use Classifications: Private Land Use and Development Plan (Adapted from Adirondack Park Agency 1982)

Classification	Appropriate Uses	Intensity Guidelines
Hamlet	Growth and service centers of the Park. The Plan permits all uses within hamlet areas	No limit
Moderate Intensity	Most uses are permitted, but relatively concentrated residential development is most appropriate.	500 principle buildings per 2.59 square kilometers. .53 hectare average lot size
Low Intensity	Most uses are permitted, but residential development at a lower intensity than above is most appropriate	200 principle buildings per 2.59 square kilometers. 1.29 hectare average lot size
Rural Use	Most uses are permitted, but rural uses are most appropriate. Low intensity residential development is also suitable.	75 principle buildings per 2.59 square kilometers. 3.44 hectare average lot size
Resource Management	Suitable uses include agriculture and forestry, game preserves and recreation. Residential development at a very low density is permitted	15 principle buildings per 2.59 square kilometers. 17.28 hectare average lot size.
Industrial Use	Existing industrial uses and future industrial sites.	No limit

Table 2: APA Land Use Classifications: State Land Use Master Plan (Adapted from Adirondack Park Agency 1989)

Classification	Definition/Appropriate Uses	Management Guidelines
Wilderness	Areas where earth and its community of life are untrammeled by humans. Hiking, XC skiing, snowshoeing, back country camping, etc.	No additions or expansions of non-conforming uses, i.e. roads, buildings. Use of motorized vehicles and off-road bicycles strictly prohibited.
Canoe Area	Like Wilderness only dominated by water. Canoeing, hiking, XC Skiing, back-country camping, etc.	Same as Wilderness designation
Primitive	Essentially wilderness, but contains structures and other improvements. All forms of recreation permitted.	Motorized vehicles and bicycles allowed. Additional structures and expansions prohibited.
Wild Forest	Similar to wilderness or primitive area only frequently lacks the sense of remoteness. All forms of recreation permitted.	Motorized vehicles and bicycles allowed. Additional structures and expansions prohibited unless a formally adopted unit management plan exists.
Intensive Use	Areas where the State provides facilities: campgrounds and day use areas	Motorized vehicles and bicycles allowed. Areas include boat lunches, visitor centers, campgrounds. Unit Management Plans required for all improvements.
State Administrative	Areas where the State provides facilities. Administrative, Scientific, and Visitor information related.	Provide administrative facilities on a scale which is in harmony with surrounding setting. Adhere to wetland regulations.
Historic	Buildings or structures with historical significance owned by the tate.	Preserve the character of the site. Adhere to wetland regulations.

When the state formed the Adirondack Park Agency, the local residents perceived the implementation of the regulations as a "takings" of their property rights (Kenney 1985). From the park residents' perspective, the state authority decided what was "best" for the Adirondacks and imposed the regulations without much input from the local residents, who were struggling to make a living. The implementation process did not include education efforts, outreach, or work with the local communities. The new regulation process, coupled with a struggling US economy, globalization, and loss of industry from the Adirondacks left the perception that the government had ended the Adirondacks' last hope for economic autonomy: development (Keller 1980).

The APA zoning regulations have generated resentment from local town governments. Although towns have the option to adopt their own land use plans with APA approval, many towns still do not have plans in place. As a result, local towns are often at odds with the APA regarding building permits. Since the 1970s, all large developments, many smaller scale developments, state land purchases, and management designations for state land have endured close scrutiny from local watchdog groups concerned about human livelihoods in the park. In response to these groups and to the existing development threats from continued building along shorelines and in the backcountry, more conservation organizations were formed.

Today, numerous non-governmental organizations have fulfilled niche roles in advocacy, economic development, and community issues. In 1994, the Wildlife Conservation Society started a program to focus on wildlife research and community-based conservation. Our conservation targets are to:

- Maintain connections with other northern forest landscapes;
- Maintain continuous area and distribution of native habitats on private lands;
- Maintain the wild experience of the Adirondacks;
- Improve the ecological integrity in human dominated landscapes;
- Minimize human-wildlife conflicts and restore wild behavior of wildlife;
- Maintain ecosystem services and ecological integrity in wild areas.

Our specific species targets include maintaining viable populations of black bear, marten, moose, boreal birds, and common loons. To achieve these targets, we must understand how resource use influences our targets as well as how conservation activities impact human livelihoods.

Resource Use, Governance, and Conservation Impacts

The Adirondack Park encompasses a multitude of resources with varying ownership and extent of restrictions. We grouped the resources into seven categories and detail the issues related to their use, how governance shapes their use, and how their use impacts conservation targets (**Table 3**). The resources include timber, non-timber forest goods, wildlife, land, water, wind, and air.

Table 3: Summary of resource use, governance, and impacts to conservation targets

Resource	User	Market	Governance	Access	Conservation Impacts
Air	Local residents and visitors	Common pool resource	Federal and State Governments	No restrictions	Yes
Land	Local residents, NYS residents, out-of-state residents	Local and commercial use	NYS DEC, Adirondack Park Agency, Local Town Governments	Development restricted on private lands, prohibited on public lands. Restrictions exist for access to public and private land for recreation.	Yes
Non-timber forest goods	Local residents	Local and commercial use	NYS DEC	Illegal on all public lands. Legal on private lands.	No
Timber	Local landowners and timber companies	Local, national, and international commercial markets	NYS DEC, Adirondack Park Agency	Illegal on all public lands. Legal on private lands. Restrictions apply.	Minimal
Water	Local residents, municipalities, and some businesses	Subsistence and local use	State Health Department, NYS DEC	Legal on public and private lands. Some restrictions on surface water.	Yes
Wildlife	Local residents, NYS residents, and out-of-state residents	Generally subsistence, some commercial use, and other illegal uses.	NYS DEC, Migratory Bird Treaty Act, Endangered Species Act	Legal on all public lands and some private lands. Some restrictions apply.	Minimal (Unknown)
Wind	Local residents, and limited commercial use	Subsistence, local, and commercial use	Adirondack Park Agency	Illegal on public lands. Legal on private lands subject to regulations.	Unknown

Timber

Access to timber resources within the Adirondack Park depends on land ownership. Timber harvest is explicitly prohibited on all public lands inside the blue line. However, harvesting is allowed on private lands, with a number of restrictions. Many local people, including small family-owned logging companies and residents working for large multi-national companies, work in the forestry industry in the Adirondacks. Many thousands of hectares have been harvested for commercial use. However, numerous logging operations in the park are closing down due to globalization of the industry. Since 2000, the four largest forest land owners have either sold or announced the sale of their properties. In the past decade, over one million acres (405,000 ha) of land has changed ownership. Some of these lands will stay in forestry through state conservation easements that allow investment companies or small private timber companies to manage the land. The rest may be used for other purposes such as development. Non-industrial private landowners also engage in small-scale forestry. Most of the wood harvested from these lands is milled locally, creating added value. In 2000, the forestry industry provided around 500 of the 35,000 jobs in the Adirondacks (50 years ago the forestry industry along with agriculture and mining were the largest employers). The market for construction of high end homes is booming, while the pulp and paper markets have declined significantly with only one paper mill left inside the park (compared to 10 in 1920). The extent of violations related to forestry is uncertain given the vast size of the

park and the small number of enforcement officers: Fewer than 150 DEC forest rangers, DEC environmental conservation officers, and APA enforcement officers are responsible for enforcing local regulations and guidelines for resource use on public and private lands in the park.

Habitat loss is one of the key threats to conservation targets in the Adirondack Park. Although timber harvesting on the private lands does disturb habitats, the regulations and best management practices often adhered to by local foresters minimize the impacts to local fauna. Timber harvest poses the greatest threat to birds that rely on intact interior forests but probably also has significant impacts on the American marten, as well as reptile and amphibian species in some areas. Given the extent of land protected from timber harvest in the Forest Preserve, the negative impacts are generally localized and do not result in population-level impacts. However, the changing nature of land ownership may pose more serious threats; when companies who have owned Adirondack lands for 50 to 100 years sell to timberland investment management organizations (TIMOs) and/or other industrial timber companies, the management priorities shift. These groups may manage the forests for a short period and then, to maximize financial return, sell within 10 years. This transition may be detrimental to conservation and local people who rely on sustainable resource extraction for long-term employment.

Non-timber forest goods

The harvest of tangible non-timber forest goods is explicitly prohibited from all public lands inside the blue line. Non-timber forest goods can be taken from private lands, so access depends on land ownership. No rules or regulations apply to non-timber forest goods on private lands. Given the extent of the forest preserve, enforcement for collecting on state lands is minimal. Examples of direct uses include berry picking for personal or commercial use and collection of wood and bark products for use by local artisans who design "Adirondack" furniture or use the "Adirondack" style for interior decorating. Artisans sell their products commercially at craft fairs, local businesses, and via the internet. Contractors who build Adirondack "great camp" style homes often hire artists to create custom pieces for their clients. To date, there are no known negative impacts of harvesting non-timber forest goods on our conservation targets.

The market for intangible forest products is also booming. Local artists and photographers use the Adirondack landscape as their subject and they sell their products locally, regionally, and sometimes internationally. Many Adirondack artists maintain galleries in local communities and support a vibrant arts economy. Future demand for these goods is likely to increase.

Wildlife

Use of wildlife in the Adirondack Park is fully governed by the DEC under NYS Environmental Conservation Law and the Migratory Bird Treaty Act. Hunting, fishing, and trapping may occur with a valid license on public and private lands during open seasons for white-tailed deer, black bear, fisher, mink, weasel, skunk, bobcat, marten, beaver, raccoon, fox, coyote, fish, turkey, and many species of migratory waterfowl. These activities are mostly limited to recreation and subsistence; however, some resources end up in wildlife trade, e.g., black bears' gall bladders sold to China. and turtles in the pet trade. Furs and taxidermy animal products may be sold commercially.

While the number of animals taken has remained steady or slightly increased for all species, the demand for hunting, fishing, and trapping has declined substantially during the last 25 years due to cultural change. The pelt market has been depressed since the mid-1980s. If the trends continue, demand for wildlife-related products will decline in the future. Even so, there is evidence of ongoing poaching—not only for the regulated species but also for species whose collection at anytime is strictly prohibited. While detection of violations may be difficult, the DEC does levy fines for illegal animal collectors or poachers. Aggregate impacts of wildlife use on conservation targets is considered minimal, but data is scarce. Population estimates based on hunting records indicate that most game populations are increasing; however, no independent assessments have been conducted to confirm these trends. Martens may be more negatively affected by trapping compared to other animals. We suspect that a variety of turtles and other herptile populations are especially susceptible to animal collectors, e.g., wood turtles.

Land

Access to land for development and recreation creates the most contention for human livelihoods in the Adirondack Park. Development, except for state facilities such as campgrounds, ski centers, or administrative buildings, is explicitly prohibited on public lands in the Adirondack Park. Development on the private land is governed by the APA. Depending on where the land is located within the park, it can be used for private or commercial venues. In hamlets, land is used for typical commercial and community venues including restaurants, motels, companies, schools, shops, galleries, libraries, and housing. Areas where hamlet-intensity development can occur are extremely limited to <10% of the park. Outside the hamlets, the uses become more residential mixed with some farming and small scale forestry. Areas where low-density rural development can occur are extensive, roughly 35% of the park. All of these uses are legal and regional and local land use plans direct and limit where and what types of development can occur. As the park and its resources have gained popularity, demand for these lands has increased dramatically, and low-density rural development is expanding.

Land values inside the park and even in individual towns vary widely. In the same town, a prime waterfront residence may be worth $2 million compared to a river front residence on a larger parcel that is worth $96,000. This value discrepancy highlights socio-economical and cultural disparities associated with the Adirondack Park community. In some ways, it represents the traditional class and spatial divide between seasonal and permanent residents: Seasonal residents live, relatively isolated, along lakeshores, and permanent residents reside in hamlet neighborhoods, rural upland areas, or on marginal waterfronts. While the park has always attracted seasonal residents, its lands and communities are becoming increasingly attractive to second-home and investment home owners as well as retirees and those wishing for a change of lifestyle. As waterfront properties become expensive, affordable only to the wealthiest people, interest in buying properties in the hamlets and in rural uplands has increased. Permanent residents cannot compete with second home and investment home buyers in part because employment inside the park typically pays much less compared to that outside the park. Since 2000 the cost of housing has continued to rise, posing challenges for middle income families to find affordable housing (Kretser, unpublished data). The cost of housing and rents is too high for those

of the lowest income to find adequate and affordable housing (Kretser 2005). The pace of low-density residential development also has a negative impact on conservation targets (Glennon and Kretser 2005).

Access to recreational amenities complicates the issue of land use. Recreational activities are marketed for tourism but are also important quality of life resources. Access to recreation on public lands is governed by the DEC via the State Land Master Plan. All types of recreation are permissible on private lands; however, access for recreation on private lands is restricted based on landowner preferences. The DEC governs what uses are permitted as well as which areas are open to the public, what signage to post for promoting visitation and informing visitors, and what facilities to maintain for visitors.

Under the State Land Master Plan, all state lands within the park are subject to Unit Management Plans (UMP). The UMP process allows for residents and communities to review and make recommendations on how the DEC should manage the state lands for recreation. Tourism and recreation support the local economy and sustain human livelihoods. The UMP process clarifies which types of recreation are allowed on which state lands, and, in theory, serves as a method by which communities can help shape conservation to their benefit. Many local residents perceive restrictions of motorized use as negative and limiting, yet studies have documented substantial economic returns of both motorized *and* non-motorized recreation (Merwin Rural Services Institute 1998; Omonhundro 2002).

Motorized and non-motorized recreation negatively impact our conservation targets by disrupting breeding and nesting of loons, habituating bears and martens to human food, and in general creating over-crowding that spoils the wild characteristics of the area. If use is concentrated in high use areas, it allows for better enforcement of recreation activities. However, the vast amount of land compared to the number of personnel patrolling makes adequate enforcement impossible.

Water

Without the water resources of the Adirondack Mountains, the park would not exist. The aesthetic, recreational, and consumptive value of water is immeasurable. As a common pool resource, it requires complex management. Access to surface waters in the Adirondack Park is regulated by the DEC and the NYS Department of Health (DOH). Surface waters are used for drinking water in local camps and some municipalities. Access to surface waters for recreation is controlled by land ownership; state access is needed for the general public to use a waterway, otherwise only those who own shoreline have access. The types of recreation permitted on waterways are governed by the APA and the DEC.

Recently, access to groundwater in the Adirondack Park has gained much attention. With most of the population growth in the United States occurring in urban areas and the arid west, the bottled water industry is booming. The demand for bottled water is expected to increase dramatically in the future. The DOH has issued bottled water permits for areas at the fringe of the Adirondack Park for corporations such as Coca Cola, Pepsi Cola, and Nestle, including businesses from Iceland, Italy, Canada, and the United Kingdom (NYSDOH 2007). However, no regulations govern the extraction of groundwater for commercial use. Selling Adirondack water has the potential to improve the local economy if local people become involved in the process. However, the trend appears to be that corporations secure permits, but conservation groups and state regulators have not formed policies to address the issues of groundwater extraction

by outside corporations. Without proper regulations governing groundwater extraction, the impacts to conservation targets could be substantial. Moreover, the region's water resources may be increasingly valuable and contentious under climate change, and this issue has the potential to play a large and politically-loaded role in the future of the region's conservation.

Air

At the turn of the 20th century, people sought a summer in the fresh air of the Adirondacks to escape urban pollution. Today, the same holds true. Between nine and 12 million people visit the Adirondack Park each year and part of their journey is to enjoy the fresh mountain air. However, acid rain and mercury pollution from power plants, and recent accounts of ozone at high elevations, make this resource particularly complex in terms of governance and conservation target impacts (Appalachian Mountain Club 2007). In some places in New Hampshire, with similar mountains and wind patterns, the ozone is comparable, if not worse than urban pollution levels. These impacts negatively affect human and wildlife health, and have the potential to harm human livelihoods.

Wind

Wind as a resource has gained attention with several recent proposals for commercial energy production in and around the Adirondack Park. Building wind turbines on the protected lands of the Adirondack Park is strictly prohibited. However, wind turbines may be located on private lands inside and adjacent to the park. Locations of wind turbines are governed by the APA. Currently a height restriction limits most locations but small scale turbines are actively being used for subsistence in several areas of the park. Proposals for commercial wind farms are growing in number, and the demand for wind resources will likely increase given the rising costs of fuel oil. Their contribution to the energy grid could reduce energy costs to families facing very high oil costs throughout the winter. Outside the park two major wind farms are in operation. Little is known about the specific impacts that wind turbines will have on our conservation targets but data from other parts of the country demonstrated the negative effects wind turbines have on birds and mammals (Johnson et al. 2002; Rabin et al. 2006). However, compared to the damaging impacts of energy generation from oil, gas, or coal on our conservation targets, the negative impacts from wind energy generation is relative.

Protected Area Impacts to Human Livelihoods

When the Adirondack Park Agency was formed in the 1970s, death threats, arson attempts, and protests ensued. These types of activities, mostly conducted by property rights activists and local town government leaders, continued at a lower rate through the 1980s and escalated again during the early 1990s following attempts to strengthen the restrictions on private land development. The relationship between the protected area and local people varies. There is a great deal of suspicion of the state (and federal) government. Some local people welcome restrictions by the state for the wilderness, wildlife, and water quality that have been protected, and the resulting economic benefits related to tourism and second home development. Others view the protected area as a hindrance to economic development, especially to job creation and affordable housing. The restrictions on land and timber resources are most contentious. While recreation on public lands has the potential to be an alternative resource use, management of state land is also contentious, and the economic benefits of recreation have not been fully realized.

In general, where public lands dominate townscapes, locals view the public land as prohibiting development of local businesses and affordable housing. Yet there is no direct relationship between the amount of Forest Preserve and key economic indicators such as the poverty rate or unemployment rate (Keal and Wilkie 2003). Some local leaders have even suggested land swaps to allow for developable state lands within townships to be traded with non-developable, and perhaps more ecologically interesting, private lands. Many officials see this option as too complicated given the amendments that would be necessary to the State Constitutional protection of the Forest Preserve.

The creation of the Adirondack Park Agency created severe animosity toward conservation efforts. Since that time, many conservation actions that have excluded local residents' perspectives have proved unsuccessful, such as the proposal for a Bob Marshall Wilderness and the proposal to reintroduce wolves. State officials, conservation groups, and local residents continue to have strained relations, especially as the amount of protected lands increases each year. However, much progress has been made in addressing the needs of local people with relation to the park during the last 10 to15 years.

Conservation Approaches Must Include Community

Numerous state and local government and non-governmental organizations in the Adirondack Park address concerns relating to human livelihoods, while many non-governmental organizations address conservation issues. However, only the Wildlife Conservation Society has successfully integrated conservation concerns and human livelihoods. Because we engage communities, we are changing the way other conservation groups approach problems. We are working with people to manage their natural resources by providing science, engaging and empowering communities, and developing community conservation stewards. By partnering with communities, we help them to see the importance of the protected areas and work with them to identify sustainable economic activities. For example, we host Community Exchange Days which bring together regional leaders to discuss ideas for development compatible with the natural resources such as the arts and green technology. We have been able to engage local communities by positioning ourselves as non-advocacy information brokers and have become a go-to resource for communities, providing salient data on a variety of topics and working with local communities on different issues in which we incorporate conservation principles.

We have not found solutions for—nor is it our intention to find solutions for —all of the human livelihood issues in the Adirondacks, but we have bridged a divide in a way that no other group has: We approach conservation with a willingness to consider the impacts it may have on human livelihoods. Two specific steps that may be taken in the Adirondacks to improve human livelihoods: 1) developing a comprehensive economic plan for the entire park that specifically identifies successful models of economic development within the constraints of a protected area; and 2) building the capacity for as many communities as possible to engage in visioning and planning for their future.

Conclusion

The transitions that have taken place within the Adirondack landscape have shaped human livelihoods. The issue of resource use and human livelihoods in the Adirondacks really is a story about disparities and the growing differences between the haves and the have-nots. This trend holds true across North America, where high demand for attractive places with abundant natural amenities has increased the value of areas near nature and protected areas.

Wealthy people can buy experiences afforded by and the resources provided by these protected lands. The power of the purse is, more often than not, held by in-migrants, seasonal residents, second home owners, corporations, and investment companies, rather than permanent residents. Those who are willing to move to or remain living in the Adirondacks and sacrifice economic prosperity do so because of the quality of life afforded by the natural resources and quaint communities. Our challenge is pursuing conservation without creating a place where only the wealthy can access resources afforded by more than a century of protection.

[1] Much of the information presented here, unless otherwise noted, can be found in more detail in Jenkins and Keal (2004).

PART 5
WCS CROSS-REGIONAL THEMATIC PERSPECTIVE

5.1 Paying for Results: The WCS Experience with Direct Incentives for Conservation

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Introduction

Biodiversity continues to be lost at alarming rates, despite decades of conservation efforts. The causes of the current biodiversity crisis are clearly anthropogenic, the over-use of nature for human consumption, globally and locally. Our best hope for conservation rests in steering people towards less environmentally destructive, resource-intensive land uses and activities.

Conservation approaches nowadays often combine the establishment and management of protected areas with landscape-scale approaches that try to affect human activities in the wider landscape surrounding protected areas. Regardless of which conservation paradigm is employed in a particular setting, decisions have to be made about where and how best to allocate conservation funds. Often faced with tight budgets, conservation practitioners have to ensure that their resources achieve conservation outcomes as efficiently as possible, in other words to get the greatest conservation benefits at the least cost.

This paper explores the concept of direct incentives for conservation, and summarizes current discussion on their benefits and potential drawbacks. It then highlights the current experience at the Wildlife Conservation Society (WCS) with various forms of more or less direct incentives for wildlife conservation.

Paying for the Invaluable

People's land use decisions are largely driven by economics. Because biodiversity is a public good, the benefits that conservation provides accrue to everyone, but private users often benefit more from the destruction or overuse of biodiversity than from its conservation. Economists would say that the public benefits (or the public costs) need to be internalized to arrive at the real economic value of biodiversity for the private user. For example, if a farmer could earn US$100 by cutting down a section of rainforest to plant a cash crop, then in order to entice him/her to set aside that land instead, s/he has to perceive that conserving the rainforest is worth at least that much.

Although many conservationists do not like to think of biodiversity as an economic good—preferring instead to emphasize the intrinsic worth of nature—most recognize that economic incentives for people living adjacent to or in areas of high conservation value can be useful for achieving the needed behavior

change. The non-economic values of biodiversity often appear insufficient to overcome the economic forces that drive its destruction. The question then is how best to make the link between conservation and economic value—or the link between conservation and livelihood security—explicit in people's minds.

To date, at the local level, most attempts to ensure an economic benefit for people that will result in biodiversity conservation have been project-based. In developing countries such initiatives tend to be grouped under the mantle of "community-based conservation," "sustainable forest management," or "integrated conservation and development projects (ICDPs)," and rely mainly on fairly indirect incentives to affect people's behavior. Typically these involve alternative income-generation projects in cases where people's traditional livelihood strategies lead to biodiversity loss, and attempt to get people to utilize natural resources sustainably. Examples commonly include support for the establishment of "biodiversity enterprises" such as collection and selling of non-timber forest products (NTFP) or ecotourism ventures, or quotas on hunting or collection of biodiversity products, such as turtle egg collection limits. The track record of such initiatives in achieving conservation is, however, checkered, often neither achieving the desired results for people or for conservation (Newmark and Hough 2000; Ferraro 2001; Agrawal and Redford 2006).

One of the principal problems of ICDPs and other indirect approaches appears to be that the desired results (simultaneous achievement of biodiversity conservation and development) are often not achieved. One of the main concerns is that people may welcome the new income-generation activities promoted by projects as complementary, providing *additional* income, but not *substituting* for activities that destroy or over-use biodiversity (Ferraro and Kiss 2002). In other words, if people can derive additional income from, say, ecotourism and still hunt threatened wildlife in the forest, they may choose to do both, since it will improve their livelihoods. If, however, income is provided for **not** hunting threatened wildlife, and this income is sufficiently attractive, then the hunting should stop. Therefore, in recent years, some economists have argued that direct incentives for conservation are likely to be superior in terms of efficiency and effectiveness (Ferraro and Kiss 2002).

What are Direct Incentives, and Why use Them?

Direct incentives for biodiversity protection can range from conservation land purchases, leases, and conservation easements (retirement of biodiversity use rights), to performance payments (for example, paying for successfully hatched turtle eggs) and tax incentives. A hybrid form between direct and indirect methods are payments for environmental (or ecosystem) services. They may be deemed less direct than strict performance payments because typically one is not paying for outcomes, but rather for services which, it is hoped, will lead to the desired outcomes (Ferraro and Simpson 2002).

All of these are increasingly being employed in the United States, Europe, and Australia through a myriad of different schemes. Direct incentive approaches to conservation are still in their infancy in the biodiversity-rich tropics. Most of the pioneer experiences written up in published literature are from Costa Rica and other Latin American countries.

Figure 1: Comparing different conservation approaches in terms of "directness" and level of use of economic incentives (Source: Wunder 2005)

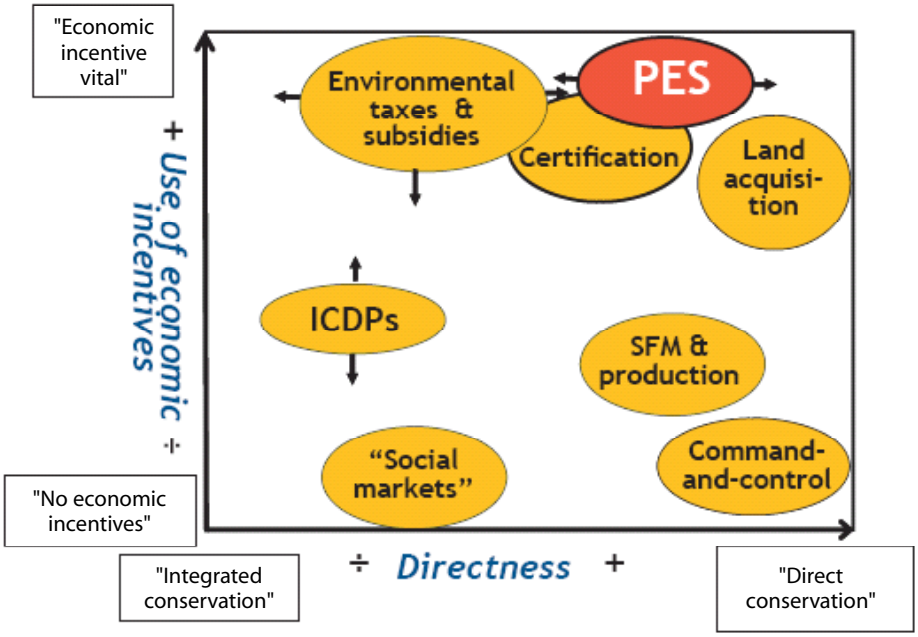

Figure 1 illustrates that different conservation approaches tend to rely on the use of economic incentives to varying degrees and may seek to achieve conservation results relatively indirectly (for example ICDPs) or directly (for example through land acquisition), or via an array of intermediate approaches. Payment for environmental services is one of the most direct approaches that also relies heavily on economic incentives. Missing from the figure are performance payments, which would feature in the upper right hand corner of the graph, being the most direct and economically driven approach to conservation.

The key to direct incentives such as performance payments and payments for ecological services (PES) is that they are conditional, i.e., they are only made if a certain action is undertaken or, as the case may be, avoided. For example, land owners may be paid for watershed protection services that they provide through avoided deforestation and afforestation on their lands. Direct payments can be seen as a form of compensation for forgone land uses, where destructive actions are not undertaken based on a contractual obligation, or as a payment for services rendered, the service here being biodiversity conservation, where people actively engage in agreed-upon pro-biodiversity activities. Most usefully, such conditionality emphasizes the link between biodiversity and the benefits it provides to people *if* it is conserved.

Proponents argue that direct payment approaches are also likely to be more cost-efficient than indirect approaches because conservation is being paid for directly (Ferraro and Simpson 2002) rather than within the framework of a complex conservation and development project. This does not mean, however, that direct payments do not also yield development benefits, or that they should be employed in a vacuum without ancillary activities. It could be argued that direct payments provide multiple development choices for the payees in that they usually get to decide for themselves how to use this income, whereas in ICDPs and similar initiatives the types of economic activities people undertake is sometimes pre-determined or recommended by the project (Ferraro and Kiss 2002).

Critics of the direct payments approach contend that it does not work well under all circumstances, especially because it requires fairly sophisticated contractual frameworks and monitoring capacity to maintain the crucial element of conditionality. It may also be that political or cultural barriers exist to receiving payments for environmental services. Evidence from initial lessons learned indicates that PES systems work best (are most cost-efficient) when the services provided are visible and beneficiaries are well organized, and when secure property rights are accompanied by strong legal frameworks, and relatively wealthy and well structured land user communities (Mayrand and Paquin 2004). These conditions often do not exist in some of the most biodiversity-rich countries.

Payments for Environmental Services (PES)

PES are based on the principle that people who provide environmental services should be compensated for their efforts, while those who benefit from such services should pay, or, in economic terms, "internalize the benefits" (Mayrand and Paquin 2004).

Typically, environmental services providers are compensated for one or more of the following:

- Biodiversity protection (both in and outside protected areas, including in agricultural landscapes)
- Watershed protection
- Protection of landscape beauty
- Carbon sequestration

Direct Incentives in Practice: The WCS Experience

WCS staff have been experimenting with a number of direct incentive approaches, although for most of these the experience is too recent to allow an assessment of long-term results. Nevertheless, there are some preliminary findings and lessons from cases in Cambodia, Lao PDR, Tanzania, and Russia, discussed in this section, and the excellent example of Community Markets for Conservation (COMACO) in the Luanga Valley in Zambia, addressed later in this Working Paper. These cases all employ one or the other type of economic incentive designed to stimulate a conservation response, but the degree of directness varies. It should also be pointed out that none of these initiatives are stand-alone. Rather, they all were/are being implemented as part of broader site-based conservation programs. As such, it is sometimes difficult to judge whether results achieved are due mainly due to the economic incentives provided, or influenced by some of the other project activities, such as education and outreach.

Cambodia: Paying Local People to Protect Crane Nests and Paying Not to Convert Wetlands into Flooded Rice Paddies

Case study details provided by Tom Clements, WCS, 2005 and 2007

An experiment with direct incentives for conservation hails from Preah Vihear, Cambodia. This project is an integral part of the overall conservation program of WCS Cambodia, which includes other components such as environmental education, protected area establishment and management, and support for ecotourism ventures, such as the Tmatboey Ibis Ecotourism Project. (Although the ecotourism project has resulted in income generation for local families and

conservation of ibis and their wetland habitat, it is not reported here because it belongs to the class of initiatives typically undertaken by traditional ICDPs.)

Preah Vihear is important for its populations of at least six globally threatened large waterbirds: two ibis species (*Pseudibis gigantea* and *Pseudibis davisoni*), rare greater adjutant storks (*Leptoptilos dubius*) in addition to colonies of lesser adjutants (*Leptoptilos javanicus*), black-necked (*Ephippiorhynchus asiaticus*) and woolly-necked storks (*Ciconia episcopus*), and sarus cranes (*Grus antigone*).

All these large waterbirds are threatened by human disturbance and collection at nesting sites. Sarus cranes, for example, are known to fetch a high market price (more than the equivalent of US$100 per bird in Thailand). The collection is mostly done by local communities who sell the chicks to cross-border traders.

Since 2003 WCS has been working to locate and protect the nesting waterbirds. Initially the research, protection, and monitoring was undertaken by WCS staff and rangers. However, a much greater number of nests can be found and successfully protected by working in cooperation with the local communities. Under a direct payment scheme, local people are now offered a reward for reporting nests, and for monitoring and protecting the birds until the chicks successfully fledge. To administer the scheme, WCS staff issue standard contracts to protectors, which include rules and a code of conduct.

In 2003 and 2004 nest protectors were paid $60 at the end of the month, assuming that the nest went undisturbed during that period. In 2005 the payment system was changed, following community consultations, to $1/day for protecting the nest with a bonus $1/day provided if the chick(s) successfully fledged. The value of a nest thus increases with time: after two months of guarding a nest, if the chicks do not fledge, a protector stands to lose $60.

The monitoring system for this project is quite rigorous, involving regular visits of protection teams by Wildlife Sanctuary or Protected Forest staff to check on the status of the nests (and to collect research data), and monthly visits by WCS monitoring staff. In addition, local rangers locate the nests and are responsible for weekly monitoring of the nest protectors in their immediate vicinity.

The total cost of the program was US$25,000 for 2005-6, of which 80% was direct payments to 115 local people. The average income of a typical household in the target population is $300-400/household annually, while the average amount paid to nest protectors annually can reach $400 per individual. Funding comes from WCS and a UNDP/GEF project that ends in 2013.

The scheme has been very successful, protecting 74 and 170 nests of globally threatened species in 2003 and 2004 respectively. The payment scheme fulfills other functions as well. It is a good demonstration to villagers and authorities in these remote places that there are benefits from species protection. Wildlife Sanctuary and Protected Forest staff also conduct awareness-raising activities in local villages to inform people about the nest protection scheme and the importance of conserving these species, as well as enforcing the law against wildlife traders and monitoring local and border markets.

The value of the direct payment was initially set based on knowledge of the local economy (e.g., $2/day is a suitable minimum wage; $100 is the value of a crane chick). WCS Cambodia staff feel that for future projects it would be advisable to use standard economic valuation techniques to determine the correct payment value, i.e., the actual opportunity cost for involvement in the scheme.

Lao PDR: Incentive Payments for Eld's Deer Conservation in Savannakhet Province

Case study details provided by: Renae Stenhouse, WCS Lao PDR, based on inputs from Souvanny Ounmany, Arlyne Johnson, Christopher Hallam, Dominic Cooper, Somsanouk Nouansyvong (WCS Laos staff), Chanthavy Vongkhamheng (WCS Laos staff and PhD student), and William McShea (Smithsonian Institute)

Rare Eld's deer (*Cervus eldi siamensis*), recently discovered to still inhabit the open dipterocarp forest in Savannakhet Province of Lao PDR, are under threat from the activities of villagers living close by. The species has already vanished from neighboring Thailand, but persists in very low numbers in Myanmar and southern Laos. Its habitat consists of large expanses of lowland areas of dry forest, patches of evergreens, streams, and seasonal pools. This habitat also supports an assemblage of other rare and unusual species such as Asiatic jackal, silver langur, barking deer, and wild pig, many of which have been eradicated from other areas of Laos due to overhunting. Villagers were initially unaware of the conservation importance of this deer and its habitat, and although the deer has been legally protected since 1995 under a wildlife conservation law, some villagers have hunted the deer and cleared its habitat.

WCS, together with the Smithsonian National Zoo's Conservation and Research Center [Smithsonian Institution (SI)], initiated a "payments for conservation" scheme in 2003 with the aim of reducing threats to the deer and increasing the size of the deer population. Villagers were asked to: (1) reduce or stop hunting, (2) maintain habitat, and (3) be involved in the conservation of Eld's deer. Under this project, WCS Laos paid an annual cash incentive (initially US$300, increased to US$450 in the second and third years) to each of three villages located near a population of Eld's deer in central-southern Laos.

The original agreement was a verbal one: WCS/SI would pay the incentives fund in return for a reduction in threats to the deer. The villagers and WCS did a threats analysis and it was agreed that if the threats did not decline, then the full incentives fund may not be paid out, but no criteria for how performance would be measured were set.

Villagers decided that the money would be divided into two uses: (1) a village development fund to benefit the entire village and (2) costs (*per diems*, amounting to around US$2/person/day of activity) for meetings, monthly patrolling, and education extension work by the Village Conservation Team (VCT). Thus payment is split between communal benefits and individual benefits. Additional *per diems* are paid to the team to assist WCS and the government in setting up biannual line transects for monitoring deer presence. Payments were complemented with education, protection/enforcement, and government capacity building. In 2004 the Eld's Deer Sanctuary was designated as a provincial protected area, and the three target villages developed rules and regulations for the sanctuary together with the district authorities.

The Village Conservation Team is made up of 15 people per village. The villagers decided on the composition of the VCT, resulting in representation from the Youth Union, militia, police, agriculture, and the headman. The remaining members were chosen by the villages' headmen, who favored friends and family members. There was some effort made to ensure inclusion of some poorer families, but no women were included.

Monitoring of the deer population is undertaken through formal surveys and reported sightings. WCS-SI-government staff and villagers monitor the deer population size by transect lines twice per year to see whether the number of deer signs is increasing, decreasing, or staying the same. WCS also asked the villagers to report all sightings of the deer to one literate person in their village, who then records the data. Shortage of funds and WCS staff resources did not allow for the more rigorous methodology required to accurately measure yearly conservation performance.

Pricing of the payment was not the result of an analysis of potential costs, but rather determined by the limited funds available to WCS for this project. The amount paid was increased after the first year so that villagers could finance complete village development projects, such as building a meeting house or fixing a bridge, and be able to say "that came from the Eld's deer incentives money."

Overall the project has had some successes. The deer population appears to be stable and slightly increasing, village-level awareness on the importance of the deer has increased, and the villagers have contributed valuable data on deer demography.

However, the WCS team also reported some weaknesses relating to inequity of villager participation (especially gender inequity). Another problem was that the payment was not conditional on performance and full cash payments were still made in the year when WCS learned of two deer killings (2005). The WCS team feared that reducing the cash payment would dissuade villagers from reporting to WCS if deer were poached.

In addition, and perhaps most significantly, the government counterparts (the Department of Forestry) asked that WCS pay the full amount even though deer were poached, as it would be unfair to penalize the entire village for one person's transgression, and because reducing the payments would lead to reduced cooperation from villagers in the future. WCS agreed to follow the government's advice. Thus in this situation, payments are in fact made for services rendered (the villagers' patrols and education activities), and not for performance. Rather than linking reduced populations to reduced payments (a disincentive), it might have been better to link payments to an increase in deer numbers. But even then, there would be opportunity for data to be falsified.

Long-term sustainability is also in question, as funding is no longer available to continue the cash payments, and it is uncertain whether hunting will resume if funding stops, or whether local "ownership" of the deer can be expected to develop to such an extent that direct incentives are no longer needed to ensure protection. It has been hard to measure success or the cost effectiveness of the incentives project.

Results cannot be clearly attributed to the cash payments: WCS conducts education and awareness-raising, and there is a law against poaching deer, so any desired conservation outcome may be due to a number of factors. The main successes in the overall project have been indirectly related to the incentives payments. The creation of the Eld's Deer Sanctuary was agreed to and then formally requested by the villages involved in the project. The project has also received very good government support, including a pledge of co-financing for the future.

Tanzania: Paying Local Communities Not to Convert Grasslands to Crops

Case study details provided by Charles Foley, WCS, 2007

An interesting case of a direct incentive comes from Tanzania, where villages are receiving communal economic benefits for maintaining traditional pastoral activities on grazing lands rather than converting these grasslands to agriculture.

The Tarangire ecosystem supports one of the highest densities of large ungulates in East Africa, including the largest population of elephants in northern Tanzania, now numbering close to 2,500 individuals. The Simanjiro Plains are the calving grounds for the majority of large ungulate species in this ecosystem, including wildebeest, zebra, eland, and hartebeest. The wildlife in Tarangire migrates seasonally. Because the soil in the park is deficient in phosphorus, the wildlife must leave the safety of the national park and disperse onto neighboring village lands in search of mineral-rich forage. The majority of the land in these dispersal areas belongs to the pastoral Maasai communities, who do not traditionally hunt wild animals and have therefore coexisted with the migrating herds. The continued tolerance of the local communities towards wildlife on their land is therefore essential for long-term conservation.

During the past two decades there has also been a steady change in land use outside the park. Rapid immigration and a growing human population have placed increasing strain on traditional pastoral activities and encouraged a shift to agriculture. Four of the nine main wildlife migration routes from Tarangire have disappeared entirely, and those remaining are all threatened to some degree.

The Tarangire Elephant Project is working with local communities and tour operators to protect the main dispersal area of the northern sub-population of elephants. Under an agreement with the local villagers, the area is to be used for livestock grazing, thus protecting both ungulate habitat and traditional grazing areas while supplying revenue to the village.

A direct payment scheme was set up by which the village council of one of the three villages (representing 2,500 to 3,000 people) in the Plains receives an annual cash payment conditional on the easement area remaining free of agriculture. The program was established through a long and elaborate buy-in process that involved input from the majority of villagers via village meetings.

The payment, supplied by photo-tourism companies, is $5,000 annually for a land easement of approximately 120 km^2. In addition, WCS provides salaries and equipment for four game scouts (from a local village), amounting to another $3,000 per year. The rules and conditions were negotiated between the business coalition and the village council and written up as a contract.

The money is paid through a local NGO set up by one of the tour operators rather than directly by WCS because it was important that the scheme be seen as a business endeavor and not a charitable donation. There has been considerable suspicion of the motives of wildlife NGOs in past years and some local people believe wildlife NGOs are seeking to expand the national park. They are therefore more willing to enter into agreements with businesses that they feel have a more transparent agenda. Instead, WCS provides technical support, such as training and finance for the game scouts. The villagers are eager to reduce illegal hunting in the area (for safety and other reasons) and have therefore welcomed the activities of the game scouts.

Payment is stipulated to continue as long as there is no agricultural activity within the easement area. It is expected that the contracts will not be broken, as it is in the villagers' interest to maintain the highly productive short grass area for cattle grazing. The easement therefore mostly represents added value to their cattle grazing activities.

In its first year of operation the program has been well received by the villagers, who see the payment as added value to their traditional pastoral activities. Protecting the land from agricultural activity is good both for their cattle and for wildlife, and therefore a powerful incentive. Other areas within the village less suitable for pastoralism have been zoned for agriculture instead.

The photo-tourism companies that operate in the Tarangire ecosystem funding this project do not actually operate in the easement area, but are funding it because of its value to the wider ecosystem. WCS only provides the game scout salaries (from donor funding). Currently funding is committed for a period of five years at $5,000 annually (plus $3,000 a year for game scouts). However, tourism revenues fluctuate and can be negatively impacted by any drop in visitors. A desired expansion of the scheme to include two other villages would require additional sources of finance. WCS staff expect that a trust fund will ultimately have to be set up for the area.

Problems other than financial sustainability could arise if a significant number of villagers decided that they would make a better living from cultivation than from pastoralism. Therefore, WCS feels that improving profits from pastoralism should also be a long-term project goal.

Russia: Linking Community Development and Biodiversity Conservation in the Russian Far East

Case study data provided by Dale Miquelle and Nikolai Kazakov, WCS

An example from the WCS Russia office uses a relatively indirect market-based incentive strategy to achieve conservation goals by developing a certification scheme for tiger-friendly non-timber forest products (NTFPs).

The Russian Far East provides habitat for the world's only viable population of Siberian, or Amur tigers (*Panthera tigris altaica*). Approximately 330-370 adult Siberian or Amur tigers are left in the wild, with 95% of these animals in the Russian Far East. The area has a unique assemblage of large carnivores, including tigers, brown bears, Asiatic black bears, wolves, wolverine, and Eurasian lynx. Living in northern temperate forests of low productivity, and hence low prey density, these tigers require large tracts of land to survive. Even under the most optimistic scenarios for habitat protection, it is unlikely that sufficient area will be protected to ensure conservation of Amur tigers in the long term. Therefore, managing habitat outside protected areas (in multiple-use areas) is a key issue in Amur tiger conservation.

Primary threats to tigers are: (1) habitat loss from intensive logging and development; (2) depletion of the prey base; and (3) poaching of tigers. Tigers are most commonly poached for their fur and for their body parts that are used in Traditional Chinese Medicine, but they are also perceived as a threat to domestic livestock and dogs and as competitors to hunters. Human-caused deaths are by far the largest mortality factor for Amur tigers, and poaching by hunters is its most common form.

The WCS team in Russia felt that the key to effective natural resource management and conservation on unprotected lands would be effective partnerships with local stakeholders. One of the potentially most influential and effective means of managing wildlife on unprotected lands is working with hunters and the hunting management structure. In 1995, new legislature provided opportunities for local people to create non-governmental "societies" (NGOs) that could obtain hunting lands. In lieu of the former large state-controlled hunting operations, today 67% of all leases are managed by NGOs. In Primorskiy Krai, 80% of hunting leases are on unprotected lands. This implies that local people are now for the first time allowed to manage wildlife populations and have a vested interest in proper natural resource management. Hunters have also traditionally been involved in other extractive activities in the forest, often having worked for the Soviet-era state agency GosPromKhoz in the collection of non-timber forest products.

WCS began working with hunting associations and hunting leases throughout Primorskiy and southern Khabarovskiy Krai in the Russian Far East to develop effective management regimes on unprotected lands. Key to success is resolving the perceived conflict between tigers and hunters for prey resources and establishing direct links between tiger conservation and economic improvement in local economies. The project goal is therefore to protect tiger habitat by supporting newly-established hunting leases. The aim is to increase the hunting associations' capacity for self-management and financial independence, and to undertake anti-poaching activities and habitat and population management for tiger prey species.

One of the key interventions within this framework is the increase of harvesting and sales of certified "tiger friendly" non-timber forest products with a focus on increasing capacity of forest communities and hunting associations to produce products marketable at either the national or international level. The "tiger friendly" certification provides value-added for NTFPs linked to tiger conservation for the hunting associations marketing the product.

Although the sale of NTFPs is, by itself, not a direct conservation incentive, the "tiger friendly" certification process establishes direct linkages between income from NTFPs and land and wildlife management. Income from these NTFPs is conditional in the sense that WCS will only grant certification if monitoring shows that the requirements have been met. Thus, by making this direct linkage, conservation objectives and improved livelihoods can be achieved through a market-based mechanism.

There are several problems that are prohibiting more rapid development of the NTFP business in the Russian Far East. They include, but are not limited to, multiple taxations on small businesses and on exports; illegal NTFP trading by Chinese merchants; massive smuggling of NTFP goods across the border to China; and a strong logging lobby. Data are not available on the costs of setting up a certification scheme, including the required monitoring, and how this would compare to setting up a more direct performance-based direct payment scheme.

Discussion

Although the above initiatives are still young, several have shown promising preliminary results and indeed appear to support the view that direct incentives, in addition to other market-based approaches, can be a good tool to achieve wildlife conservation results. As all of these activities were part of larger conservation programs, it is not entirely clear how much of the early successes in these projects is attributable to the direct payments (except perhaps in the Cambodian nest protection case), and how much is due to other activities simultaneously undertaken by the projects.

Critics of the direct incentive approach argue that uncertain or inequitable land tenure, limited experience with legal contracts and their enforcement, and limited prospects for investment or employment outside the agriculture sector make such approaches difficult to implement in developing countries (Ferraro and Kiss 2002). These concerns are valid, but also apply to indirect approaches. More important, perhaps, may be political or cultural barriers to performance-based payments, particularly to withholding payments in response to poor performance.

In the Cambodia case, an unforeseen cultural issue was that Cambodians had trouble with the concept of payments for results rather than for time worked. Another issue of philosophical dimensions is whether it is actually morally justifiable, in the case where a destructive activity is actually illegal (like crane egg collection in Cambodia), to pay people not to do it. Pragmatically, however, where law enforcement is not effective enough to prevent illegal acts, it may still be the simplest way to achieve the desired results.

Since economic efficiency is one of the arguments used to advocate for the direct payments approach, an important question is how much to pay, when to pay, and whom to pay. Services to be provided and results to be achieved need to be well defined and, theoretically, a price should be negotiated based on an assessment of their true value based on local market conditions. Economic valuation of ecosystem services is notoriously difficult, but various methodologies have been tried. The key here is that, for people to choose conservation over alternative land uses, the benefits of conservation have to be at least marginally greater than those which they feel they could derive from other (more destructive) land uses. In practice, all of the WCS experiments with direct payments relied on subjective estimates of the "right price" based on factors such as availability of funds and willingness to accept the payment.

Conditions and timing of payments are also important considerations. In the Cambodia nest protection example, initially the scheme was based upon "payments for work" (i.e., $2/day) rather than "payments for success." This led to perverse situations where WCS was perceived as an employer with responsibility for protectors' well-being, whilst the protectors shared little of the risk. In addition, the loss of benefit to a protector for collecting a mature chick (a few days at $2/day) was less than the trade value (although no cases of a protector actually selling chicks were reported). Subsequently WCS decided to increase the risk shared by the protectors by paying them $1/day for their work and $1/day for results upon successful fledging. This reinforces the point that it is essential to establish a link in people's minds between benefits and conservation outcomes. In the case of the less-direct payment for services rendered, it is possible that people may not assume responsibility for conservation results, whereas linking payment directly to conservation success ensures that this is the case.

The issue of timing of payments is also exemplified by the Cambodia cases. Cambodians value immediate benefits much higher than long-term benefits, and local discount rates may be very high. In such situations, an up-front or regular payment scheme will probably be more effective than those that promise future benefits. Similarly, long-term sanctions, if they are at all desirable, may not be effective.

Whom to pay can be a dilemma fraught with difficulties. It is relatively easy to determine in the case of well-defined individual property rights. However, where land tenure is insecure or lands are held in common (as is often the case in indigenous territories) or state-owned (for example in Laos), the payee may have to be a community organization or another body designated by the state. In the example from Cambodia above, control of land lies with the state, and marginalized rural communities living in close proximity to significant biodiversity have limited capacity to assert or achieve recognition of land rights. Securing their land rights and empowering local enforcement to protect these rights are crucial to any incentive scheme that seeks to affect land use decisions and are therefore one of the primary focuses of the WCS conservation program. Whether communal payments or individual payments are more appropriate can also be an issue of culture and local perceptions. In Cambodia, for example, individual benefits seem to be valued much higher than communal ones, perhaps because of its conflict-ridden history, which suggests that individual payments should be pursued where possible. In Laos, on the other hand, a mix of payments to individual members of the VCT for actual services rendered and to the village at large as a communal benefit was chosen. One problem that emerged from the communal payment approach was that withholding payment because of non-performance by one person (e.g., a poacher) would penalize an entire village, even if all other villagers hold up their end of the bargain.

Equity issues may arise, particularly when target communities are stratified along a gradient of income and land ownership patterns from landless to relatively well-off land owners. The Laos case shows how resentment can arise when certain members of a village are selected over others to receive benefits, or even when certain villages are selected as target villages over others. Another flaw of the Laos initiative was that gender issues were not dealt with and decisions on whom to include on the VCTs were left entirely up to the villages. WCS might have had an opportunity to involve women in the project and thereby promote objectives beyond wildlife conservation. In general, care should be taken so that inequitable power structures are not inadvertently exacerbated through direct payment schemes, if not for equity reasons, then at least because the wealthier individuals will also tend to be those with the power to make land use decisions. A stakeholder analysis to consider who owns or has access to biodiversity and who has the potential to protect or harm it should be a prerequisite to such schemes.

Another question is what form payments should take. Compensation does not always have to be in cash—it may be in kind (e.g., help to increase land tenure security or help to strengthen internal organization of community groups), or a combination of the two, depending on local preference. On the other hand, the more in kind assistance has to be provided, the more the initiative begins to resemble traditional ICDPs, and the more transaction costs will tend to increase, because of the likely need for consultants, community development specialists, lawyers, etc. (although some of these may also be needed for the establishment of any direct payment scheme). For projects to work, building up a relationship of trust with a potential community of service providers is an important first step in all cases.

Lastly, as in all conservation and development projects, sustainability is a key issue. If conservation outcomes are to last, a constant source of financing for payments will most likely be necessary. In that sense, market-based approaches, such as the COMACO model in Zambia (in this Working Paper) or the Amur tiger NTFP scheme, may offer some advantage, as they can become self-sustaining if the business model is successful. When payments stop, as is currently the case in Lao PDR, there is a risk that previous destructive activities may resume, although it is too early to judge whether awareness raising and a sense of ownership over the natural resources may mitigate this.

Conclusion

There is cause for cautious optimism from the preliminary findings by WCS field staff that support the utility of direct incentives and, more generally, market-based mechanisms. Hope for conservation results does indeed spring from making the link between conservation and livelihoods as explicit as possible. If a direct approach based on economic incentives is felt to be appropriate in a given context, the implementation details (such as whom to pay, when, and how much, from what funds, and through what mechanism) depend on factors such as local laws, preferences, capacities, and infrastructure, as well as the availability of funding. A direct payment to individuals (e.g., nest protectors) or groups (e.g., the village council) may be the best way to proceed where external factors such as political, legal, and cultural frameworks favor this kind of approach.

The most important advantage of direct incentives is, however, the conditionality of benefits. Even if direct cash payments prove too difficult to implement in a given situation, receipt of any type of benefit by a community could be made contingent on "biodiversity-friendly" behavior, thus increasing the likelihood of positive outcomes for biodiversity.

Finally, although the principal advantage of using direct incentives pointed out by economists is cost-efficiency, it may be worthwhile for conservation organizations working in developing countries that lack the requisite structures to help set these up or strengthen them. In such cases, they can be implemented as components of more traditional conservation projects. This of course increases the transaction costs of a project, but it serves the vital purpose of introducing conditionality as a motivator for conservation, and thereby leads people to better understand the links between conservation and their livelihoods.

PART 6
PERSPECTIVES FROM OUTSIDE WCS

6.1 Reframing the Protected Areas-Livelihood Debate: Conserving Biodiversity in Populated Agricultural Landscapes

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Protected Areas and Ecoagriculture

Many of the strict protection regimes in protected areas (PAs) in the world's highest biodiversity areas are not working. Population growth in the last remaining wilderness areas is booming at twice the world's average (Cincotta and Engleman 2000). Inhibiting local people's access can be impractical, unaffordable, and ethically questionable. The international community is beginning to understand this: The recent Durban Accord from the World Parks Congress endorses an approach to conserving biodiversity that moves beyond PAs and seeks to address root causes of biodiversity loss and promote biodiversity at a landscape scale. The Accord also recognizes the sovereignty of local people over forest areas considered part of the public domain and their potential role in determining management regimes.

However, current proposals for expanding PAs often continue to be made without appreciation of impacts on local people or consideration of alternatives. PAs must provide livelihood opportunities for the people living in and around them. If designed and managed properly, these opportunities can be compatible with goals of environmental services protection and biodiversity conservation.

Communities need more than conventional extraction agreements—they need agriculture. Given the proper institutional environment and market access, it is possible and profitable to manage biodiversity-friendly agricultural systems in PAs. These systems have enormous potential for conservation and livelihoods. However, agriculture has historically been viewed by conservationists as the main threat to biodiversity. Animosity between conservation and agriculture has led to academic and institutional cultures of compartmentalization, distrust, and closed-mindedness to the potential for the co-existence, and indeed mutual benefit, between agriculture and biodiversity. In reality, the Millennium Assessment (Hassan 2005) calculated that more than 45% of the world's 100,000 protected areas had more than 30% of their land area under crops.

The emerging paradigm of ecoagriculture is focused on the potential of PAs to contain agricultural areas, and the potential of agriculturally-dominated landscapes that provide ecosystem services to include biodiversity conservation. Ecoagriculture is a landscape planning approach which aims to achieve agricultural production and sustain rural livelihoods in ways that also protect wild plant and animal species and the natural ecosystem services upon which both humans and wildlife depend (McNeely and Scherr 2003).

From a landscapes planning and agricultural production perspective, ecoagriculture requires an appreciation for local knowledge and sustainable agricultural practices. Ecoagriculture management also requires multi-stakeholder landscape planning processes and access to supportive product and ecosystem service markets.

Implicit in the design of ecoagriculture landscapes in PAs is the consideration of equity and access for the people who live there. While there are, of course, real trade-offs between conservation and development as the Global Environmental Agenda meets Local Agents (Pfeffer et al. 2001), a well-functioning ecoagriculture system can provide livelihood opportunities for people in PAs that are compatible with conservation goals. But until people get the access and rights to take advantage of these opportunities, the chasm between these values will continue and the conservation agenda will continue to be undermined by local peoples' aspirations (Pfeffer et al. 2006).

Although experience documenting and analyzing ecoagriculture in PAs is fairly new, many successful examples have been identified throughout the world and efforts are being made to scale them up and support enabling environments to create more.

This paper aims to reframe the topic of "Parks and Livelihoods" to consider the role of ecoagriculture as an approach that simultaneously conserves biodiversity and supports local livelihoods in and around PAs. It focuses on five key topics: 1) landscape management strategies for agricultural production and biodiversity conservation; 2) the potential of community managed lands for conservation; 3) the need for flexible management and regulation of resource access within PAs to enhance livelihood options; 4) methods of financing conservation in agriculture landscapes; and finally 5) the role of conservationists in ecoagriculture management.

Agriculture Landscape Design for Conservation

Agriculturally-dominated landscapes have tremendous potential as biodiversity habitat, but they must be managed for this purpose. For an ecoagriculture approach, farmers must ensure protection of wildlife: i.e., protection of nesting areas; diverse perennial cover to serve as protection from predators; adequate access to clean water throughout the year; territorial access between dispersed population groups to ensure genetically and demographically viable populations; all-season access to food from diverse sources; viable populations of predators and prey; healthy populations of other species with which they are interdependent (such as their pollinators); and biologically active soils (Scherr and McNeely 2007).

Although many ecosystem service and conservation functions can be provided by a network of healthy patches of natural habitat within agriculture-dominated landscapes, agricultural land itself can also play an important role. Towards this end, agricultural and conservation innovators are pursuing strategies such as minimizing agricultural pollution of natural habitats, managing conventional cropping systems in ways that enhance habitat quality, and designing farming systems to mimic the structure and function of natural ecosystems (Scherr and McNeely 2007).

Principles and strategies to synergistically link agriculture and conservation in mosaic landscapes exist and are available to farmers and land managers, but ecoagriculture planning can succeed only if there is a supportive management structure. In many cases, this is not based on traditional notions of a PA, but rather is led by local farming communities with incentives to manage their agricultural systems to maximize conservation.

Community-led Conservation

Documented experience with community-led conservation (Molnar et al. 2004, 2007) demonstrates that effective conservation is possible without strict PA regulations. In fact, much of the world's forest areas are already under local community control. Community conserved forest landscapes identified in Africa, Asia, and Latin America total at least 370 million ha, a greater area than the world's public protected areas (Molnar et al. 2004.) The management issues in these arrangements take different forms depending on the context. Molnar et al. (2004, 2007) identifies four general types of community conservation areas and the biodiversity conservation potential in each:

1. *Indigenous and traditional stewards of large areas of natural habitat achieving conservation similar to that of public protected areas* – These community-managed areas may support both resource and biodiversity conservation and local income and livelihoods. This category of community-conserved areas has important advantages for conservation, including large, nonfragmented areas able to support large species often protected by their religious value. Many livelihoods in these areas are selected by communities for their long-term relationship with natural resources and adaptability to ecological changes. An example includes part of the 30 million ha of indigenous reserves or territorial lands in the Brazilian, Peruvian, and Bolivian Amazon. These areas are effective in conserving biodiversity (Nepstad et al. 2006).

2. *Communities managing working landscape mosaics compatible with biodiversity conservation* – These situations are found in more intensively utilized spaces where people have longstanding relationships with their surrounding ecosystems and have developed extractive, cropping, grazing, and water and forest management practices over a long adaptive process. In some situations the communities' management of nature is central to the composition and range of biodiversity, and local ecological knowledge and practice are crucial to that biodiversity's continuance. Certain sections of these areas are allocated for more strict conservation; in others, biodiversity values are conserved by complementary management of the resource for multiple purposes. The forest landscapes are fragmented but provide effective corridors as links to adjacent spaces. An example of this is the 20 million ha of complex agroforestry livelihood systems in South and Southeast Asia, including traditional and tribal peoples (Colfer and Byron 2001; Poffenberger 2000).

3. *Community-driven conservation on the agricultural frontier* – This category includes agricultural frontier zones where settlers are relatively recent arrivals in regions with important biodiversity values. They adapt or are willing to adapt their economic activities if they secure adequate livelihood returns through sustainable management. Generally, the positive examples have emerged as a result of partnerships between settlers and nongovernmental organizations (NGOs) or government programs that let settlers organize themselves to protect their interests and find ways to adapt to the current policy and market environment. Some shifting cultivators are switching to perennial species of economic value and conserving secondary forests to reduce the use of fallows and fire. Upland migrants who have maintained forested landscapes in some regions of the Philippines are an example (Barry et al. 2003).

4. *Community-driven conservation and restoration in intensively managed landscapes* – This is perhaps the most widespread type of community conservation. Biodiversity is found in critical habitat niches that supply food and water sources, pollinator habitats, and other similar resources of value to local people. Some communities have organized land use to provide key connectivity among habitats. This type is exemplified by community windbreaks that protect crops and livestock and provide ecological connectivity between forest remnants in Costa Rica.

Community-led conservation is not a solution everywhere, and is often not politically possible. Local people in and around PAs struggle for the rights necessary for community conservation, in part because many of these groups are among the poorest and most politically marginalized on earth. PAs tend to be in low productivity rain-fed areas, where land values and productive potential are relatively low. These are the types of areas where parks can be established with little objection from governments or commercial interests, and local people are often not consulted when the park's boundaries and regulations are established.

Nonetheless, numerous documented examples of the success of community conservation demonstrate its potential (Molnar et al. 2004, 2007). But for these regimes to continue to be effective, and for them to be scaled up, they need to be supported with key enabling elements, including:

- Securing tenure rights and resource access;
- Adequate institutional, regulatory, and policy support and the flexibility to grow local community institutions;
- Access to markets, including markets for environmental services, that value community products and their multiple benefits;
- Finance channeled in a flexible way to complement local initiatives, rather than planning or designing models from outside or governing from above;
- Engaging communities in conservation science as research partners.

Need for More Flexible Management within Protected Areas

In the cases where community conservation is not appropriate or is impractical, and where more conventional public PA management regimes are in place, local people should still be engaged in access agreements and play a role in management. PA managers should re-examine how much area to strictly protect and consider how more could be managed under restricted use. In some cases, strict prohibitions on resource access inside parks is appropriate and effective, but clearly sometimes it is not. When local communities are consulted, they may advocate to site PAs in areas that maximize local agricultural benefits, such as important pollinator habitat and water recharge areas. This protection can enable other livelihood options, such as fishing or tourism.

Communities should be allowed to negotiate access agreements that provide for some harvesting and use of PA land. While these agreements should be negotiated based on evidence of ecological disturbance, certainly some sustainable use is possible.

Financing Conservation in Ecoagriculture Landscapes

A core challenge for conservation is financing. Traditional PAs are expensive and create financial losses for people who once relied on their resources. Public sources of financing, overseas development assistance, and foundation support for protected areas, particularly in developing countries, are declining (Molnar

et al. 2004), and the conservation community estimates a gap of $27-$30 billion annually of finance required to manage and expand existing protected areas (Conservation International 2004). To make up this gap there need to be new sources of financing. A part of the solution is for communities to develop more economic opportunities outside of PAs. While there are promising signs in ecotourism and private philanthropy, agriculture presents the largest opportunity by far. There is room for agriculture to be intensified and income dramatically increased in and around PAs. Agriculture also has a high multiplier effect on employment generation.

Along with shifting to view community-led ecoagriculture management as a potential ally of conservation, conservationists must also fundamentally rethink ways of organizing public support for the private entrepreneurial activities of farmers that produce environmental benefits. Ecoagriculture systems need to be incentivized by more than traditional agricultural product markets. Particularly in PAs, farmers need incentives to produce and steward environmental services. As previously discussed, if local farmers have more control in the siting of PAs, they will tend to select areas that conserve agriculturally beneficial resources such as pollinator habitat and water sources. But in the case of environmental services that do not directly benefit local farmers' agricultural production, such as non-agricultural biodiversity or carbon sequestration, farmers need to be connected to markets that pay them for these global "products." Agrocertification schemes have the potential to capture some of these environmental values, and these markets will be critical to create the necessary incentives for farmers to develop and maintain ecoagriculture landscapes.

The Role of Conservationists in Ecoagriculture

In community managed lands and in conventional PAs, ecoagriculture management will require more sophisticated institution-building beyond what is required for traditional PA management. Therefore, an ecoagriculture approach could fundamentally redefine the role of conservationists. For market support, PA managers could play an intermediary role with communities to lower marketing costs and provide expertise and assistance linking to warehouses, transportation, loans, and any other market bottlenecks (see Lewis in this Working Paper). Conservationists can also help to convene multi-stakeholder landscape planning exercises and community-led research to support ecoagriculture planning. They can engage in national policy processes on agriculture, agitate for ecologically sensitive approaches, and advocate for environmental ministries to see agriculture as a potential ally.

Conservation organizations should take a proactive role in promoting ecoagriculture in and around PAs and should invest in developing the capacity in this realm. This shift for conservationists will help validate the conservation agenda locally and more clearly identify roles for local people in biodiversity conservation.

6.2 Protected Areas, Poverty, and Policy: A Review of Biodiversity and Protected Areas within National Poverty Reduction Strategies

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In recent years there has been a somewhat heated debate on the links between biodiversity conservation and poverty reduction. One thread of this argument has been concerned with the current focus of international development assistance policy on poverty reduction as its major priority and, as a result, an apparent "downgrading" of other aspects of a broader sustainable development agenda—including biodiversity conservation (Lapham and Livermore 2003; Sanderson and Redford 2003; Sanderson 2005) Although poverty reduction had been a recurring theme on the international development agenda, it was not until the late 1990s that it became the priority focus of development assistance policy.

In 1996 the Development Assistance Committee (DAC) of the Organisation for Economic Cooperation and Development published seven international development targets (IDTs)—the predecessors of the Millennium Development Goals (MDGs)—with an overarching emphasis on poverty reduction. Many bilateral aid agencies shifted their policies in line with these targets—for example, the UK Department for International Development (DFID) published a White Paper on poverty reduction in response to this (DFID 1997). The Millennium Development Goals (MDGs) launched by the United Nations in 2000 repackaged the IDTs and gained an unprecedented level of international commitment to poverty reduction (Satterthwaite 2003).

Recognizing the failure of two decades of structural adjustment programs to produce significant gains in the economic status of developing countries, the World Bank launched a new framework for development assistance—the Comprehensive Development Framework—emphasizing developing country ownership and direction of the development agenda (Stiglitz 1998).

Poverty Reduction Strategy Papers (PRSPs) were introduced in 1999 and were initially designed as the mechanism for those countries who qualified for debt relief under the World Bank's and International Monetary Fund's (IMF) Heavily Indebted Poor Countries (HIPC) initiatives to account for the allocation of funds that they would previously have used to service debt repayments. PRSPs were subsequently extended beyond HIPC countries to all countries seeking World Bank and IMF concessional lending and are now the main vehicle by which bilateral donors coordinate their support: "The objectives of PRSPs include improving donor coordination and ensuring that governments and civil society groups take a lead in defining policies. PRSPs aim to put poverty alleviation at the core of national spending priorities by integrating macroeconomic, social, and sectoral policies" (Hewitt and Gillson 2003).

The dual focus of development assistance policy on poverty reduction and on "country-led" development has changed the way many bilateral donor agencies channel their financial assistance to developing countries. One noticeable change has been a shift from project support to direct budget support (DBS), where aid money is paid directly to the treasury of the recipient country and is then allocated by its government according to priorities identified in its PRSP (ODI 2006). As a consequence, unless biodiversity conservation was a priority identified by recipient countries, development assistance funding that had previously been available for biodiversity conservation projects was significantly reduced (Lapham and Livermore 2003; Roe 2004).[1]

Recognizing this new policy context, recent discussions on financing for biodiversity conservation in general—and protected areas in particular—have been couched in terms of their contribution to poverty reduction objectives (Emerton et al. 2006). Conservation organizations have urged the mainstreaming of protected areas into poverty reduction strategy papers and other national development plans in order that they can be better supported. For example, Recommendation 5.29 from the 2003 IUCN World Parks Congress recommends "mainstreaming protected areas into national and international development planning and policy, particularly poverty reduction strategies and the implementation of the Millennium Development Goals" (IUCN 2005). The Conclusions produced by Council of the European Union in response to the Message from Paris—the main outcome of the 2006 IUCN Conference on Biodiversity in European Development Cooperation—emphasizes that this is the correct approach, reiterating that any financial support for biodiversity within development cooperation programs must be "founded on national and regional ownership that is reflected by the integration and mainstreaming of biodiversity into development strategies and plans."

This paper explores the extent to which biodiversity and protected areas have been integrated into PRSPs. The paper reflects work in progress and presents the preliminary findings of an analysis of 60 full or interim PRSPs[2] (the total number produced and made available on the World Bank website as of May 2007).

The PRSP Sample

PRSPs are not homogeneous, formulaic documents. A number of issues are worth noting here to illustrate the diversity of material:

- A number of PRSPs are known domestically as socio-economic development plans, growth and development strategies, and so on. In some cases, these are rolling plans that are produced on a routine basis but that have recently been adapted to incorporate poverty reduction in response to World Bank requirements.
- Different countries have reached different stages of development of their PRSPs. To date, 53 countries have prepared full PRSPs while a further 12 are still at the interim stage.

PRSPs are intended to be rolling documents that are responsive to changing national conditions and priorities. Of the 53 full strategies, 46 have already had at least one previous iteration.

Given that PRSPs were originally developed as part of the HIPC process, it is perhaps not surprising that the majority of countries covered are from the poorest continent—Africa, with 28 Full PRSPs and six Interim PRSPs. This is followed by Eastern Europe and Central Asia, with a total of nine PRSPs.

Results of the Review of PRSP Biodiversity and Protected Area Content

Biodiversity

The majority of PRSPs include some mention of biodiversity. Of the 60 PRSPs reviewed, in only five cases was there no mention and three of these (Central African Republic, Indonesia, Macedonia) were very un-developed interim PRSPs which did not include any in-depth analysis of any issue. The remaining two—Gambia and Haiti—make reference to the links between environment and poverty but do not specifically consider biodiversity.

Of the 55 PRSPs that do address biodiversity, just under 50% (26) simply make a passing reference to it, with no elaboration of its importance to poor people or its role in poverty reduction. Examples of this kind of treatment include Cape Verde—which highlights biodiversity loss as an environmental problem but makes no further analysis; Guyana—which highlights the pro-poor tourism potential of biodiversity assets but doesn't elaborate further; and Vietnam—which notes a target to increase forest coverage.

Conversely, nine countries provide a detailed analysis of the contribution of biodiversity to poverty reduction. A recurring theme is the recognition of the dependence of poor people on natural resources and the links between poverty and resource degradation—poverty being both a cause and a result of degradation. Linked to this is the role that biodiversity plays in underpinning ecosystem services that are important to poor people. Soil quality and water regulation are highlighted as key services affected by biodiversity loss—particularly forest degradation—which have important implications for poor people in terms of food and fuel security. Availability of medicinal plants is a third key service for poor people. In a number of cases, biodiversity is highly valued as a driver of tourism, one of the main pillars of some national economies. But in other cases emphasis is placed on the fact that biodiversity resources have not been sufficiently valued to date and there is significant unrealized potential for enterprise development, job creation, and GDP contributions. **Table 1** summarizes the key issues raised in the nine PRSPs that pay particular attention to biodiversity.

Protected Areas

The treatment of protected areas in PRSPs is as varied in breadth and depth as the treatment of biodiversity. Just over 20% (12) of the 55 PRSPs that mentioned biodiversity included little, if any, analysis of the role of protected areas. For some, this is not surprising given the small size of the protected area estate (Guinea-Bissau, Afghanistan, Cape Verde), the undeveloped nature of the PRSP (Macedonia, Indonesia, Central African Republic), or the fact that the countries are embroiled in, or emerging from, conflict (Sierra Leone, Liberia, Chad, Cote d'Ivoire). For others, however, the lack of attention to protected areas is surprising. Bhutan, with 30% of its land protected, highlights the dilemma of balancing its strong conservation record—of which it is proud—with the need to provide for socio-economic needs. Its conservation ethic is cited as a constraint to some traditional poverty reduction strategies such as road building, but there is no discussion as to the impacts—positive and negative—of this at the local level.

The Congo Basin is the world's second largest rainforest after the Amazon. WWF notes that the "Yaounde Declaration [on the conservation of the Congo Basin] committed [Central African] leaders to creating protected areas covering at least 10% of the Congo Basin Forest, eliminating illegal logging and halting the bushmeat trade" (WWF undated). However, the PRSPs of the Congo Basin countries pay surprisingly little attention to this commitment and to the implications this may bring. Congo, for example, notes the huge potential of, but currently little benefits from, forestry and biodiversity. It notes the impact of poor people on forest resources and bushmeat in particular, but includes no elaboration of strategies to address this and no mention of protected areas.

A further 16 PRSPs mentioned the need for protected areas as a strategy to tackle biodiversity loss—either establishing them from scratch or expanding the existing coverage—but with no analysis of what this would actually mean in terms of poverty reduction goals or local livelihoods. In many cases the PRSPs simply articulated a target land area to be protected, or expressed a need to create or expand the protected areas network.

Table 1: Biodiversity issues in selected PRSPs

Country	Key Issues
Bangladesh	Highlights current levels of biodiversity loss and causal factors including population pressure, land conversion, and over-exploitation. It recognizes the fact that the poor are forced to "mine" natural resources for survival but that the resulting loss in biodiversity aggravates poverty. While conservation needs to be ensured through "appropriate intervention, investment, and management," it is recognized that the participation of the poor at community level is essential. Key benefits from biodiversity conservation are noted particularly with respect to fisheries – given the number of people dependent on this for income and food.
Bolivia	Highlights the great potential of its biodiversity resources but the current lack of sustainable management of those resources. It estimates if appropriate activities were developed in ecotourism, bio-prospecting, and so on, biodiversity could contribute an additional 10% of GDP within 15 years or so. Furthermore, well-managed sustainable use projects associated with high value species, e.g., vicuna, could have specific advantages for indigenous and local communities.
Ghana	Sees environmental degradation as the key constraint to agriculture – on which the country's economy is based. In relation to this it advocates "human-centred biodiversity conservation initiatives" – entailing local participation and equitable benefit sharing. Tourism is identified as a key potential growth area – with associated local benefits including jobs and small enterprises.
Kenya	Tourism is highlighted as one of the main drivers of the economy. Community-based tourism and wildlife conservation are seen as key to expanding the tourism sector bringing, in turn, more benefits for poor people through jobs and small enterprises. Human-wildlife conflict is also identified as a specific issue which requires particular attention.
Mozambique	Clear that achieving the objectives of the PRSP depends on the relationship between natural resource use and benefits for the poor and emphasizes the need for community participation in – and benefits from – conservation as a mechanism to drive the fledgling tourism industry.
Nicaragua	Makes a clear link between resource degradation and ecosystem services that have an impact on poor people and poverty. In particular it highlights the links between forest loss, soil degradation (with an associated knock-on effect on agricultural productivity), and flooding. It articulates a number of market-based strategies capturing biodiversity value including debt-for-nature swaps and payments for environmental services.
Sri Lanka	Estimates that unsustainable resource use comes at a cost to the national economy of around 2.5% of GDP. Highlights the link between forest loss, water flows, and soil conservation, and the effects these have on food and fuel security for poor people. Community involvement in natural resource management is seen to be key to reducing poverty including "empowering the poor to serve as custodians of the nation's precious wildlife heritage."
Uganda	Highlights value of forests, fisheries, and wetlands for export products but also emphasizes the need for community management and local benefits – especially through wildlife-based tourism. Community management outside of protected areas is recognized as critical to effective conservation and the need for local benefits and addressing issues of human-wildlife conflict is recognized in this context.
Zambia	Emphasizes the value of biodiversity in terms of the contribution of wildlife-based tourism to both national economic growth and local development processes.

Nevertheless, nearly half (27) of the 60 PRSPs reviewed had given some consideration to the role of protected areas in poverty reduction. In the majority of cases the PRSPs focused on national level benefits from protected areas. In particular, tourism stands out as the key mechanism by which countries expect to benefit from investments in a protected area network. National level benefits from tourism include foreign exchange earnings, GDP contributions, and so on. As well as national benefits, a number of PRSPs pay attention to the "pro-poor" potential of tourism—especially as a strategy for job creation and small enterprise development in rural areas, where few other development opportunities exist (although often the local benefits of tourism development are assumed, little attention is paid to the strategies necessary to enable poor people to take advantage of such opportunities—for example, access to credit and training).

Beyond the economic opportunities provided by tourism, the role of protected areas in supporting the delivery of ecosystem services—including climate regulation, soil conservation and fertility, and water supply is well recognized.

Of the 27 PRSPs that consider the poverty reduction potential of protected areas in some detail, nine provide some insightful analyses of the local level impacts—considering not just potential benefits but also possible costs that may need to be taken into account (**Table 2**). They also include some analysis of strategies for maximizing benefits and minimizing costs. Seven of these identify local benefits from tourism as the key contribution of protected areas to local livelihoods, and in Kenya, considerable detail is provided on strategies to enhance the pro-poor potential of tourism to maximize local benefits, including government/private/community partnerships, credit for enterprise development, and community conserved areas. Economic opportunities are also available in the form of jobs and training in conservation (Sri Lanka) and revenue from park entry fees (Uganda). Other livelihood benefits include ecosystem services associated with the improved status of biodiversity resources as a result of the protected areas, particularly food security.

Six PRSPs explore local costs associated with protected areas. These include increased human-wildlife conflict (for example in Mozambique, a ban on hunting in protected areas has meant that communities are less able to deal with problem animals that are raiding their crops, and this is seen as contributing to poverty) and loss of access to resources (Bangladesh, Georgia, Ghana). In other cases, however (Bolivia, Nicaragua), clear demarcation of protected area boundaries has been seen as a mechanism for strengthening traditional resource rights and enabling resident communities to prevent incursions by migrants.

Where land and resource rights are an issue, all PRSPs noted the need to involve local communities in protected areas planning. Uganda, for example, notes the government has a commitment to local consultation before allocating land for protection, while in Ghana, it is suggested that "fair and adequate compensation" be provided when land is acquired by government for protection. Where land issues cannot be resolved through consultation or where compensation is not an option, other strategies mentioned include the development of alternative livelihood strategies (Georgia), co-management (Bolivia), more secure access to common property resources (Bangladesh), and revenue sharing (Bolivia, Ghana, Mozambique, Sri Lanka, Uganda).

Table 2: Livelihood costs and benefits of protected areas in PRSPs

Country	Livelihood benefits	Livelihood costs	Strategies to maximize benefits/ minimize costs
Bangladesh	Benefits associated with increased resources – particularly fisheries	Reduced access to resources resulting in conflict and social unrest	Community involvement in PA management; regulatory framework to recognise rights of vulnerable groups to local common property resources.
Bolivia	Overlap of protected areas with indigenous territories means that securing the financial and ecological sustainability of PAs will, by default, help secure indigenous livelihoods. Income benefits from commercialization of NTFPs.		Co-management – particularly with those representing indigenous communities; revenue sharing with local communities.
Burkina Faso	Local benefits from tourism, income from sustainable wildlife use		
Georgia	Local benefits from tourism	Loss of access to resources	Develop alternative livelihood strategies; participatory spatial planning
Ghana	Local benefits from tourism	Inequality of benefit sharing; lack of compensation for land acquired by government	Promoting equitable benefit sharing schemes; ensuring fair and adequate compensation; maximizing community involvement
Kenya	Local benefits from tourism	Human-wildlife conflict	Govt-private-community partnerships to extend reserves around national parks; community conserved areas; community based tourism; review entry fees to encourage tourism to less-visited parks; credit for SME development; compensation for human-wildlife conflict; community involvement in land use planning
Mozambique	Local benefits from tourism	Crop losses from problem animals	Community participation, benefit sharing
Nicaragua	Local benefits from tourism; local benefits from improved ecosystem service delivery; enforcement of local land rights (ability to prevent incursions)		Recognition and definition of property rights for indigenous communities
Sri Lanka	Local benefits from tourism; training and employment in conservation jobs		Community buffer zones around protected areas; revenue sharing; long-term forest use leases
Uganda	Revenue sharing (20% park entry fees); local benefits from tourism; improved ecosystem service delivery	Human wildlife conflict	Problem animal and vermin control to minimize crop losses; commitment to local consultation before allocating land for protection

There appears to be little correlation between those countries that include a reasonably substantive analysis of protected area contributions to poverty reduction in their PRSPs and those countries with a high percentage of land area under protection. Tanzania, for example, has nearly 40% of its land area under protection. Reducing land degradation and biodiversity loss are key targets within Tanzania's PRSP, and the integrity of protected areas is seen as one mechanism to contribute to these. However, there is no analysis of the costs and benefits the protected area network might bring at the local level. Conversely, Bangladesh, Georgia, and Mozambique have all given serious consideration to the costs and benefits of protected areas and yet only have small areas currently under protection (**Table 3**).

Table 3: Attention to protected areas in PRSPs of countries with high PA coverage

Country	PA coverage (%)	Analysis of PA issues in PRSP
Senegal	11	Management of natural resources is one goal of the PRSP but recognizes the need to strike a balance between satisfying the needs of the population and biodiversity conservation. Community based management of PAs seen as one strategy to address this but not specific analysis as to how this might contribute to poverty reduction or local livelihoods.
Kenya	12.3	Benefits of PAs include tourism, but there is a recognized need to spread the benefits of tourism widely. Human wildlife conflict is a negative consequence that requires serious attention. Strategies for maximizing the contribution of PAs include: govt-private-community partnerships to extend reserves around national parks; community conserved areas; community based tourism; review entry fees to encourage tourism to less-visited parks; credit for SME development; compensation for human-wildlife conflict; community involvement in land use planning.
Indonesia	13.6	Interim PRSP not fully developed
Mongolia	14	Dependence of population on natural resources is noted and incentivizing community conservation through employment is advocated but no specific analysis of the role of PAs.
Burkina Faso	15.4	Wildlife conservation is seen as part of the rural development strategy within the PRSP and local benefits are anticipated through jobs and enterprise opportunities. PAs are mentioned in this context but with no analysis of strategies to ensure the flow of these benefits at the local rather than national level.
Ghana	15.4	There are significant local benefits that could be derived from PA-based tourism but strategies are needed to deal with the negative aspects including inequality of benefit sharing and lack of compensation for land acquired by government.
Liberia	15.8	Improved natural resources management is one policy within the IPRSP. However, immediate focus is on revitalizing the forestry sector with less attention to biodiversity conservation and the role of PAs.
Lao PDR	16.2	Unable to access PRSP document
Malawi	16.3	Wildlife and PA management are recognized as key to grow the tourism industry but little analysis of the links to poverty reduction and livelihood benefits other than PAs being seen as a means to reduce human wildlife conflict (though relocation of problem animals).
Ethiopia	16.4	Three priority actions are identified to link environment and development, of which one is to "strengthen measures to preserve, develop, manage, and sustainably use biodiversity resources." This is seen as contributing towards the tourism industry which then has the potential to generate foreign exchange earnings. There is, however, no analysis of the local level benefits from this.
Central African Republic	16.6	Interim PRSP not fully developed

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Country	PA coverage (%)	Analysis of PA issues in PRSP
Cote d'Ivoire	16.9	Notes the tourism potential of PAs and sees restoring forest resources as a key component of rural development strategy. No specific mention of benefits of PAs, simply a note that they need to be better managed.
Congo	17.7	Notes the huge potential of, but currently little benefits from, forestry and biodiversity. It notes the impact of poor people of forest resources and bushmeat in particular but includes no elaboration of strategies to address this and no mention of PAs.
Nepal	18.1	PAs are seen as important for developing the country's tourism potential and there is a policy object to distribute tourism earnings widely in rural areas – but no indication of mechanism to do this, e.g., revenue sharing, community tourism, etc.
Tajikistan	18.3	A PAs programme has just been started to address environmental degradation but little consideration to date as to how this might impact at the local level. Environmental protection is also considered crucial to encourage tourism with associated employment benefits.
Bolivia	19.4	If properly developed – e.g., through co-management arrangements –the overlap of PAs with indigenous territories means that securing the financial and ecological sustainability of PAs will, by default, help secure indigenous livelihoods. Income benefits from commercialization of NTFPs.
Honduras	20.8	Notes the degradation caused by slash and burn agriculture but links this to the lack of secure land title. Notes the need to provide incentives for forest-resident communities to practice sustainable forest management including land title. Payments for environmental services seen as a key incentive mechanism for PA management.
Nicaragua	21.9	Local benefits from PAs include those associated with tourism as well as local benefits from improved ecosystem service delivery. However, enforcement of local land rights is essential in order to empower resident communities to prevent incursions.
Benin	22.6	Notes role of forest resources as a source of food and income but sees lack of community participation in forest management as a constraint to sustainable resource use. Has an ongoing programme intended to help build capacity to better manage forest reserves and adjacent lands – including through community managed and co-managed PAs.
Cambodia	22.7	Discusses a draft law intended to improve management of PAs including respect for indigenous peoples' rights. Also emphasizes role of community conserved areas. But no further articulation of potential costs and benefits.
Dominica	25.6	Tourism seen as a major element of growth strategy and includes a focus on biodiversity and community participation. PAs are noted for their role as tourism attractions but with no analysis of their potential costs and benefits at local level.
Uganda	26.4	The government is committed to sharing the financial benefits of PAs with local communities (20% park entry fees). Local benefits are also derived from tourism and improved ecosystem service delivery. Nevertheless, human-wildlife conflict remains a key issue, as does the issue of land use planning and decision making.
Sri Lanka	26.5	Local benefits from protected areas include jobs from tourism as well as training and employment in conservation jobs. Strategies necessary to maximize local benefits will include community buffer zones around PAs; revenue sharing; long-term forest use leases.
Bhutan	30.2	Notes the challenge of balancing its proud conservation record – and associated PA estate – with socio-economic needs but does not suggest any strategies to address this challenge beyond the use of environmentally friendly technologies where development does occur – such as road building.

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Country	PA coverage (%)	Analysis of PA issues in PRSP
Tanzania	39.6	Reducing land degradation and biodiversity loss are PRSP targets. Maintaining the integrity of the PA network seen as one mechanism to contribute to this (along with a clamp down in illegal harvesting and promotion of CBNRM) but no analysis of likely costs and benefits.
Zambia	41.4	Emphasizes the role of tourism in national economic growth and in rural development. A number of PAs are key to the tourism industry including national parks and game management areas (GMAs). It is noted that within GMAs, communities can earn revenue from tourism licenses and hunting concessions but not analysis of impacts of other PAs.

Conclusions

In 2002 the World Bank carried out an analysis of the extent to which environmental issues had been mainstreamed into PRSPs. This included a review of 40 interim and full strategies. One of the main findings of the review was that the average score for addressing environmental issues was low and that there was considerable room for improvement: "The fact that many PRSPs pay so little attention to basic issues of environmental health, natural resource degradation, and vulnerability to hazards is a cause for concern" (Bojo and Reddy 2002).

This preliminary, brief analysis is encouraging as it shows the progress that has been made since then—at least as far as biodiversity issues are concerned. The fact that nearly all countries that have produced PRSPs make some reference to biodiversity and to protected areas is an achievement in itself. While it is clear that for some this is clearly an issue that is noted but with no analysis of its links with poverty reduction, others have provided some sophisticated analysis of its importance.

The fact that biodiversity is addressed within the Millennium Development Goals (MDGs) will have helped its integration into country poverty reduction strategies—in many cases PRSPs and national MDG strategies are closely linked if not the same document. The biodiversity indicator within the MDG framework is the "the ratio of area protected to maintain biological diversity to surface area." As noted, a number of PRSPs simply use this kind of indicator to deal with the issue of protected areas. The danger here is that a narrow focus on the quantity of land area ignores the quality of the natural resources contained within these areas, their management, and governance regimes, and the land and resource rights of people living in and around them. It is therefore encouraging that a number of PRSPs have not just paid cursory attention to this issue, but have thought through in some detail issues of benefits—and how; who are rights holders and how this is enforced; who bears the costs, and how can these be mitigated or compensated.

Another encouraging sign is the degree to which PRSPs have evolved over time. As mentioned earlier, PRSPs are not intended to be static documents that once completed are left on the shelf to collect dust. A number of countries have already gone through iterations of their strategies and changes can be seen in the way in which biodiversity and protected area issues are analysed and addressed over time. In Bangladesh, for example, the interim PRSP—prepared in 2003, two years before the full PRSP—includes attention to the links between environment and development but makes no specific mention of the role of biodiversity and protected areas in poverty reduction. The same is true for earlier versions

of the Bolivia, Georgia, and Kenya strategies—just highlighting a few which are now very strong on their analysis of protected area issues.

In Ghana, the interim PRSP (2000) does mention the need for a "sustained supply of forest and wildlife products" and notes the need for community involvement in natural resource management. There is no mention of protected areas. Protected areas are also not mentioned in the first version of Ghana's full PRSP (2003), although it does announce an ambitious plan to generate income for local communities from wildlife and other natural resources.

So, PRSPs evolve and will continue to evolve over time. A challenge for conservation organizations will be to engage with the process to ensure that biodiversity and protected area issues are given the full attention they deserve—but without glossing over the sometimes negative impacts of conservation interventions and the need to address these as well. As Bojo and Reddy note, what matters overall is not so much what is in the PRSP—for it is only a statement of intent—but what is happening on the ground. However good the policy is, the outstanding challenge is to turn it into good practice.

[1] Although it should be noted that this mainly applies to funds available through bilateral programmes.Funding that is channelled though multilateral agencies – for example the GEF – has been steadily increasing in recent years.

[2] At the time of writing 65 full or interim PRSPs were posted on the World Bank website, but it was not possible to access five of those documents.

6.3 Hard Choices: Understanding the Trade-offs between Conservation and Development

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Protecting and sustaining the earth's natural heritage over time presents an enormous challenge for the global community. Species and habitats continue to disappear and the ecosystem services vital to the health of animal, plant, and human communities alike are increasingly disturbed. While the loss of global biodiversity is well documented, there is considerable debate within the conservation field about how to respond most effectively (Wells and McShane 2004; Agrawal and Redford 2006; Brockington et al. 2006; Wilke et al. 2006). The problem is that many people living in areas of high biodiversity in the tropics have been marginalized and their livelihoods are made even more precarious by ongoing environmental degradation. The growing international concern for biodiversity conservation that emerged in the late 1970s concentrated on areas where the coincidence of poverty and natural resources is most pronounced, which has further intensified debate about how much biodiversity can be saved in the face of the suffering of local people. Human rights campaigners have taken up this issue and have accused park authorities and their supporters in the conservation community of illegal imprisonment, eviction, and even genocide of local peoples (Chatty and Colchester 2002; Brockington et al. 2006). The disagreements are typical of an increasing polarization of positions—it is not just indigenous people versus conservationists, but protection versus people, and parks versus development. This acrimony and conflict is taking place against a backdrop of massive loss of ecosystems and species populations and a history of disenfranchisement and increasing levels of rural poverty.

Given the juxtaposition of human poverty and biological wealth, there is a need to enhance the well-being of local people while slowing ecosystem destruction. Faced with the ethical imperative to conserve the earth's natural systems *and* address human poverty, the reigning conservation paradigm—which segregates islands of relatively untouched nature from their disadvantaged human neighbors—began to erode in the early 1980s (Wells and McShane 2004). As a result, the dominant approach within the international conservation community shifted toward so-called win-win approaches, which sought to conserve biodiversity while simultaneously furthering local social and economic development. Unfortunately, the record of such approaches is decidedly mixed and the need to make trade-offs between human livelihoods, biodiversity, and ecosystem services is the rule rather than the exception. This implies that informed and possibly hard choices will have to be made to achieve the best possible outcomes.

The False Promises of Win-Win Scenarios

The term "win-win" has been widely used in a number of disciplines, most notably marketing and communications, as a way of generating positive thinking and results towards a variety of different goals—usually economic. Its promise of "no losses" makes it popular political discourse at the higher levels of government as well. It is a common term applied by international organizations (multilateral and bilateral aid agencies, development and conservation organizations) to describe achieving both conservation and development simultaneously. The use of this language has been most pronounced in the policy discourse about the environment and poverty reduction, which is acknowleged today as the primary

goal of most development efforts (e.g., Millennium Development Goals, UNDP-EC Poverty and Environment Initiative, Convention on Biological Diversity, etc.) (OECD 1996; Ambler 1999; GEF 2005). Most development assistance agencies will not support conservation unless links to reducing poverty can be demonstrated. Meanwhile, conservation organizations have increasingly built poverty reduction into their conservation initiatives. All imply that natural resources can be managed in ways that achieve benefits for local people while sustaining local and global biodiversity.

After more than 20 years of international conservation experience under this paradigm, initiatives that produce win-win outcomes appear to be rare (Christensen 2004). Nevertheless, a win-win approach to projects, often referred to as "Integrated Conservation and Development" or "Community-Based Conservation," is now accepted wisdom. In practice, however, many attempts to simultaneously meet the twin goals of biodiversity conservation and human development have fallen short of expectations (Robinson 1993; McShane and Wells 2004). Frustrated expectations, in turn, have led to a backlash against conservation from some human development and rights groups, and fueled sentiment within certain corners of the conservation field to turn away from the plight of communities adjacent to protected areas. Parts of the practitioner and academic communities are beginning to call into question the assumptions underlying this because they increasingly recognize that many situations on the ground involve competing rather than complementary social, economic, and ecological goals (Barrett and Arcese 1995; Robinson and Redford 2004).

The idea of integrating conservation and development has been enormously attractive to national and international donor agencies, foundations, and NGOs. However, relatively few attempts at integration have demonstrated durable significant improvements in either conservation or human well-being. Skeptics argue that the idea of integrated conservation and development is conceptually flawed, and that many of the practical difficulties experienced by such approaches are the result of unrealistic assumptions about this integration (McShane and Newby 2004). Ecologists have warned that some integrated conservation and development initiatives based on extraction and use of the natural resource base are unsound. Other analysts point out that such initiatives may actually exacerbate negative ecological impacts by acting as growth magnets that encourage people to migrate into project areas (Kramer et al. 1997; Oates 1999; Terborgh 1999). The economic benefits generated by conservation and development initiatives have not usually been great enough or quick enough in arriving—either as an incentive or an alternative—to prevent the human activities that threaten biodiversity. Few initiatives have been able to provide the range of income-generating, labor intensive activities that satisfy the livelihood needs of local people. Project activities have not been able to distribute benefits effectively, with benefits disproportionately received by more powerful interests, rather than the poorest groups or others that are actually using the resource. As a result, such efforts have not had the anticipated effect on desired biodiversity conservation or development outcomes.

The difficulty in addressing linked conservation and development goals is in part due to a limited understanding of the complexity of choices that need to be made and their short- and long-term implications. This is especially true when biodiversity conservation goals appear to be in conflict with human well-being goals. Many of the problems with implementation of these dual efforts have the following characteristics:

- Planning from afar – project designs that aim to satisfy the hopes of international donor agencies for rapid win-win resolution without sufficient knowledge and understanding of local cultural, social, economic, and political circumstances;
- Lack of accountability – external actors rarely are accountable to the communities that are impacted by the conservation efforts;
- Lack of capacity and legitimacy – conservation organizations rarely are internally equipped to weigh different choices nor do they have legitimate rights to do so;
- False assumptions about local communities – frequently conservation practitioners consider all rural human communities alike: as those which are homogeneous, conservation-minded, highly integrated coalitions that share benefits freely and equally;
- Underestimation of the challenges of working with multiple stakeholders – every stakeholder comes with different interests and status, and with the intense pressure on landscapes from land clearing for agriculture, logging, and commercial enterprises, if often supported by powerful economic and political interests;
- Lack of specifically identified measurable conservation targets, goals, and objectives – frequently conservation efforts have weak designs lacking direction and the incentives to reach goals; and
- Focus on local ecosystems rather than the complete system – there is often too narrow a view of the system, leaving incomplete understanding of the wider physical, political, economic, and social landscape.

It is now acknowledged by some of the strongest proponents of "win-win" approaches that outcomes have proven unrealistic in many cases (see Box), and that greater understanding of the relationships between political, economic, social, and ecological factors is required.

Resolving the trade-offs between conservation and development are difficult because the relationship (or the views people hold about this relationship) between people and nature is so strongly influenced by where they are raised, how they are educated, their life experiences, and the survival conditions and options they have faced. Though not necessarily fixed over time, in the face of catalytic events, evolving normative frameworks, or other factors, these different beliefs exert a strong influence on behavior. Moreover, they are often contested and typically underlie difficulties in integrating conservation and development aims. In addition, lack of conceptual clarity about terms such as "biodiversity" and "poverty" inhibits systematic analysis. Assumptions based on inadequate evidence often obscure legitimate differences in preferences and limit the effectiveness of policy and programmatic interventions. A better understanding is needed about how groups with different values, points-of-view, and backgrounds formulate their approaches to conservation and development challenges and how this, in turn, affects responses.

Constraints to Understanding Trade-offs

The term "trade-off" used in this paper does not describe a binary system of winners and losers, but management choices that intentionally or otherwise change the diversity, functioning, and services provided by ecosystems over space and time (the Millennium Ecosystem Assessment [2005] provides a good discussion of the services provided by ecosystems). Trade-offs are made as a result of the interests, actions, and ideas between different stakeholders or users,

Trade-offs and the Global Environment Facility

A recent review of projects supported by the Global Environment Facility (GEF) found that expectations of win-win situations for global and local benefits proved unrealistic in most cases. It has been difficult to attain in practice win-win situations that are sustainable and replicable partly because of insufficient attention to the development of alternative courses of action and trade-offs, the potential for negative impacts, and the need to develop mitigation strategies. Many GEF interventions require trade-offs to be made between environmental conservation or restoration and existing local or national resource uses.

Most GEF projects in the biodiversity portfolio and many in international waters involve some form of restriction of existing patterns of resource exploitation, which will lead to a loss of livelihood to communities or sections of communities. Indeed, the provision of alternative income-generating activities and ecotourism incentives in many projects implicitly acknowledged trade-off relationships, but such interventions often lacked analyses.

The result of the GEF review is a recommendation that GEF activities should include processes for dealing with trade-offs between global and local benefits in situations where win-win results do not materialize.

Source: GEF 2005

and between different geographic and social scales. Trade-offs exist among different interests and priorities, particularly among economic development, social welfare, and conservation goals (Brown 2004; Winter 2005). Trade-offs also exist between long-term and short-term time horizons, where typically biodiversity conservation, as a long-term objective (such as through the creation of national parks), is traded off against short-term economic benefits (such as conversion to agricultural land).

The spatial and temporal scales over which conservation and development benefits are realized—as an outcome of the trade-offs—are rarely commensurate with the scales over which costs are borne. In particular, the benefits may derive regionally or globally while costs are borne locally, and costs may be imposed today while benefits are deferred to the future. Other situations may also hold true. For example, increased local genetic and species diversity in agricultural systems often leads to better control of pests and diseases, but this does not necessarily result in incentives for local protection of biodiversity and also may not link to any important global values (Sayer and Campbell 2004). Moreover, the current mechanisms (market or otherwise) for redistributing costs and benefits in space and time are often inadequate where they exist at all.

While acknowledging that accomplishing either conservation or development objectives is extremely difficult, there continues to be a general poor understanding among practitioners, in both theory and practice, of the ecological and social complexities within which conservation interventions are carried out (Brechin et al. 2003). This incomplete theoretical understanding, traceable in part to limited social science expertise in many conservation organizations and to the urgency with which organizations approach the problem (thus lacking proper studies or research), is exacerbated by the rhetorical elegance of the win-win paradigm, which appeals to donors and avoids the potentially divisive political requirements of calculating explicit trade-offs (Wells and McShane 2004). In addition, there is little direct pressure for self-correction in the face of disappointing outcomes because conservation actors are not typically held

accountable to those who are sometimes negatively impacted by their decisions (Jepson 2005).

The theoretical weakness, internal rules, financial constraints, and external competition between organizations has compounded the reluctance to report mixed results. This, in turn, has limited learning and development of alternative approaches. Moreover, because so much funding has been predicated on producing win-win outcomes, acknowledgement of problems with project implementation poses certain organizational risks. External social, political, and economic forces often undercut local conservation responses, and most actors in the field have not developed the tools required to anticipate and address these larger, conflicting factors, such as a failure or lack of markets. Finally, there are few institutions able to adequately assess and distribute costs and benefits between competing interests once trade-offs are identified (Barrett et al. 2001).

An imperative to consider wider societal needs has become a generally accepted, if somewhat ill-defined, norm within the conservation community over the last decade (Wright *in litt.*). This has provided the impetus for the emergence of the win-win paradigm. But the existence of such a general norm is not likely to alter practice unless it is supported by procedural norms that establish *how* a party might comply to do this. A procedural norm might go beyond acknowledgement of social impact to an affirmative responsibility to address some, but not necessarily all, social impacts from conservation actions. This might include responsibilities to investigate social consequences of conservation, to avoid them if possible, and offer compensation when they cannot be avoided.

Would such a norm apply even if it meant accepting less than optimal biodiversity conservation outcomes in cases where the social cost is too high? Or, conversely, are there some social costs that must be borne by an individual or segment of a population for the greater social good?[1] And, even if such a norm existed, could it be adhered to as a practical matter (e.g., are there practical methods and incentives by which conservation actors can navigate between these competing objectives)? In light of such questions, "trade-offs" provide a useful conceptual prism through which to explore how conservation may more effectively proceed in a more socially sensitive—or less socially costly—way. Trade-offs are tangible and require deeper insights into the social context within which conservation is practiced. Understanding how to resolve trade-offs may lead to new policies, practices, or institutional arrangements through which social norms can be adhered to at acceptable cost and risk to different, sometimes competing, values.

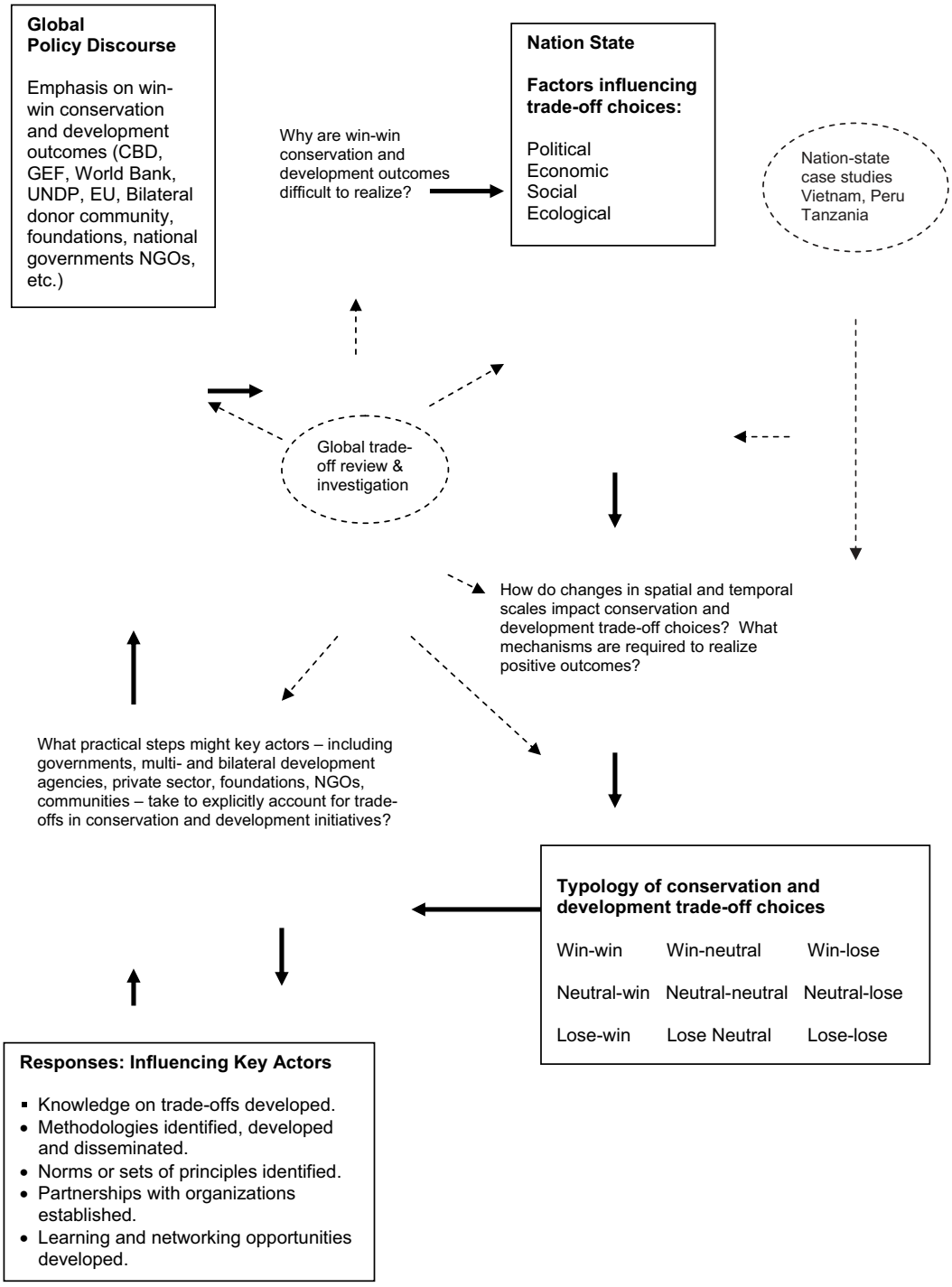
The emergence of a new paradigm and altered practice will require conservation actors to grapple with the need to negotiate with unfamiliar interest groups and perhaps compromise on deeply held values if they are to succeed in a complex world of contradictory perspectives. Such a shift will not be easy. It will require a more nuanced understanding of the political, social, and economic landscape than has characterized conservation program development and implementation in the past.

Advancing Conservation in a Social Context

Advancing Conservation in a Social Context (ACSC) is a research initiative based on the recognition that conservation and development are integrally related and that their linked trajectories have varying implications for biodiversity, livelihoods, and human well-being. While conservation and development can be mutually supportive, under many conditions in time and space they can be discordant, entail trade-offs, and require contestation and negotiation.

The ACSC research initiative proposes to identify and investigate conservation and development trade-offs in all their complexity in diverse real-world settings. The initiative examines these diverse trade-off issues in comparative national contexts as well as at a global scale. In this way, ACSC aims to identify the most promising means to enhance the capacity of key actors to address challenges and opportunities for sustainable conservation and improved human well-being (**Figure 1**).

Figure 1: ACSC Conceptual Framework



Research will be grounded in three case study countries: Peru, Tanzania, and Vietnam. The nation-state remains the most important political unit for decision-making and negotiation of trade-offs between biodiversity and human well-being goals. However, recent conservation priority-setting approaches, such as hotspots or ecoregions, cut across national boundaries, deemphasizing the political and institutional structures of the nation-state. Thus, conservation actions and priorities have often become disconnected from the institutions necessary to resolve tensions and trade-offs over competing goals. The country-level emphasis addresses the political and power issues that lie at the core of conservation and development choices while engaging key actors who must ultimately participate in any resolution. Focusing on three countries enables a depth and rigor of analysis of concrete social-ecological realities not possible at a global scale. However, this national-scale analysis will be enriched by a corollary global survey of academic and practitioner understanding of trade-offs and various mechanisms and norms that have been developed in arenas outside the conservation field.

Research will analyze how trade-offs have been negotiated at different scales within the three national contexts; what level of biodiversity loss, if any, is considered acceptable by different stakeholder groups; how human costs have been or might be mitigated; and who has participated in the decision-making process in different situations. The temporal aspects of conservation will also be investigated, including how succeeding political regimes have resolved trade-offs and how future trends, such as climate change, may portend the need to alter previously negotiated arrangements. Particular attention will be placed on understanding the different perspectives, values, needs, and capacities of key decision makers, and on the interplay between the limits or opportunities for human benefit that flow from different biological resources. The strategy for ACSC to bring about changes in policy and practice in the conservation sector is comprised of five steps.

First, the ACSC will produce, publish, and disseminate research findings that describe the state of trade-off understanding and experience at a country and global scale. At present, the difficulties in altering practice and policy are exacerbated by the lack of solid evidence. Instead, promotional anecdotes or ideologically-driven critiques tend to dominate.[2] The country case studies will be the first systematic analysis of this topic, supported by specific evidence from the field. They will document the process by which conservation trade-offs have been negotiated, identifying the role of various political, economic, social, and ecological factors, and evaluating the resulting impacts on various groups. It is from this body of knowledge that more generalized norms and values will be derived. This, we believe, has the potential to fundamentally change the terms of the debate.

Second, this systematic national analysis will be complemented by a broader global survey of academic and practitioner understanding of trade-offs and the various mechanisms and norms that have been developed within and outside of the conservation arena. It will monitor, collect, and synthesize a broad range of literature relevant to the trade-off issue and track and document emerging trends and critiques on cross-cutting aspects such as values, rights and ethics, and spatial and temporal scale relationships. It will also focus on the global policy aspects of the research by looking at inter-organizational interactions.

The third step will be issuing a blue ribbon panel report on the country-level and global findings. This will help solidify norms implicit in past trade-offs or articulate emerging norms and will include recommendations for the adoption,

adaptation, and implementation of the research findings. The goal of the report is to have an impact on global policy discourse and give rise to processes of trade-off resolution.

The fourth product of the ACSC research will be the development or identification of tools, institutional arrangements, techniques, and training to enable key actors to more effectively address trade-offs. Where gaps are identified, new methods will be created, and existing approaches refined to improve understanding of when trade-offs are important and especially, how they can be calculated and negotiated. Decision support tools, successful case examples, and training tools and techniques will be developed, or those in existence will be marketed. These include exploration and testing of mediation, adjudication, market, and other mechanisms and institutional arrangements for distributing the costs and benefits of conservation in space and time and across affected groups. We will explore how conservation actors can engage with atypical partners, such as those dealing with social justice issues.

The ultimate result of the research, to be accomplished during the subsequent two-year diffusion phase, will be actual changes in conservation policy and practice and an increased desire and ability of conservation actors to address trade-offs. This phase will focus on wider diffusion and dissemination to conservation decision-makers of the initiative's experience and approaches. It will include support for first adopters that apply the recommendations. ACSC will use a two-track diffusion strategy to accelerate the pace at which the findings are adopted by the key actors: first, through communication of influence, and second, through communication of knowledge. Influence leaders on the blue ribbon panel and others involved with ACSC will establish a broad norm that impacts actors' attitudes about the importance of trade-offs.

Conclusion

Win-win scenarios, where both natural resources are conserved and human well-being is improved in specific places over time, have been difficult, if not impossible, to realize. Compromise, contestation, and even conflict are more often the norm. Conservation might be accomplished with no or minimal impact on human well-being or improvements on development at negligible cost to biodiversity. The challenge for conservationists is to explicitly acknowledge the need to share risks and costs and to find a balance between improving livelihoods and biodiversity conservation. Important issues include how to negotiate these trade-offs, what level of biodiversity loss is acceptable, how human costs might be mitigated, and who takes part in the decision-making process. While conservation cannot ignore the needs of human beings, development that runs roughshod over the environment will eventually be unsustainable (or collapse).

[1] An example of weighing of public good against private costs can be found in various Supreme Court rulings interpreting the Fifth Amendment of the US Constitution's prohibition against "taking of private property without just compensation." How is such a balance be adjudicated in other legal and political settings and who bears the responsibility for determining the outcome when, for example, the balance to be struck is between a global good and local cost?

[2] This challenge is articulated in a 2004 paper by Sutherland et al., The Need for Evidence-Based Conservation, that called for a reform of how conservation practices are assessed similar to the revolution in medical practice that resulted from the formalization of a systematic analysis of past experience and accepted practice.

6.4 Deforestation vs. Poverty at Kibale National Park, Uganda: A Ten-year Perspective

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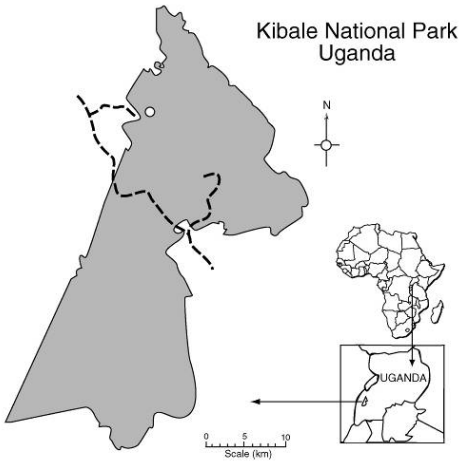
Parts of this paper are excerpted from Naughton-Treves et al. 2006. Burning biodiversity: Woody biomass use by commercial and subsistence groups in western Uganda's forests. Biological Conservation 134(2): 232-241. See also Naughton-Treves (www.geography.wisc.edu, "Deforestation in Western Uganda: Biodiversity and Poverty Concerns").

Physical and Ecological Characteristics

Kibale National Park (795 km^2) is located in Kabarole District in western Uganda, lying immediately northeast of the Rwenzori Mountains. Kibale National Park holds the last substantial tract of premontane forest in East Africa (Chapman and Chapman 1996) (**Figure 1**). Surrounding Kibale National Park is a mosaic of grasslands, smallholder agriculture, papyrus swamps, tea, eucalyptus plantations, and patches of natural forests. These forest patches average 32 ha in size (range 3 to 350 ha) and are located almost entirely in wet lowlands or steep slopes.

Figure 1: (Colin Chapman, McGill University)



The forest in this region is classified as a *Parinari* forest, distinguished on photo aspect maps by large spreading crowns of *Parinari excelsa* (Skorupa 1988; Kingston 1967). At this elevation (1370 m to 1525 m), the presence of *P. excelsa* and the subdominants (*Pouteria altissima, Olea capensis, Newtonia buchananii*, and *Chrysophyllum gorungosanum*) is associated with old-growth forest (Osmaston 1959). As is typical of many tropical tree communities, tree growth rates in the region are highly variable among species (Chapman 2004). Species typically found in old-growth or mature trees have growth rates of between 1 and 3 cm Diameter at Breast Height (DBH) per year, while species colonizing gaps or disturbed areas can have growth rates exceeding 10 cm DBH/year and can reach >15 m in height and >10 cm DBH in just five years (Chapman, unpublished data). While rates of seed dispersal into areas of disturbed forest are not reduced, recruitment of seedlings and saplings is very poor,

due to competition with grasses and an aggressive herbaceous layer. Areas of mature forest are not typically susceptible to fire, while areas of degraded forest are (Chapman et al. 1999; Lwanga 2003).

Cultural and Social Context and Rules of Forest Resource Access

The dominant ethnic group in the area is the Batoro people. Since their arrival in Kabarole District during the 19th century (Naughton-Treves 1999), the Batoro have developed a local system of ownership and forest use, incorporating both spatially explicit resource domains (e.g., royal and village forests) and user rights to specific tree species (Kapiriri 1997). (Prior to independence, the region was known as the Toro Kingdom.) Royal forests are managed similarly to village forests except that a special tax, which is collected by a representative of the *Omukama* (king), is levied on any commercial users (J. Kasenene, pers. comm.). As is common in East Africa, forest access rules are complex and include overlapping tenure claims (Rocheleau and Edmunds 1997). Most forest patches and swamp forests are considered village property that is subdivided into individually-managed parcels. Few individuals have legal title to their land; they claim it instead under customary rules. Some elements of communal ownership persist. Individual owners are typically obligated to give kin and neighbors permission to use natural forests and old fallows for fuelwood, medicinals, drinking water, and other subsistence purposes.

Traditional forest property regimes were undermined by state-imposed regulations and commercial timber markets during and immediately after the colonial period. During this time, the Ugandan Forest Department assumed ownership of all large blocks of forests (including Kibale Forest in 1932) and managed them for timber extraction. Local people were prohibited from harvesting resources in state forests and were expected to rely instead on surrounding forest patches. Two to three communities of roughly 12 households each were displaced from the reserve at this time. Following independence, between 1971 and 1986 Uganda experienced war, severe economic recession, and the disintegration of the state. The Forest Department lost control of Kibale and other forest reserves (Hamilton 1984), and during this turbulent period, the population density in Kabarole District tripled (from 27 to 97 people per km^2) due to high fertility rates and the immigration of tens of thousands of Bakiga people from southwestern Uganda (World Bank 1993).

Recent History of the Protected Area

In 1990, the post-war Ugandan government "upgraded" Kibale from a reserve to a national park and used force to control illicit use of park resources (Feeny 1998). It was during this period that the EU funded an eviction of ~30,000 illegal settlers from the Kibale Corridor connecting Kibale National Park with Queen Elizabeth Park. This eviction was carried out by the Ugandan Forest Department staff with support from the Ugandan police and district staff (Feeny 1998). Oxfam and other observers sharply criticized Uganda Wildlife Authority (UWA) for the violence associated with the eviction and the failure to provide resettlement or compensation for those evicted. Years later, an inter-ministerial task force investigated the eviction and condemned the manner in which it was implemented. Some of those evicted eventually received land in Bugangaizi, but there they suffer far poorer infrastructure and soil fertility (Feeny 1998). The following study is from a culturally and ecologically distinct region roughly 30 km north of the corridor.

Ugandan environmental agencies have gradually shifted toward more participatory approaches and, in recent years, park managers and local leaders have begun to discuss collaborative management at Kibale. They now allow some neighboring communities to use non-timber forest products within specified zones provided they prepare formal contracts delineating rights and responsilities (KNP General Management Plan 2005). Outside the park, the continued rapid population growth (3.4%, among the fastest in Uganda) and high demand for fuelwood and charcoal has intensified pressure on forests (Government of Uganda 2002).

Resource Use, Sustainability, and Patterns of Deforestation

Over 95% of Kabarole's people rely exclusively on wood for energy (Government of Uganda 2002). Charcoal production for regional and national urban markets is expanding (Chapman and Chapman 1996). Brick production is also increasing to meet construction demands of growing urban and semi-urban areas. The area devoted to tea cultivation in Kabarole has expanded by 2,000 ha (~10%) in the past 40 years (Mulley and Unruh 2004), much of this within 10 km of Kibale Park, where tea production expanded six fold between 1955 and 1988 (S. Mugisha, unpublished data). Mulley and Unruh (2004) explain that this expansion intensifies pressure on forests in two ways: First, tea companies require significant amounts of eucalyptus to dry their tea (roughly one hectare of eucalyptus is needed per every three hectares of tea), and second, they import laborers from outside Kabarole, many of whom eventually leave the tea companies and establish homesteads on land near the park boundary. Roughly half of the local tea labor force is recruited from areas beyond Kabarole District (K. Lameck, J. Manager, Finlay Tea Ltd., pers. comm. 2006).

Amidst growing demands for forest resources and uncertain access rules, deforestation in Kabarole has continued apace. According to remote sensing analysis by Mulley and Unruh (2004), between 1955 and 2001 forest declined by 7,967 ha outside of Kibale National Park, while increasing by 10,823 ha within the park due to forest regrowth in formerly cultivated areas. A similar analysis along the western boundary of Kibale showed that closed canopy forest loss inside the park within 500 m of the boundary proceeded at 0.2% per year between 1995 and 2001. During this same period, closed canopy forest declined outside the park by 3 to 4% per year, with the fastest rates occurring within 1 km of the park boundary (**Table 1**). This peak in deforestation rates near the park was similarly observed for other forest reserves of the Albertine Rift (Plumptre 2002). The accelerated deforestation near the park boundary is cause for concern given the deleterious effects of isolation on biodiversity conservation (Balmford et al. 2001). As in the case of other African forest parks, the pattern of deforestation portends future pressure on Kibale, particularly if surrounding forests are exhausted (Struhsaker et al. 2002).

Table 1: Deforestation within and outside Kibale park boundary[1]

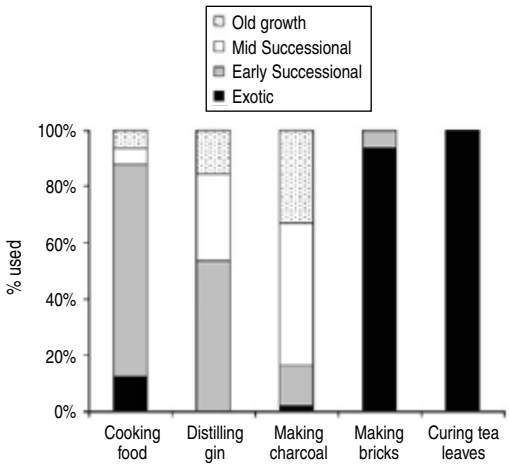
	Forest loss 0-5 km from park, annual % (error)	Forest loss 0-1 km inside park, annual % (error)
1995-2001	3.5 (.77)	0.2 (.1)
2001-2005	4 (1)	0.3 (.2)

A survey of 160 residents neighboring Kibale found that all respondents rely on firewood for cooking. Charcoal production was the second most frequent use (17.8%), but this was confined largely to natural forest edges and prevalent around village-managed forest patches. Banana gin distillers (14.4% of the total respondents) resided mainly along the edge of forest remnants and Kibale Park. Only 2.5% of respondents baked bricks. Overall the amount of biomass harvested per combustion episode differed significantly amongst the different users (Kruskall Wallis = 68.01, $P<0.001$), with charcoal using more biomass than any other group (Mann-Whitney tests between pairs $P<0.02$ or less). Brick-making used more woody biomass than stills ($P=0.003$), and biomass collection for stills was more than collection of cooking firewood ($P<0.001$).

As a group, women gathering firewood for cooking ("domestic consumers") used the greatest number of woody species (50). At the other extreme was the tea processing plant, which relied entirely on one species of eucalyptus (*Eucalyptus grandis*) to fuel its tea leaf driers. Brick makers, gin distillers, and charcoal producers all used a comparable number of species (~26). The number of woody species used during each combustion episode also differed significantly among the five user groups (Kruskall Wallis = 9.264, $P=0.026$). The number of species burned during an average brick-making project was less than that taken to fuel stills (pairwise comparison using Mann-Whitney, $Z=3.1$, $P=0.008$), produce charcoal ($Z=3.3$, $P=0.002$), and cook food ($Z=3.4$, $P<0.002$). Fueling stills typically involved a species harvest that was comparable to charcoal production and used marginally more species than the average used during a day's cooking ($Z=1.98$, $P=0.054$). Finally, the number of species used in charcoal production was similar to that collected for fuelwood. The major difference seems to be that in producing bricks people are more selective and only use trees found near roads (e.g., *Eucalyptus* sp. and other exotic species).

More important than a simple tally of the average number of species used per combustion episode is the *type* of species harvested by the different groups (**Figure 2**). Women relied mainly on fast-growing early successional species like *Vernonia* sp. for cooking. In previous research (Naughton-Treves and Chapman 2002), we calculated that each household in the study area would require roughly 0.5 ha of land fallowed for ~4 years to meet their fuelwood needs for cooking (8.4 kg per day). Brick makers meanwhile primarily harvested eucalyptus trees. By contrast, gin distillers and charcoal producers burned slow-growing hardwood species such as *Parinari excelsa*, *Newtonia buchananii*, and *Olea welwitschii*. These species are rapidly disappearing from forests outside the park and provide important food resources for frugivores in the region. During interviews, respondents ranked these three old-growth species as "most scarce" along with two early successional species: *Bridelia micrantha* and *Prunus africana*. *Prunus africana* is listed on Appendix II of CITES and is highly valued for its medicinal properties (Anonymous 2005).

Figure 2: Type of species harvested and percentage of use



Resource Use, Access Rules, and Governance

On average, women collect just over half their firewood for cooking from fallow land and woodlots on their own property. Their second major source is woody species growing on their neighbors' land. During interviews, women explained that this is customary and that it would be rude for their neighbor to refuse them "small sticks" for cooking. Women also collected fallen branches of hardwoods from forest remnants. Average time spent searching for and collecting firewood was 1.1 hours/day (range 0.5 to 3), relatively low compared to the travel and collection times of nearly 5 hours/day recorded in some other parts of Africa (Kammen 1995).

Charcoal production is officially regulated by a license system where individuals pay the equivalent of ~US $14.60 ($8.70 transport fee and $5.88 burn fee) per month to produce as much as they can from anywhere in the district. There is an active, illicit trade in sharing and duplicating these licenses. Individuals living in remote forested areas do not buy licenses; rather, it is the intermediary who buys and transports the charcoal to town that must have the license. Certain individuals (often Kiga immigrants) specialize in manufacturing charcoal, an arduous job commonly referred to as "poor man's work." The access rules for charcoal producers are often unclear. In fact, during several interviews, landowners asked us to explain to them who had the right to produce charcoal. Most typically, landowners who agree to have charcoal produced from a portion of their territory of village forest receive one or two sacks of charcoal (each worth ~2500/= or ~$1.40) as payment (average yield per "heap" is 17 sacks). Individuals residing on Royal forested land have no right to demand payment or to deny permission to charcoal producers. In such cases, the King's representative collects one or two sacks of charcoal per heap. Some individuals, single women in particular, complained that they could not refuse "men who come with papers" (i.e., licenses). Evidently, customary norms of access do not govern the charcoal business, and neither do legal codes. For example, it is illegal to clear forest alongside streams, yet the majority of charcoal production occurred close to water given that this is where the last natural forest grows.

Unlike the other fuelwood uses described so far, tea is part of the formal national and international economy. Tea processing factories in Kabarole appear to abide by environmental laws. Most keep careful records of their fuelwood use. Some publicly post rules for environmental stewardship, and one

company, J. Findlay (U), attained accreditation for Environmental Management under the ISO 14001 system. The tea factory in the study area now burns only eucalyptus trees grown on their private property. But some other factories continue to buy eucalyptus from local farmers. Moreover, as tea production continues to expand in Kabarole, more land for raising eucalyptus is required, which the tea companies acquire by buying land from local people. Under this practice, eucalyptus is often planted in wetlands, although this practice is illegal (Mulley and Unruh 2004).

Current Relations between the Protected Area and Local Peoples

Using survey data from 1996, 1998, 2005, and 2006 (n=224 households), I tested poverty (various welfare indicators: roof material, water source, livestock ownership, woodlot size) vs. proximity of landholding to Kibale Park. Some indicators suggested that there is a disproportionate presence of very poor households on Kibale's edge. For example, one is more likely to encounter homes with grass thatch roofs near the park edge, and households neighboring the park have fewer employees and smaller woodlots.

These data reveal that most households are far better off than they were eight years ago, including those at Kibale's edge. But over 30 households were missing from the original set of 243 when we attempted to interview them in 2006. They had sold off all their land and moved to Kasese (a much poorer district) or to Kampala. Their neighbors described these "missing" households in regretful tones. Most Ugandans consider losing all claims to a piece of land a dire scenario. To predict who was most likely to sell off their land, I used a multivariate analysis. Some variables were too strongly correlated to enter the same analysis (e.g., distance to road and distance to park, in which case I selected the stronger variable). Preliminary results indicate that the most vulnerable households were those living on small farms, far from Kibale, at sites where the forest patch was severely reduced or eliminated. These households account for the bottom quintile of rural population and are the only group that showed impoverishment during the study period in parallel with declining forests. This result accords with research elsewhere indicating that the poorest households rely on communal access forests during times of crisis (health problems or injury, or loss of income) (Vedeld et al. 2004).

Conclusions

Kibale National Park is becoming isolated due to rapid deforestation on adjacent land. The fact that forest loss was much slower within the park during the past decade is a signal of effective conservation in the short term. In the future, the park's forest resources will be under increasing pressure as natural forest is eliminated from the surrounding area.

- Local people are clearing forest in response to extralocal forces, such as urban charcoal demand, uncertain forest access rules, population growth, and tea expansion.
- Overall, during the past decade forests have declined rapidly, and human welfare has improved significantly.
- The poorest of the poor (bottom quintile) have not enjoyed consistent improvements in livelihood as have the rest of the population. As communal forest patches are privatized or eliminated, these very poor are forced to sell off all their land and move to cities or regions with cheaper land.

- The disproportionate presence of poor households at the edge of Kibale does not signal that the park is acting as a "poverty trap." Rather, the park allows some poor to persist because it offers a source of "emergency" resources. But complicating the causal relationship is the fact that land markets are not as well developed at the park edge.

[1] Results from ASTER & LandSat image analysis of 15 km2 of closed canopy forest along western boundary. Full results available in Naughton-Treves (www.geography.wisc.edu).

6.5 Transfrontier Conservation Areas, Animal Diseases, and Human Livelihoods: Issues of System Health and Sustainability

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This paper draws heavily on two AHEAD-GLTCA documents, namely, Cumming (2004b), and Cumming et al (2007) and on work by Cumming in the South East Lowveld of Zimbabwe, partially supported by the Resilience Alliance and by CESVI (Cooperazione e Sviluppo).

The primary purpose of protected areas in southern Africa has shifted during the last 100 years from "protecting the game" and the establishment of game reserves to protecting biodiversity and, increasingly, to generating economic returns to support park operations and surrounding communities (Cumming 1999a, 2004a; Walker 1999; NPWMA 2007). Most of the larger southern African national parks (i.e., fully protected areas) are situated on national boundaries and fall within planned or developing Transfrontier Conservation Areas (TFCAs); many TFCAs contain land tenure regimes other than protected areas.

A central assumption underlying the creation of TFCAs is that both wildlife and tourists will be able to move more freely across international boundaries and across a range of land use regimes within these larger landscapes. Since many of these areas include small scale farming areas (i.e., traditional or communal farming lands), the frequency of contact between wildlife, domestic animals, and people is expected to rise and thus increase the risks of zoonotic disease transmission, with potentially adverse impacts on the health of wild and domestic animals and on human livelihoods.

Some standard approaches to controlling animal diseases entail fences and a strict seperation between wildlife and livestock, and between differing land uses. These are likely to pose a major obstacle to the ecological and conservation objectives of many of the larger TFCAs. Control measures that target a specific disease in an effort to protect a particular agriculture sector—for example Foot and Mouth Disease (FMD) and beef exports—can have major effects on wildlife-based enterprises, the extension of wildlife conservation areas, and on livelihoods (Child and Riney 1987; Taylor and Martin 1987; Child 1988). These single-resource decisions with multiple-resource consequences are usually reinforced by a "command and control" management culture and policy—an approach that is increasingly failing within the region. The "pathology" that characterizes so much of natural resource management (Holling and Meffe 1996) is apparent in disease management in southern Africa, if not in much of the world.

This essay examines issues involved in establishing TFCAs and the information, research, and conceptual approaches needed to inform the development of sustainable social-ecological systems over large landscapes that encompass a mosaic of land uses and enterprise systems. The approach draws on the **A**nimal **H**ealth for **E**nvironment **A**nd **D**evelopment (AHEAD)—Great Limpopo Transfrontier Conservation Area (GLTFCA) work and on ideas about managing complex adaptive systems and the importance of resilience and adaptability

in sustaining regional social-ecological systems (Gunderson and Holling 2002; Walker et al. 2006).

Context

Transfrontier national parks and associated transfrontier conservation areas are a recent development in southern Africa. Three transfrontier national parks have been established in southern Africa by international treaty (Ais-Ais—Richtersveld, Kgalagadi, and the Great Limpopo), and memoranda of understanding have been signed to develop several transfrontier conservation areas which include national parks within their still tentative boundaries. TFCAs vary in area from ~200 km^2 to >100,000 km^2 and typically include a mix of land tenure regimes ranging from national parks to private conservancies, hunting areas, and communal farming areas. In most cases the precise boundaries of TFCAs have still to be defined.

Potential economic benefits from wildlife-based tourism in marginal lands have been a primary driver of TFCAs, and expectations in rural communities are high (Cunliffe 2003). Conservation arguments include the need to re-establish ecological connectivity and historical migration routes of large wild mammals. This entails opening corridors between protected areas and the removal of boundary fences that may constrain animal movement (Timberlake and Childes 2004).

However, most TFCAs include subsistence farming areas and livestock. One of the greatest threats to the creation and sustainability of TFCAs—and the protected areas embedded within them—is zoonotic disease risk resulting from increased contact between wildlife, domestic animals, and humans. The interactions at the interface between animal health, human livelihoods and health, and ecosystem services are poorly understood, resulting in policy and development that are compromised by a lack of appropriate information and understanding of the complex systems involved.

Over the last four years, the development of a conceptual framework and approach to facilitate "development and conservation success… through integrated understanding based on innovative inter-disciplinary applied research, monitoring, and surveillance at the interface between wild and domestic animal health, ecosystem goods and services, and human livelihoods and well-being"(the overall objective of the AHEAD-GLTFCA programme, Cumming 2004) in the Great Limpopo Transfrontier Conservation Area (GLTFCA) provides a model that may be more widely applicable to achieving conservation and protected area goals, while also meeting the livelihood needs of communities within the TFCAs. Key issues and questions relating to the development of TFCAs in southern Africa are covered briefly below, followed by an outline of the conceptual framework developed for the AHEAD-GLTFCA program.

Key Issues and Questions

Livelihoods in marginal lands in southern Africa

Between 1961 and 1994, cereal production per person declined by nearly 30% while protein (meat and milk) production declined by more than 50% in southern Africa (Cumming 1999b), resulting in much of the region becoming net importers of food. Livestock populations reached a ceiling in about 1987, by which time the number of humans surpassed the number of livestock units. Meat and milk production per animal and per person for the region are about 1/25th of the production levels in Europe (Cumming 1999b). In many communal lands, high populations and low levels of agricultural inputs result in

food deficits in most years, with rural populations being increasingly supported by remittances from off-farm wage labor and food aid programs (Eilerts and Vhurumuka 1997; Campbell et al. 2002; Cumming 2005).

Given the alarming trends and comparisons in regional food production, the need to produce greater wealth from marginal lands through alternative enterprises, such as high valued wildlife-based tourism, is clear. Furthermore, such service-orientated generation of wealth, which is also partly decoupled from primary production and drought, is likely to generate greater employment opportunities in marginal lands. However, because the tourism sector is also subject to the vagaries of world markets, the need to maintain a diversity of production systems (i.e., irrigated agriculture, wildlife, and livestock) in arid lands is likely to remain paramount (Cumming 2005; Cumming and Lynam 1997).

Biodiversity and livelihoods

The central importance of conserving biodiversity and natural capital as a cornerstone to sustaining ecosystem goods and services, animal health, and ultimately human health and livelihoods in marginal lands is an underlying assumption of sustainable development. This raises questions about how much biodiversity and natural capital may need to be foregone to realize peoples' aspirations for development within TFCAs. It also raises difficult questions about carrying capacity and population-to-resource ratios (Cumming and Lynam 1997; Cumming 2005). However, TFCAs may be comprised of a full range of land uses—from strict protected areas to zones of intensive agriculture and urban development—without compromising biodiversity, ecosystem goods and services, and system health in general.

Disease and system health

Where and how do diseases, particularly zoonotic diseases, fit into the picture? How many are there and how serious are they? From the perspective of the wildlife/domestic animal/human interface, there are at least 15 diseases of concern in the GLTFCA (**Table 1**). Some of these (e.g., FMD, Bovine Pleuropneumonia, East Coast Fever, Trypanosomiasis) can have very serious economic consequences if not contained (Windsor and Wood 1998; Dolan 1999). Others, such as Bovine Tuberculosis (BTB), apart from their impacts on wildlife and livestock, also potentially threaten human health, particularly in HIV/AIDS compromised communities. Similar concerns and considerations apply to most of the other large TFCAs in the region where there are complex mixes of land tenure and land use and several important zoonotic diseases (**Table 2**).

Table 1: Animal diseases of concern in the Great Limpopo Transfrontier Conservation Area. The origin of diseases is indicated as either indigenous (indig.) or introduced (alien). (Cumming 2004)

Mode of Transmission	Disease	Origin	Wildlife	Domestic Animal	Human	Comments
Contagious	Rinderpest	Alien	+	+	-	Last outbreak in 1896
	Foot and Mouth Disease	Alien	+	+	-	New strain introduced from Zambezi Valley in 2000
	Malignant catarrhal fever	Indig.	+	+	-	
	Brucellosis	Alien	+	+	+	
	Bovine tuberculosis	Alien	+	+	+	
	Anthrax	Indig.	+	+	+	
	Rabies	Indig.	+	+	+	European street virus introduced to SA in 1892
	Canine distemper	Alien	+	+	-	
	Toxoplasmosis	Indig.	+	+	+	
	Sarcoptic mange	Indig.	+	+	+	
Vector borne	Trypanosomiasis	Indig.	+	+	-	No human cases south of the Zambezi Valley
	African Swine fever	Indig.	+	+	-	
	African horse sickness	Indig.	+	+	-	
	East Coast Fever (Theileriosis)	Alien	+	+	-	
	Heartwater (Cowdriosis)	Indig.	+	+	-	
Endoparasite	Echinococcosis	Indig.	+	+	+	
	Cystercercosis	Indig.	+	+	+	

The interaction between the state of ecosystem services, land use, and disease in wildlife, livestock, and humans is poorly understood (**Figure 2**) with the result that policy relating to disease control and management is poorly developed or non-existent. As indicated earlier, the paradigm governing disease management remains, for the most part, fixed in a command-and-control mode that was applied when livestock was seen as the most productive and important use of rangelands. Examples include the massive efforts to eliminate game animals in an effort to control tsetse flies and trypanosomiasis (Child and Riney 1987) and the enormous investment in game fencing across the region (Taylor and Martin 1987; Cumming 1999b). The development of TFCAs thus provides a challenge and an opportunity to develop a more comprehensive, balanced approach to disease management that might be summarized under the rubric of "One Health" (Osofsky et al. 2005).

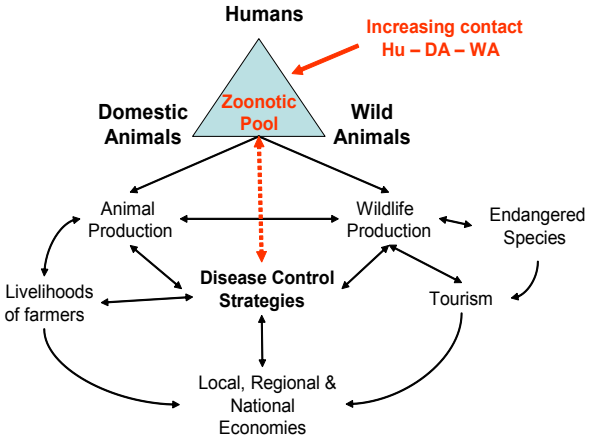
Table 2: Summary of (a) the major land tenure categories; (b) land uses within each Transfrontier Conservation Area (TFCA) outside of protected areas; and (c) the more important diseases in 13 TFCAs, in Southern Africa. The number of discrete units within each land tenure type and the proportion of each TFCA covered by state protected areas (SPAs) are shown for each TFCA. Abbreviations for land tenure categories and diseases are given below. For land use outside protected areas Irriga refers to small and large irrigation schemes, Wildl refers to wildlife as a formal land use in areas outside state protected areas but within the TFCA. The percentage area of SPAs are rough estimates.

No	TFCA	Area km^2	Major land tenure categories (No of units)								Land use outside SPAs				% SPA	Important diseases					
			NP	SA	FR	GMA	PC	PF	CC	CF	Crops	Stock	Irriga	Wild		FMD	BTB	ECF	Tryps	BPP	ASF
1	Kavango-Zambezi	220,000	10	2	32	3	1	3	-	20+	✓	✓	?	✓	30%	+	+	+	+	+	?
3	Niassa –Selous	110,000	2	-	-		-				✓	✓			75%	+	?	+	+	-	+
3	Great Limpopo	100,000	5	1	-	-	6+		3	10+	✓	✓	✓	✓	45%	+	++	+	-	-	+
4	Kgalagadi TFNP	37,256	3								`-	-	-	-	100%	-	-	-	-	-	-
5	Iona—Skeleton Coast	32,000	2									✓			100%	+	-	-	-	-	-
6	Mana – Lower Zambezi	25,000	4	3		2					✓	✓		✓	80%	+	-	+	+	-	?
7	Drakensberg-Maloti	13,000										✓			?	-	-	-	-	-	-
8	Liuwa Plain	10,000?	1								✓	✓			?	+	?	+	?	+	?
9	Ais-Ais – Richtersveld	5,360	2						1		✓	✓	-	-	80%	-		-	-	-	-
10	Shashe-Limpopo	4,872	2	1			4?	9		1	✓	✓	✓	✓	40%	?	-	+	-	-	-
11	Lebombo	4,195	3	-	-	-	-	-		3+					?	-	+?		+	-	?
12	Nyika-Mwaza Marsh	4,134				1					✓	✓			70%	+		+	+	-	?
13	Kasunga-Lukusuzi	2,316	2								✓	✓			60%	+		+	+	-	?

Major land categories:
State protected areas (SPA): NP – National Park, SA – Safari Area, FR – Forest Reserve,
Communal land designated as wildlife areas: GMA – Game Management Area (Zambia), Wildlife Management Area (Botswana), CAMPFIRE Area (Zimbabwe)
Free or leasehold land: PC – Private Land Conservancy, PF – Private/Commercial Farm Land (not under wildlife)
Traditional Communal farm land: CC – Communal Land Conservancy/Wilderness Area, CF – Communal Farming Land

Important diseases:
FMD – Foot and Mouth Disease, BTB – Bovine tuberculosis, ECF – East Coast Fever (Theileriosis), Tryps – Trypanosomiasis (Sleeping sickness), BPP – Bovine Pleuro-pneumonia, ASF – African Swine Fever

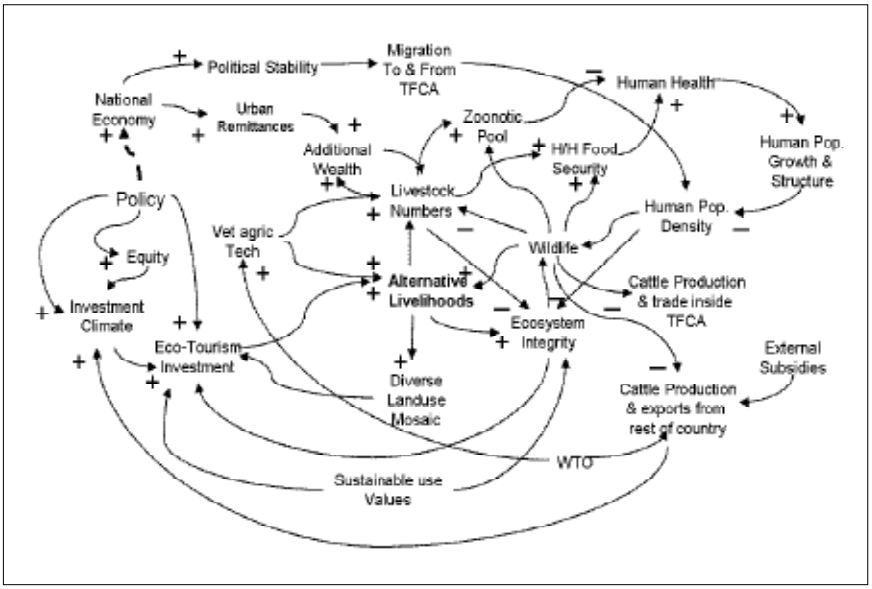
Figure 2: Conceptual diagram of the linkages between wildlife, livestock, and human diseases, and the potential implications of disease control strategies for livelihoods and conservation. (From Cumming et al. 2007)



Land use options, livelihoods, and sustainability

An initial overarching question is whether the establishment of a large transfrontier conservation area, centered on the recently created Great Limpopo Transfrontier National Park, is a viable and sustainable form of land use for the approximately 100,000 km^2 and more than 500,000 people living within its tentative boundaries in Zimbabwe and Mozambique alone. Might not other development options be more appropriate or desirable? While the concept of a national park is reasonably well defined, that of a TFCA is not. Many people regard a TFCA as an extension of the protected areas that entails a vast area in which wildlife-based tourism is the dominant, possibly only, form of land use. However, the reality is that the GLTFCA includes land uses that range from fully protected national parks to highly intensive agro-industries based on irrigation. GLTFCA is best viewed as a coupled social-ecological system. However, a very large proportion of the area is held under communal tenure where the dominant land use is subsistence agro-pastoralism that is heavily subsidized by off-farm income and food aid. A central issue in the establishment and long term sustainability of the GLTFCA is its potential impact on the livelihoods of the people living in the communal lands and on the future development of these areas. The interaction of factors affecting the livelihoods of small-scale communal farmers are complex (**Figure 3**) and not readily resolved by simple, single-sector, top-down development interventions (Ostrom and Jansen 2002).

Figure 3: Systems diagram of major influences affecting alternative livelihoods in a communal agro-pastoral system in the GLTFCA (Mozambique and Zimbabwe) (From Cumming et al 2007)



The evolution of these large TFCAs and the coupled social-ecological systems (SES) will result in benefits and losses (trade-offs). Wild and domestic animal health, the sustainable delivery of ecosystem goods and services, and associated human health issues form an important component of this dynamic development. The key point here is the set of questions that deal with the likely or possible courses of TFCA evolution.

Alternative development scenarios

What are the alternative scenarios for the development of a semi-arid area of 100,000 km^2 covering a wide range of land use and tenure systems? Even if the TFCA proceeds as presently planned, there are many uncertainties and possible paths of development as it unfolds. Some of these paths are more likely to be realized than others, but all reasonably plausible alternatives—and even fairly unlikely but influential ones—should be examined. More specifically, these questions relate to the various potential consequences in terms of synergies, costs and benefits, and trade-offs between:

1. Alternative land uses and patterns of land use;
2. Alternative production and livelihood options; and
3. Alternative disease management strategies.

Further important questions will arise concerning: 1) the effects of alternative development options on biodiversity and ecosystem goods and services; 2) the implications of alternative investment strategies; and 3) the risks of alternative development choices or paths to achieving sustainability.

A central question, nested under the overall question of system sustainability, is "How does system health impact on the TFCA social-ecological system, and vice versa?" However, instead of focusing on a single overarching question, a more tractable approach would be to examine a range of linked questions or themes within a common vision (such as long term sustainability and resilience). The following themes provide starting points: (a) animal health and disease; (b) land use, ecosystem goods and services, and animal health; and (c) human livelihoods, ecosystem goods and services,[1] and animal health.

Key Thematic Questions

Animal health and disease

For most TFCAs in southern Africa, even very basic information on the incidence and spatial and temporal patterns of diseases in wildlife, domestic animals, and humans is not known—with the possible exception of one or two diseases. So, the basic questions that need to be answered are:

1. What are the levels (i.e., both prevalence and incidence) and spatial and temporal patterns of diseases in wildlife, livestock, and humans in the TFCA?
2. How are these patterns related to land use or land tenure or both—and to human livelihoods?

Providing answers to these questions is not a trivial undertaking. Nevertheless, these answers are necessary to develop a coherent set of more cogent questions and a research program with predictive models on the role of disease and animal and human health in the development and sustainability of the TFCA. The assumption that disease issues are of central importance needs to be challenged by carrying out the necessary baseline surveys, analyses, and modelling. Cross disciplinary examination of other key threats to sustainability is also essential.

Land use, ecosystem goods and services, and animal health

The underlying disease dynamics need to be known in order to explore many of the issues that fall under the theme of land use, ecosystem goods and services, and animal health. But that information is not presently available, nor is there detailed information on the distribution and status of ecosystem goods and services within the GLTFCA. Are there alternative, readily measurable, proxies that can be used for examining the links between land use, ecosystem goods and services, and animal and human health? The normalized deviation vegetation index (NDVI) may serve as an initial proxy for primary production and the state of ecosystem goods and services, and so provide the basis for answering two primary questions more readily:

1. What is the distribution of primary production as reflected by NDVI (a proxy for ecosystem goods and services) in the GLTFCA?
2. How does NDVI vary seasonally and annually in relation to soils, topography, land use, and land tenure?

Once patterns of primary production in relation to land use and tenure have been explored using remote sensing, the next step would be to conduct rapid stratified (and preferably participatory) ground surveys and ground truthing to determine livestock and wildlife numbers, condition, and disease status. These preliminary assessments would provide the basis for developing a set of models to inform current development and policy initiatives as well as provide a sounder basis from which to explore more specific questions about the links between land use, ecosystem goods and services, and wildlife and domestic animal health.

Human livelihoods, ecosystem goods and services, and animal health

An evaluation of trade-offs between alternative land uses will need to examine economic, social, and environmental costs and benefits. The questions linking the elements within this theme—human livelihoods, ecosystem goods and services, and animal health—and providing links to the two previous themes are:

1. What are the plausible alternative livelihoods (futures) for the GLTFCA and the various components within it?

2. What are the associated social, economic, and environmental costs and benefits of current and alternative futures?
3. What is the potential for synergistic linkages between major land use options and how may they contribute to sustainability and resilience?

This problem will need to be tackled at three levels: a) local or farm community/village; b) the sub-regional (i.e., within each country); and c) the regional, i.e., the entire TFCA.

A Conceptual Framework and Key Questions

Answers to the main questions posed above would provide the basis for exploring the linkages between animal, human, and ecosystem health and feed directly into the important issues of social and cultural values and resource management choices, i.e., policy and institutions. Social and cultural choices then lead to management and feedback to the continuing exploration of ecosystem productivity and sustainability, costs and benefits to all stakeholders (including the environment and biodiversity), and animal and human health and well being. Further consideration of these issues leads to five important supplementary questions that embed a TFCA in a wider context of national and international linkages, summarized in **Figures 4 and 5**.

Figure 4: A conceptual outline for the AHEAD-GLTFCA program based on three initial key questions that link to policy and adaptive management strategies and which provides a basis for feedback to ongoing research, learning, adaptation, and development. (Revised from Cumming et al. 2007)

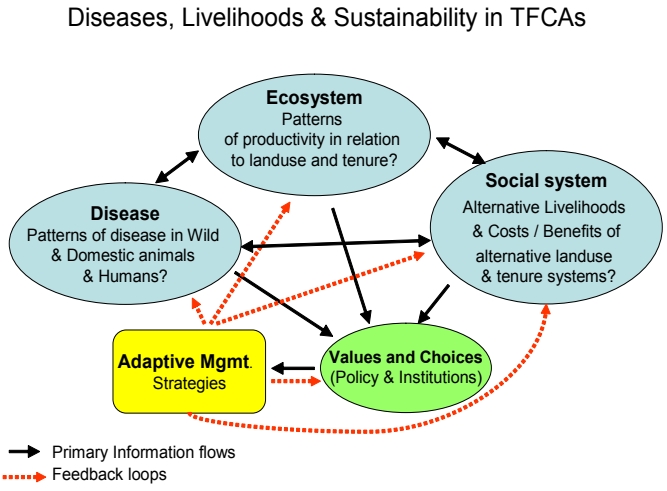
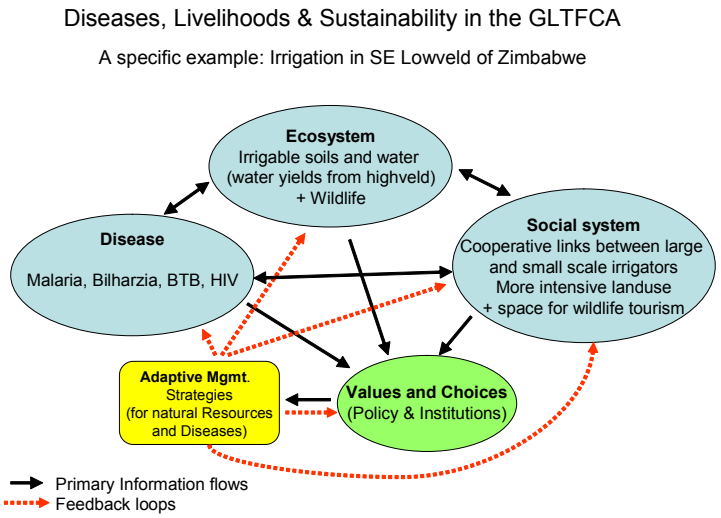


Figure 5: A specific example of the application of the broader questions to a particular sector or component within the GLTFCA. (From Cumming et al. 2007)



A key feature of this proposed framework is that it focuses on questions that have to be tackled before the program can move into more advanced and specific research areas, i.e., an initial characterization of the system is required as the basis for developing more advanced research questions. This is not to say that exploring advanced questions, developing models, or informing policy with the best information will have to await the completion of baseline surveys. As indicated in Figures 4 and 5 there are cross linkages and feedback loops between the research questions, policy, and resource management (development) and, if appropriately used, these can provide the basis for ongoing cycles of advancement that serve to link, and overlap, with shorter- and longer-term goals. In this way, the key ecological questions concerning productivity, ecosystem goods and services, and land tenure could be tackled rapidly and at relatively low cost. Information and analyses resulting from these answers lead to questions about sustainability and resilience of the social-ecological systems that might be encompassed by the GLTFCA. If the longer term objective is to develop a sustainable, healthy, and resilient social-ecological system, then we might add to, or reframe, some of the key questions along the following lines:

1. What types and pattern of land tenure will enhance system health, productivity, and resilience (sustainability) of the social-ecological system (SES) of the GLTFCA? (In this context "health" refers to animal, human and ecosystem health—a "One Health" concept.)
2. What is the state and trend of the five capitals (natural, human, social, financial, and physical) in each land use/land tenure component of the GLTFCA and how might these change and influence system health under differing scenarios?
3. How will the biodiversity, environmental, social, and economic trade-offs/opportunity costs of alternative patterns of land use influence adaptability and resilience of the SES?
4. What cross-subsidies exist within the system and how vulnerable are they to disturbance or shocks?
5. What is the level of external subsidy to the GLTFCA and how dependent is the system on, or vulnerable to, external subsidies? (How do external subsidies support or hinder the development of adaptability, transformability, and resilience of the SES?)

These are important questions, and even partial answers to them would further strengthen the links between research, policy, and development, and contribute to sustainable development of the GLTFCA social-ecological system. The conceptual framework outlined in this essay places emphasis on the sustainable development of the TFCAs as linked to social-ecological systems. This is framed in terms of overarching questions linking disease, ecosystem goods and services, and socio-economic systems into an interdisciplinary "One Health" paradigm. The framework provides a workable interdisciplinary research and development framework for the AHEAD-GLTFCA program and for TFCAs in general, focused on the role of disease in system dynamics.

[1] The term "ecosystem good and services" as used here includes biodiversity and the wider concerns of soil stability and primary production. The term "ecosystem health" could be used but has been avoided because of the controversial connotations often associated with its use.

6.6 Securing Protected Areas: Compulsory Land Acquisition in East Africa

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Protected areas (PAs) are a traditional means for pursuing wildlife management and have become increasingly central to conservation strategies (Hutton et al. 2005). As investments shift from community-based wildlife management and other people-friendly approaches to placing more land in PAs, the future of biodiversity rests largely on the security of PAs.

Efforts are underway to address actions that weaken or threaten PAs. In East Africa, degazettement and significant in-park land use changes pose a serious and growing threat to PAs. In Kenya, during the Moi regime, public land was a common patronage resource used to garner votes, service favors, and achieve other short-term political gains (Klopp 2001). Between 1962 and 2002, at least 200,000 illegal land titles were issued, most on orders of the president or other senior public officials (Government of Kenya 2004). More recently, in Uganda, the government has sought to degazette or change land use practices in several PAs for economic development purposes, including the Pian Upe Wildlife Reserve, Butamira Forest Reserve, Mabira Forest Reserve, and several forest reserves on Bugala Island (Manyindo 2003; Tumushabe 2003; Tumushabe and Bainomugisha 2004a).

Expanding PAs often involves the acquisition of private property in a compulsory manner or eminent domain (the term "eminent domain" is not universal, but is used in East Africa). The procedures for extinguishing private land rights, placing private property in the public domain, and transferring public land into PAs are clearly spelled out in law. As competition for land increases, community advocates are focusing on the law and practice of these procedures to protect property rights.

In Kenya, courts have quashed attempted acquisitions on procedural grounds, ruling that for compulsory acquisition to be lawful it must strictly comply with the provisions of the Constitution and the Land Acquisition Act (Sifuna 2005). In Tanzania, the High Court has ruled on numerous occasions that PAs established through extra-legal means are "unconstitutional" and therefore "null and void," although it has not ordered remedies of degazettement and reoccupation (Mchome 2002; Nshala 2004a, 2004b).

In 2004, the presidential Commission for Human Rights and Good Governance issued a non-binding ruling that 135 Nyamuma villagers who were forcibly displaced for the expansion of the Serengeti National Park should be compensated for their losses and allowed to resettle on their land (Legal and Human Rights Centre 2003; Government of Tanzania 2004). The government rejected the Commission's recommendations, and in 2005, the villagers sued. The High Court dismissed this, but the villagers have lodged their dissatisfaction at the Court of Appeal (Keregero 2005).

In Botswana, in December 2006 the High Court ruled that more than 1,000 San people from the Gana and Gwi clans "were dispossessed forcibly, unlawfully and without their consent" by the government in 2002 from their ancestral homeland and have the right to live, hunt, and gather in the Central Kalahari Game Reserve (Survival International 2006). The reserve, the world's second largest PA, was established in 1961 specifically to protect the Bushmen and preserve their homeland. Human rights advocates around the world hope this case will set a precedent for other people seeking their traditional land rights.

To secure Africa's PAs from a legal perspective, the codified procedures for acquiring private property must be consistently implemented and enforced. To promote local legitimacy, the procedures must be democratic—they must incorporate fundamental democratic principles, such as transparency, inclusion, and accountability. Procedures that are not open, do not allow for public participation, and offer few opportunities for recourse and redress are not legitimate. Little comparative research has been conducted on these issues, but anecdotal information shows that some PAs were established by extra-legal means.

This paper presents the results of research conducted in Kenya, Tanzania, and Uganda on the law and practice of eminent domain. Three issues are addressed: 1) the permissible uses and purposes for expropriation; 2) the procedures for exercising eminent domain; and 3) the compensation awarded. It concludes with recommendations to democratize eminent domain, promote accountability, and protect the process from excessive external interference.

Eminent Domain and Protected Areas

Most land and natural resources in Africa are state-owned or public property held in trust for the people by the government. In Kenya and Tanzania, "radical title" over land is vested in the president, who holds ultimate power over all land; in Uganda, all land is public property and radical title is vested in the people. Eminent domain authority is conferred on the president, but can be delegated by him to other entities, including unelected and private bodies such as corporations, for achieving valid public purposes. In many countries, leaseholds are the principal legal means of securing land (statutory or granted rights of occupancy) and eminent domain is the only legal method of extinguishing private land rights.

The majority of poor rural people do not hold granted rights partly because they lack the knowledge, capacities, and resources needed to navigate the application process and meet the title conditions. The application process often requires an expensive cadastral survey and management plan approved by the government, while occupancy, use, and other conditions are not always consistent with traditional land use practices. Occupancy conditions may require permanent residency while usufruct conditions tie security of tenure to prescribed uses and the ability to show "proof of use." Breach of these requirements can lead to revocation of title.

Rural people more often secure their land through customary rights. In some countries, customary rights—at the individual, household, and community level—are recognized in law (customary or deemed rights of occupancy) but may also tie security to occupancy and use conditions. In other countries, the law does not provide customary rights the same level of legal protection as granted rights. Where the law provides equal status, it has been difficult to implement and courts have tended to rule in favor of granted rights (World Bank 2003a).

Secure property rights encourage investments and promote economic growth. But private property that is absolute or limitless can impede a society, so it must be possible for private property—customary and granted rights—to be expropriated for public purposes. Land acquisition laws that make it too difficult for government to acquire private property can jeopardize public interests, while procedures that significantly weaken property rights can limit investments.

With international attention on democracy and poverty reduction, conservation-induced hardships are under increasing scrutiny. Societies are examining the sometimes competing policy objectives of conservation and development, weighing the public benefits of PAs—some that may accrue over time—against the immediate needs of people who depend on land for their livelihoods.

Eminent Domain Uses

Legal scholars consider eminent domain a preexisting power of the state—an attribute of sovereignty—not a grant of new authority. Still the authority is recognized in many constitutions and legislation. In Kenya, eminent domain authority can be exercised "...in the interest of defense, public safety, public order, public morality, public health, town and country planning, or the development or utilization of any property in such manner so as to promote the public benefit" (Constitution 1992, 75(1)(a)). In Uganda, eminent domain can be used when "the taking of possession or acquisition is necessary for public use" (Constitution 1995, 26(2)(a)).

In Tanzania, the Land Acquisition Act (LAA) provides a more detailed definition of eminent domain uses, authorizing the president to "acquire any land for…any public purpose" (LAA 1967, 2(a)4(1)) and more specifically, for:

- Exclusive government use and general public use;
- Any government scheme, social services and housing, and industrial, agricultural and commercial development;
- Sanitary improvement, including reclamations;
- New, extension or improvement of city, municipality or other settlement;
- Airfield, port, or harbor;
- Mining for minerals and oil;
- Use by a community or community corporation; and
- Agricultural development by any person.

Further, when a corporation requires land for work "of public utility or in the public interest or in the interest of the national economy," the president, with parliamentary approval, can declare such purpose to be a public purpose (LAA 1967, 2(a)4(2)).

Laws that clearly and conservatively define public purpose, public use, public benefit, and public interest give governments less discretion in exercising eminent domain and can protect citizens against the misuse of this authority. Expansive and broad uses of eminent domain weaken private property rights and can create legitimacy problems for governments, even when land is acquired for genuine public purposes.

In Uganda, the courts have interpreted "public interest" narrowly to mean that the acquired property must promote the general interest of the community, not the particular interest of individuals. On numerous occasions, the government has sought to amend the constitution and enabling legislation—including an on-going effort to develop a new land policy—to grant the president the authority to acquire land for investment and economic development purposes (Government of Uganda 2004; Tumushabe and Bainomugisha 2004b; Sserwanga 2007). This is reminiscent of the post-independence period when laws emphasized state powers for development over the protection of private property rights. At that time, many governments streamlined eminent domain procedures—restricting opportunities for participation and recourse, limiting or dispensing entirely with compensation, and allowing for the possession of property before the payment of compensation (Dunning 1968).

The LAAs in East Africa do not explicitly note PAs as a public purpose, but PAs are a recognized use of eminent domain. Governments justify compulsory acquisitions for conservation by simply invoking PAs as an established use. Legal scholars argue that eminent domain is justified when the public good overrides private property rights—when the benefits to the public outweigh the costs to the affected individuals. In Tanzania and Uganda, the government is not required to justify the proposed land acquisition in these terms. But in

Kenya, "…the necessity therefore is such as to afford reasonable justification for the causing of any hardship that may result to any person having an interest in or right over the property" (Constitution 1992, 75(1)(b)), and the Minister of Land is required to certify this justification in writing to the Commissioner of Lands. The law does not obligate the government to actually value the public benefits and weigh them against the costs to the affected people.

Eminent Domain and Protected Area Procedures

Two sets of procedures are involved in exercising eminent domain to establish PAs—the procedures to acquire private land and place it in the public domain, and the procedures for placing public land in PAs. In Kenya, there are six steps to exercise eminent domain (Sifuna 2005):

- The Minister of Lands directs in writing the Commissioner of Lands to acquire a particular parcel of land in a compulsory manner. The instructions must indicate the purpose for which the land is required and the responsible public institution.
- The Commissioner publishes a notice of intention in the *Kenya Gazette*—the official government journal—and provides a copy to "every person who appears to him to be interested or who claims to be interested in the land" (LAA 1968, 9(1)(b)).
- The Commissioner publishes in the *Gazette* a notice of inquiry to hear claims for compensation and serves a copy to every person with interest in the condemned land.
- The Commissioner convenes a public inquiry to determine which individuals have legitimate land claims, the value of the land, and the amount of compensation payable to each valid claimant.
- The Commissioner serves every person receiving compensation, awards compensation, and files notices of all awards in the Office of the Commissioner.
- The Commissioner serves notice to all persons with interest in the land indicating the day the government will take possession, removes the land from the register of private ownership, and places the land in the public domain as public utility land.

Three steps are required to place public land in a PA:

- The Minister of Wildlife consults with and obtains the consent of the Minister of Lands or, if the Minister dissents, the approval of Parliament.
- An environmental impact assessment is undertaken and all requirements fulfilled.
- The Minister of Wildlife declares the land under protected area management.

In East Africa, new legislation contradicts the LAAs enacted in the mid-1960s. In Kenya, under the Wildlife Conservation and Management Act of 1976, the Minister for Wildlife has discretionary powers to declare "any land" a PA. The Constitution and LAA, however, require the approval of the Minister of Lands to acquire private lands in a compulsory manner and to place public land in PAs. As a result, the Minister of Wildlife can only acquire private land on a voluntary basis without the consent of the Minister of Lands to establish a PA.

Moreover, public participation in eminent domain decisions is limited. In Kenya, "…every person interested in the land, is entitled to be heard, to produce evidence, and to call and to question witnesses at an inquiry" (LAA

1968, 9(6)). The legal position, however, is that when the public inquiry is undertaken, the land has already been acquired, although the government has not yet taken possession. The inquiry only determines who has valid claims and what compensation should be paid to the claimants, not whether the acquisition is justified. The Minister exercises eminent domain without reference to the affected landowners, who are advised through the notice only after the power has been exercised. The environmental impact assessment which also requires participation is a recent addition with the Environmental Management and Coordination Act of 1999 and only applies to placing public land into specific uses, not to the acquisition of private land.

In Kenya, a substantial portion of rural land that communities use in common—rangeland, forests—is "trust land" held by local authorities. Local authorities are enjoined to hold the land "for the benefit of the persons ordinarily resident on that land and give effect to such rights, interests or other benefits in respect of the land as may, under African customary law for the time being in force and applicable thereto be vested in any tribe, group, family, or individual" (Constitution 1992, 115(2)). Many, however, use such land with little regard to the trust obligations and appoint the Commissioner to manage trust land on their behalf. By doing so, local authorities are converting what is essentially common property into public land. When such lands are required for conversion into PAs or other public uses, they are acquired through a separate "setting apart" procedure that does not require public participation.

In East Africa, the procedures for exercising eminent domain authority are a wholly government affair. In democracies, the government's authority is checked by institutionalized accountability measures including civil society monitoring and legislative oversight. In the absence of functioning democratic institutions, such vertical and horizontal accountability measures do not exist or are restricted and ineffective. With few limits and little oversight, governments have the freedom to exercise eminent domain at their discretion and without repercussions.

In East Africa, any person aggrieved by the acquisition of land by the government may petition the High Court for redress. In Kenya, the courts have tended to issue strict interpretations to the provisions of procedure set out in the Constitution and LAA. In 1994, the court held that "…the notice published under section 6(2)…must include the identity of the public body for whom the land is acquired and the public interest in respect of which it is acquired. It is only when a notice contains such information that a person affected thereby can fairly be expected to seize his right to challenge the legality of the acquisition. That is because the test of the legality of the acquisition is whether the land is required for a public body for a public benefit and such purpose is so necessary that it justifies hardship to the owner. Those details must be contained in the notice itself for the *prima facie* validity of the acquisition must be judged on the content of the notice. The test must be satisfied at the outset and not with the aid of subsequent evidence" (Mombasa HC Misc. Appl. No.55, 1994). The court went on to declare the notice in question defective and quashed the proposed acquisition. The ruling was upheld by the Court of Appeal (Mombasa Court of Appeal, No.252, 1996). These protections, however, are only available to a minority of people who can pursue their rights in court.

Compensation

Compensation should ensure that displaced people are as well or better off after their land is possessed as they were before. Providing compensation requires an understanding of what property qualifies for compensation, who holds valid

claims, how the property is assessed and valued, and when the compensation should be paid.

In Kenya, land, crops, trees, structures, and fixed improvements (i.e., houses, fences, irrigation systems) are eligible for compensation. In Tanzania, the government is required to pay compensation for only certain land. "No compensation shall be awarded in respect of any land which is vacant ground" (LAA 1967, 12(1)). (Agricultural and pastoral lands are not considered vacant but they must be in "good estate management".) Land that is not properly used or inadequately developed is not eligible for compensation.

Further, in Tanzania, "…compensation awarded shall be limited to the value of the unexhausted improvements of the land" (LAA 1967, 12(2)). "Unexhausted improvements" is defined as "any quality permanently attached to the land directly resulting from the expenditure of capital or labour by a person…and increasing the productive capacity, utility or amenity thereof, but does not include the results of ordinary cultivation other than standing crops or growing produce" (LAA 1967, 12(7)). This excludes investments to improve land, such as labor to develop the farm and soil nutrients to ensure high crop yields (Nshala 2004a, 2004b).

People who hold only customary rights are often denied compensation. In Tanzania, the 1952 law that established the Mkomazi Game Reserve explicitly preserved preexisting customary land rights. In 1988, however, the government evicted several thousand Maasai from the reserve and did not compensate them. Some affected Maasai sued the government and in 1998 the High Court awarded each plaintiff who testified $450 and ordered the government to relocate them. Not pleased, the Maasai appealed and in 1999 the Appellate Court, citing "indisputable surrounding circumstances," overturned the High Court judgment and ruled that the Maasai held no customary land rights and were not entitled to any compensation (Lobulu 1999; Tenga 1999; Mchome 2002; Veit and Benson 2004).

In Kenya, property owners are compensated by land replacement at new sites—"land for land" compensation—or paid at market price. Crops and structural improvements are also assessed at market value. In Tanzania, compensation for land can be awarded in cash or "a grant of public land not exceeding in value the value of the land acquired" (LAA 1867, 11(2)). With little unclaimed or unoccupied land, however, the alternative land is often marginal and of low value. Crops and other improvements are valued at government rates which are usually below market value. Property is rarely valued at replacement costs unless required—and paid—by international development agencies. Government auditors, not independent assessors, often identify and value the eligible improvements. Assistance for relocation is rarely provided.

When compensation is paid varies in East Africa. In Uganda, the law obligates the government to pay full compensation before the acquisition—"…the assessment officer shall take possession of the land as soon as he has made his award…" (LAA 1965, 6(1)). Advocates have used this provision to try to quash acquisitions (Kampala HC, Misc. Cause, No.100, 2005) while the government has sought to allow the president to acquire land without first paying compensation (Government of Uganda 2004; Tumushabe and Bainomugisha 2004b).

In Kenya and Tanzania, the law obligates the government to pay compensation "promptly," but does not require payment before taking possession of the land. In Kenya, "…full compensation shall be paid promptly to all persons interested in the land" (LAA 1968, 8) and "…the Commissioner shall, as soon as practicable, pay compensation…" (LAA 1968, 13(1)). When compensation is not paid on or before the taking of possession, "the Commissioner shall pay

interest on the amount awarded at the rate of six per cent per annum from the time of taking possession until the time of payment…" (LAA 1968, 16(1)).

Compensation can be expensive. In Gabon, the cost to compensate the people affected by 13 new PAs has been estimated at US $80 million (Cernea and Schmidt-Soltau 2006). Africa's development challenges are enormous and budgets are stretched; few governments have the financial resources to cover compensation costs. International organizations support PA management (i.e., park staff salaries, infrastructure, anti-poaching patrols) and increasingly direct payments to landowners who safeguard biodiversity on private property (Ferraro and Kiss 2002), but they rarely contribute to paying eminent domain compensation. In contrast, corporations are often required to pay such compensation for land acquired for public works. In some cases, companies—and donors that support development projects—provide a premium as a purchase incentive, pay the full compensation award before taking possession, and cover the costs of the acquisition process (World Commission on Dams 2000; World Bank 2003b).

The number of people who have received fair compensation promptly is not known, but anecdotal information suggests that many people displaced by PAs have not been paid. Some governments are pursuing reconciliation to correct past wrongs. In South Africa, restitution laws allow people to reclaim lost land. In 1998, the Makuleke people regained full ownership and title of 24,000 ha of Kruger National Park. The land—which had been taken by the apartheid regime in the late-1960s and incorporated into the park—was returned after the people reached a mediated settlement with the new democratic government. Now, a Joint Management Board with the government manages the land in ways that are compatible with wildlife. The Makuleke have entered into partnerships with private investors to build tourist facilities, and have used some proceeds for community development initiatives (Maluleke 2004).

Recommendations

Several policy options and recommendations on the law and practice of eminent domain are presented below.

Knowledge and Understanding

Little systematic and comparative research has been conducted on eminent domain, conservation, and poverty reduction in Africa. Investigations are needed on the law, practice, and outcomes of PAs established by eminent domain. How does law balance the public goods of conservation and development, and of compulsory acquisitions and secure property rights? How have courts interpreted the law? Are compulsory acquisition procedures democratic and consistently applied? How has eminent domain affected property rights, investment, and development?

New research is underway to better understand the affects of PAs on adjacent communities, identify best practices in mitigating park-people conflicts, and establish the full value of PAs (Schmidt-Soltau and Brockington 2004; Wilkie et al. 2006; Burke et al. 2007). Less attention is focused on the well-being of people displaced by PAs. How many people have been displaced by conservation and received fair compensation promptly? Are people better off before or after being dispossessed of their land? Experience shows that involuntary resettlement, even when mitigated, often gives rise to severe economic and social risks, including displaced and dismantled production systems, loss of income sources, weakened community institutions and social networks, dispersed kin groups and diminished or lost cultural identity and traditional

authority. What support do displaced people need to maintain or improve their standard of living?

Eminent Domain Uses

To protect property rights, eminent domain must be disciplined and restricted to genuine public purposes, not ordinary government business or economic development. Eminent domain should be invoked as a last resort, after carefully considering and rejecting all alternative approaches and exhausting all reasonable efforts to encourage voluntary relocation. Eminent domain should be exercised when other conservation approaches are inadequate and when PAs provide the best or only strategy for achieving conservation. Conservation approaches that are less harmful or more beneficial to local people should take priority over PAs.

Given the adverse effects of involuntary displacement, eminent domain must have high justification standards. Governments should be required to provide specific justification for proposed PAs. Notices of intention should include a review of alternative conservation approaches and present the best possible calculations of the proposed PA's public benefits and the costs to the affected people as well as to property rights. Such information can inform public debates and help establish whether the PA benefits outweigh the collective costs.

Further, eminent domain should not be exercised unless the government can provide evidence of its capacity to meet all procedural requirements and ensure the land will deliver the public purpose. High costs and stretched national budgets are not valid excuses for neglecting compensation. PAs established by eminent domain that fail to meet their intended public purposes within a reasonable and specified time period should be degazetted and reoccupied.

Eminent Domain Procedures

When administrative matters are not embedded in democratic institutions, power is limited principally by internal accountability mechanisms and by domestic and international pressure. Despite laudable political reforms, democracy has not taken hold in many African nations. As a result, property rights would be better protected by strengthening available accountability measures and institutionalizing additional safeguards in the use of eminent domain. Checks and balances help guard against the abuse and misuse of eminent domain, limit arbitrary acquisitions, and ensure that governments use their authority only for valid public purposes.

Accountability mechanisms include: granting communities the rights of free, prior, and informed consent over eminent domain and conservation decisions; mandating public participation in the process of acquiring land in a compulsory manner; organizing referendums or other ballot-box initiatives on potential land acquisitions and proposed PAs; requiring parliamentary approval of eminent domain decisions; and establishing an ombudsman to hear citizen complaints, mediate conflicts, and facilitate compromises. These measures have been used effectively in Africa and elsewhere to protect property rights and conserve biodiversity (Perrault et al. 2005; Alcorn and Royo 2007).

Compensation

With the payment of fair and prompt compensation, eminent domain is essentially a compulsory sale. To ensure that people displaced by PAs recover from the shock of involuntary resettlement, compensation should be provided

across all tenure categories. Customary rights-holders who lose land should be recognized as legitimate claimants and they—or their descendents—should be awarded compensation.

The procedures for assessing and valuing property must be transparent, open, fair, reliable, and replicable. Condemned property should be valued by independent assessors and shielded from politics. Property values should be based on open market values or replacement costs, and a premium in the form of incentive should be considered to encourage willing seller-willing buyer arrangements. Many governments have established land funds, although few have sufficiently capitalized them to provide any meaningful support. Conservationists should help raise money to support these costs.

Further, displaced people should, at a minimum, receive a significant percentage of their award before the government acquires the land, and a time table should be established for paying the remaining amount with interest pegged to the national rate of inflation. If the government does not pay compensation by the established date, the PA should be degazetted and the land returned to its rightful occupants.

Conclusion

The links between conservation, development, and democracy are multi-dimensional and complex, but there is little dispute that democracies excel in many areas including establishing PAs with broad public support. While there are winners and losers from many PAs, developing PAs through democratic means ensures that the costs, benefits, and trade-offs from alternative conservation approaches are addressed, increasing the likelihood that PAs provide public benefits and that affected people are adequately compensated.

Biodiversity in Africa is threatened by both irregular degazettement and extra-legal gazettement of PAs. Democratizing land transfers between the public and private domains limits corruption and patronage while supporting conservation and poverty reduction. Conservationists recognize the biodiversity dividend of democratizing the process of transferring land from the public to the private domain, but many see only short-term threats to democratizing eminent domain procedures, not opportunities for sustainable conservation.

To meet Convention on Biological Diversity goals, governments must: limit and discipline the authority of eminent domain; democratize the procedures for expropriating landed private property; and implement the procedures for exercising eminent domain, including paying fair compensation promptly. PAs that are legally secure and locally legitimate are best-positioned to deliver sustainable conservation. Such measures will also help regularize public-private land transfers, protect private property rights, and promote the United Nations Millennium Development Goals of poverty reduction.

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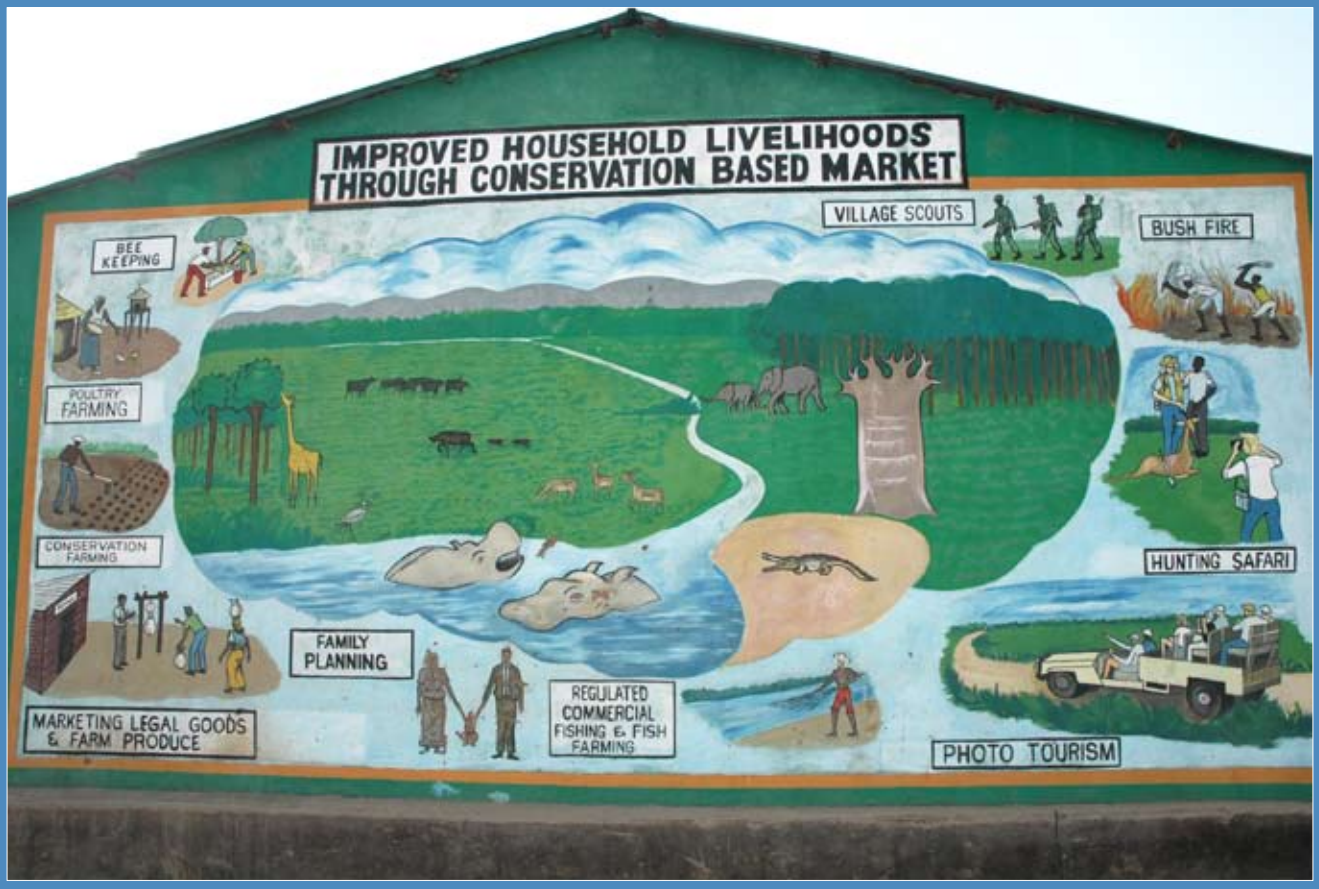

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